LICENSE RENEWAL APPLICATION

Hope Creek Generating Station

Facility Operating License No. NPF-57

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1.0 ADMINISTRATIVE INFORMATION

1.1 <u>GENERAL INFORMATION - 10 CFR 54.19</u>

1.1.1 NAME OF APPLICANT

PSEG Nuclear LLC hereby applies for a renewed operating license for Hope Creek Generating Station (Hope Creek).

1.1.2 ADDRESS OF APPLICANT

PSEG Nuclear LLC
80 Park Plaza, T4B
Newark, NJ 07102

1.1.3 DESCRIPTIONS OF BUSINESS OR OCCUPATION OF APPLICANT

PSEG Nuclear LLC is a Delaware limited liability company formed to own and operate nuclear generating stations. PSEG Nuclear LLC is a wholly owned subsidiary of PSEG Power LLC, a Delaware limited liability company which is wholly owned by Public Service Enterprise Group Incorporated (PSEG), a corporation formed under the laws of the State of New Jersey. PSEG Nuclear LLC is the licensed operator of Hope Creek, which is the subject of this application. The current Hope Creek operating license (Facility Operating License No. NPF-57) expires at midnight on April 11, 2026. PSEG Nuclear LLC will continue as the licensed operator of Hope Creek under the renewed operating licenses.

Hope Creek is owned 100 percent by PSEG Nuclear LLC.

1.1.4 DESCRIPTIONS OF ORGANIZATION AND MANAGEMENT OF APPLICANT

<u>PSEG Nuclear LLC</u>

PSEG Nuclear LLC is organized under the laws of the State of Delaware. PSEG Nuclear LLC's principal place of business is in Hancock's Bridge, NJ. PSEG Power LLC is a Delaware limited liability company, wholly owned by Public Service Enterprise Group Incorporated (PSEG), a corporation formed under the laws of the State of New Jersey with their headquarters and principal place of business in Newark, NJ. PSEG is a publicly traded corporation whose shares are widely traded on the New York Stock Exchange.

All of the Directors and principal officers of PSEG Nuclear LLC, PSEG Power LLC and PSEG are U.S. citizens. Neither PSEG Nuclear LLC, PSEG Power LLC nor its parent, PSEG, is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government. The Directors and principal officers of PSEG Nuclear LLC and their addresses are presented below:

Board of Directors (PSEG Nuclear LLC)		
Name	**Title**	**Address**
Clarence J. Hopf, Jr.	Director	PSEG Nuclear LLC 80 Park Plaza, T4B Newark, NJ 07102
Thomas P. Joyce	Director	PSEG Nuclear LLC 80 Park Plaza, T4B Newark, NJ 07102
Richard P. Lopriore	Director	PSEG Nuclear LLC 80 Park Plaza, T4B Newark, NJ 07102

Principal Officers (PSEG Nuclear LLC)		
Name	**Title**	**Address**
Thomas P. Joyce	President and Chief Nuclear Officer	PSEG Nuclear LLC One Alloway Creek Neck Rd. Hancock's Bridge, NJ 08038
Robert C. Braun	Site Vice President, Salem	PSEG Nuclear LLC One Alloway Creek Neck Rd. Hancock's Bridge, NJ 08038
John F. Perry	Site Vice President, Hope Creek	PSEG Nuclear LLC One Alloway Creek Neck Rd. Hancock's Bridge, NJ 08038
Carl J. Fricker	Vice President, Operations Support	PSEG Nuclear LLC One Alloway Creek Neck Rd. Hancock's Bridge, NJ 08038

1.1.5 CLASS OF LICENSE, USE OF THE FACILITY, AND PERIOD OF TIME FOR WHICH THE LICENSE IS SOUGHT

PSEG Nuclear LLC requests renewal of the Class 103 operating license for Hope Creek (License No. NPF-57), for a period of 20 years beyond the expiration of the current license. Approval of this License Renewal request would extend the operating license for Hope Creek from midnight April 11, 2026 until midnight April 11, 2046. Hope Creek would continue to generate electric power during the period of extended operation. PSEG Nuclear LLC also requests the renewal of specific licenses under 10 CFR Parts 30, 40, and 70 that are subsumed in the current operating license.

1.1.6 EARLIEST AND LATEST DATES FOR ALTERATIONS, IF PROPOSED

No plant alterations or modifications have been identified as necessary in connection with this application.

1.1.7 RESTRICTED DATA

With regard to the requirements of 10 CFR 54.17(f), this application does not contain any “Restricted Data,” as that term is defined in the Atomic Energy Act of 1954, as amended, or other defense information, and it is not expected that any such information will become involved in these licensed activities.

In accordance with the requirements of 10 CFR 54.17(g), the applicant will not permit any individual to have access to, or any facility to possess restricted data or classified national security information until the individual and/or facility has been approved for such access under the provisions of 10 CFR Parts 25 and/or 95.

1.1.8 REGULATORY AGENCIES

PSEG Nuclear LLC recovers the costs incurred from operating Hope Creek in its own wholesale rates. The Federal Energy Regulatory Commission (FERC) regulates the interstate sales of electricity generated at Hope Creek:

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

1.1.9 LOCAL NEWS PUBLICATIONS

News publications in circulation near Hope Creek that are considered appropriate to give reasonable notice of the application are as follows:

Today’s Sunbeam
93 Fifth Street
Salem, NJ 08079
856-935-1500

Gloucester County Times
309 South Broad Street
Woodbury, NJ 08096
856-845-3300

Bridgeton News
100 East Commerce Street
Bridgeton, NJ 08302
856-451-1000

The News Journal
P.O. Box 15505
Wilmington, DE 19850
302-324-2500

1.1.10 CONFORMING CHANGES TO STANDARD INDEMNITY AGREEMENT

10 CFR 54.19(b) requires that “each application must 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.” The current indemnity agreement (No. BX08-05) for Hope Creek states in Article VII that the agreement shall terminate at the time of expiration of that license specified in Item 3 of the Attachment to the agreement, which is the last to expire; provided that, except as may otherwise be provided in applicable regulations or orders of the Commission, the term of this agreement shall not terminate until all the radioactive material has been removed from the location and transportation of the radioactive material from the location has ended as defined in subparagraph 5(b), Article I. Item 3 of the Attachment to the indemnity agreement includes license number NPR-57. Applicant requests that any necessary conforming changes be made to Article VII and Item 3 of the Attachment, and any other sections of the indemnity agreement as appropriate to ensure that the indemnity agreement continues to apply during both the terms of the current license and the terms of the renewed license. Applicant understands that no changes may be necessary for this purpose if the current license number is retained.

1.2 GENERAL LICENSE INFORMATION

1.2.1 APPLICATION UPDATES, RENEWED LICENSES, AND RENEWAL TERM OPERATION

In accordance with 10 CFR 54.21(b), during NRC review of this application, an annual update to the application to reflect any change to the current licensing basis that materially affects the contents of the license renewal application will be provided.

In accordance with 10 CFR 54.21(d), PSEG Nuclear LLC will maintain a summary list in the Hope Creek Updated Final Safety Analysis Report (UFSAR) of activities that are required to manage the effects of aging for the systems, structures, or components in the scope of license renewal during the period of extended operation and summaries of the time-limited aging analyses evaluations.

1.2.2 CONTACT INFORMATION

Any notices, questions, or correspondence in connection with this filing should be directed to:

C. Fricker
Vice President - Operations Support
PSEG Nuclear LLC
One Alloway Creek Neck Road
Hancock's Bridge, NJ 08038

with copies to:

C. Neely
Director, Regulatory Affairs
PSEG Nuclear LLC
One Alloway Creek Neck Road
Hancock's Bridge, NJ 08038

J. Stavely
Manager, License Renewal
PSEG Nuclear LLC
One Alloway Creek Neck Road
Hancock's Bridge, NJ 08038

M. Gallagher
Vice President License Renewal Projects
Exelon Nuclear LLC
200 Exelon Way
Kennett Square, PA 19348

1.3 PURPOSE

This document provides information required by 10 CFR Part 54 to support the application for renewed licenses for Hope Creek. The application contains technical information required by 10 CFR 54.21 and environmental information required by 10 CFR 54.23. The information contained herein is intended to provide the NRC with an adequate basis to make the findings required by 10 CFR 54.29.

1.4 DESCRIPTION OF THE PLANT

Hope Creek Generating Station is a single-unit facility located at the southern end of Artificial Island in Lower Alloways Creek Township, Salem County, New Jersey. Philadelphia is approximately 64 km (40 mi) northeast and Salem, New Jersey, is 13 km (8 mi) northeast of the site. The Hope Creek Generating Station was originally planned to be a two unit BWR station. During the construction phase of the project, a decision was made to cancel Unit 2 but complete construction of the power block. Those areas of the Unit 2 power block are classified as cancelled structures within the UFSAR.

Hope Creek occupies about 62 hectares (153 acres) of approximately 300 hectares (740 acres) owned by PSEG Nuclear LLC on Artificial Island. The Salem Generating Station, Units 1 and 2 (Salem Units 1 & 2) are also located within this 300-hectare (740-acre) parcel.

The Hope Creek reactor is a single cycle, forced recirculation boiling water reactor supplied by General Electric with a Mark I containment. The reactor produces steam for direct use in the steam turbine. The primary containment is of a Mark I design that consists of a drywell, a suppression chamber in the shape of a torus and a connecting vent system between the drywell and the suppression chamber. Hope Creek was initially licensed to operate at a rated power level of 3,293 MWt. License Amendment No. 131, dated 7/30/2001, authorized a 1.4 percent increase in the licensed rated power level to 3,339 MWt. License Amendment No. 174, dated 5/14/2008, authorized a further 15 percent increase in licensed rated power level to 3,840 MWt.

Also located on Artificial Island are Salem Units 1 & 2, which are operated by PSEG Nuclear LLC, and are jointly owned by PSEG Nuclear LLC and Exelon Generation LLC. There are no Salem Units 1 & 2 systems, structures, or components (SSCs) that are relied upon for the operation of Hope Creek. There are interconnections between the Salem and Hope Creek fire protection systems (Section 2.3.3.10) and the electrical transmission network, Salem-Hope Creek Tie Line (Figure 2.1-2).

1.5 APPLICATION STRUCTURE

This license renewal application is structured in accordance with Regulatory Guide 1.188, “Standard Format and Content for Applications to Renew Nuclear Plant Operating Licenses,” and NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule”. In addition, Section 3, Aging Management Review Results and Appendix B, Aging Management Programs, are structured to address the guidance provided in NUREG-1800, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants”. NUREG-1800 references NUREG-1801, “Generic Aging Lessons Learned (GALL) Report.” NUREG-1801 was used to determine the adequacy of existing aging management programs and which existing programs should be augmented for license renewal. The results of the aging management review, using NUREG-1801, have been documented and are illustrated in table format in Section 3, “Aging Management Review Results,” of this application.

The application is divided into the following major sections:

Section 1 – Administrative Information

This section provides the administrative information required by 10 CFR 54.17 and 10 CFR 54.19. This section describes the plant and states the purpose for this application. Included in this section are the names, addresses, business descriptions, and organization and management descriptions of the applicant, as well as other administrative information. This section also provides an overview of the structure of the application, general references, and a listing of acronyms used throughout the application.

Section 2 – Scoping and Screening Methodology for Identifying Structures and Components Subject to Aging Management Review, and Implementation Results

This section describes and justifies the methods used in the integrated plant assessment to identify those structures and components subject to an aging management review in accordance with the requirements of 10 CFR 54.21(a)(2). These methods consist of: 1) scoping, which identifies the systems, structures, and components that are within the scope of 10 CFR 54.4(a), and 2) screening under 10 CFR 54.21(a)(1), which identifies those in-scope structures and components that perform their intended function without moving parts or a change in configuration or properties, and that are not subject to replacement based on a qualified life or specified time period. Additionally, the results for systems and structures are described in this section. Scoping results are presented in Section 2.2, "Plant Level Scoping Results." Screening results are presented in Sections 2.3, 2.4, and 2.5.

The screening results consist of lists of components, component groups, and structures that require aging management review. Brief descriptions of mechanical systems and structures within the scope of license renewal are provided as background information. Mechanical system and structure intended functions are provided for in-scope systems and structures. For each in-scope system and structure, components requiring an aging management review are identified, associated component intended functions are identified, and appropriate reference to the Section 3 Tables where the aging management review results are provided.

Selected structural and electrical components, such as component supports and electrical cables, were evaluated as commodities. Under the commodity approach, selected structural and electrical component groups were evaluated based upon common environments and materials. Structural and Electrical components requiring an aging management review are presented in Sections 2.4 and 2.5, respectively. Component intended functions and references to the applicable Section 3 Tables are provided.

Section 3 – Aging Management Review Results

10 CFR 54.21(a)(3) requires a demonstration that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation. Section 3 presents the results of the aging management reviews. Section 3 is the link between the scoping and screening results provided in Section 2 and the aging management programs provided in Appendix B.

Aging management review results are presented in tabular form, in a format in accordance with NUREG-1800, "Standard Review Plan for Review of License Renewal Applications." For mechanical systems, aging management review results are provided in Sections 3.1 through 3.4 for the Reactor Vessel, Internals, and Reactor Coolant System, Engineered Safety Features Systems, Auxiliary Systems, and Steam and Power Conversions Systems, respectively. Aging management review results for Containments, Structures, and Component Supports are provided in Section 3.5. Aging management review results for Electrical Commodity Groups are provided in Section 3.6.

Tables are provided in each of these sections in accordance with NUREG-1800, which provide aging management review results for components, materials, environments, and aging effects which are addressed in NUREG-1801, and information regarding the degree to which the proposed aging management programs are consistent with those recommended in NUREG-1801.

Section 4 – Time-Limited Aging Analyses

Time-limited aging analyses (TLAAs), as defined by 10 CFR 54.3, are listed in this section. This section includes each of the TLAAs identified in the NRC Standard Review Plan for License Renewal Applications and in plant-specific analyses. This section includes a summary of the time-dependent aspects of the analyses. A demonstration is provided to show that the analyses remain valid for the period of extended operation, the analyses have been projected to the end of the period of extended operation, or the effects of aging on the intended function(s) will be adequately managed for the period of extended operation, consistent with 10 CFR 54.21(c)(1)(i)-(iii).

Appendix A –Updated Final Safety Analysis Report Supplement

As required by 10 CFR 54.21(d), the Updated Final Safety Analysis Report (UFSAR) supplement contains a summary of activities credited for managing the effects of aging for the period of extended operation. In addition, summary descriptions of time-limited aging analyses evaluations are provided.

Appendix B – Aging Management Programs

Appendix B describes the programs and activities that are credited for managing aging effects for components or structures during the period of extended operation based upon the aging management review results provided in Section 3 and the time-limited aging analyses results provided in Section 4.

Section B.2.1 and B.3 of Appendix B discuss those programs that are contained in Section XI and Section X of NUREG-1801, respectively. A description of the aging management program is provided and a conclusion based upon the results of an evaluation to each of the ten elements provided in NUREG-1801. In some cases, exceptions and justifications for managing aging are provided for specific NUREG-1801 elements. Additionally, operating experience related to the aging management program is provided.

Section B.2.2 of Appendix B also addresses each of the ten program elements for programs that are credited for managing aging that are not evaluated in NUREG-1801.

Appendix C – BWRVIP Applicant Action Items

This Appendix provides the requested responses to applicant action items contained in the NRC safety evaluation reports associated with NRC-approved Boiling Water Reactor Vessel and Internals Program reports.

Appendix D – Technical Specification Changes

This Appendix satisfies the requirement in 10 CFR 54.22 to identify technical specification changes or additions necessary to manage the effects of aging during the period of extended operation. There were no Technical Specification Changes identified necessary to manage the effects of aging during the period of extended operation.

Appendix E – Environmental Information

This Appendix satisfies the requirements of 10 CFR 54.23 to provide a supplement to the environmental report that complies with the requirements of subpart A of 10 CFR Part 51 for Hope Creek.

1.6 ACRONYMS

Acronym	Meaning
AMP	Aging Management Program
AMR	Aging Management Review
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	Anticipated transients without scram
ARI	Alternate rod injection
BWR	Boiling Water Reactor
BWRVIP	Boiling Water Reactor Vessel Internals Project
CASS	Cast austenitic stainless steel
CFR	Code of Federal Regulations
CLB	Current licensing basis
CRD	Control Rod Drive
CUF	Cumulative Usage Factor
DBA	Design basis accident
DBD	Design basis document
DBE	Design basis event
DOT	United States Department of Transportation
EAF	Environmentally Assisted Fatigue
ECCS	Emergency Core Cooling System
EFPY	Effective full-power years
EHC	Electro-Hydraulic Control
EPRI	Electric Power Research Institute

Acronym	**Meaning**
EQ	Environmental qualification
FAC	Flow-accelerated corrosion
FHAR	Fire Hazards Analysis Report
FSSD	Fire safe shutdown
GALL	Generic Aging Lessons Learned Report NUREG 1801
GL	Generic Letter
GSI	Generic Safety Issue
HCGS	Hope Creek Generating Station
HELB	High energy line break
HEPA	High efficiency particulate air
HPCI	High Pressure Coolant Injection
HVAC	Heating, ventilation, and air conditioning
HX	Heat exchanger
I & C	Instrumentation and controls
IASCC	Irradiation-assisted stress corrosion cracking
IEEE	Institute of Electrical and Electronics Engineers
IGSCC	Intergranular stress corrosion cracking
IN	Information Notice
INPO	Institute of Nuclear Power Operations
IPA	Integrated plant assessment
ISI	Inservice inspection
ISG	Interim Staff Guidance
IST	In-service testing
LBB	Leak before break

Acronym	Meaning
LER	Licensee event report
LLRT	Local leak rate test
LOCA	Loss-of-coolant accident
LRA	License renewal application
MCC	Motor control center
MIC	Microbiologically-influenced corrosion
MOV	Motor-operated valve
MSIV	Main Steam Isolation Valve
MWt	Megawatts thermal
NEI	Nuclear Energy Institute
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NEIL	Nuclear Electric Insurance Limited
NRC	Nuclear Regulatory Commission
OE	Operating experience
OSHA	Occupational Safety and Health Administration
P&ID	Piping and instrumentation diagram
PM	Preventive maintenance
PTS	Pressurized Thermal Shock
P-T curves	Pressure-temperature limit curves
PWR	Pressure Water Reactor
RCIC	Reactor Core Isolation Cooling
RCPB	Reactor coolant pressure boundary
RG	Regulatory guide

Acronym	Meaning
RHR	Residual Heat Removal
RT_{NDT}	Reference temperature nil-ductility transition
RWCU	Reactor Water Clean Up
SACS	Safety & Turbine Auxiliary Cooling System
SBO	Station Black Out
SCC	Stress corrosion cracking
SGS	Salem Generating Station
SLC	Standby Liquid Control
SRP	Standard Review Plan
SRV	Safety relief valve
SSCs	Systems, structures, and components
SSE	Safe shutdown earthquake
TID	Total integrated dose
TLAAs	Time-limited aging analyses
UFSAR	Updated Final Safety Analysis Report
UHS	Ultimate heat sink
USE	Upper-shelf energy

1.7 GENERAL REFERENCES

1.7.1 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

1.7.2 NEI 95-10, "Industry Guidelines for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," Revision 6, June 2005.

1.7.3 Regulatory Guide 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses", Rev 1, September 2005.

1.7.4 NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" United States Nuclear Regulatory Commission, Rev 1, September 2005.

1.7.5 NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," United States Nuclear Regulatory Commission, Rev 1, September 2005.

1.7.6 10 CFR 50.48, "Fire Protection."

1.7.7 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants."

1.7.8 10 CFR 50.62, "Requirements for Reduction of Risk From Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants."

1.7.9 10 CFR 50.63, "Loss of All Alternating Current Power."

1.7.10 10 CFR 50.61, "Pressurized Thermal Shock."

1.7.11 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."

1.7.12 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."

1.7.13 10 CFR 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

1.7.14 NUREG-0800, Section 9.5.1, Appendix B, Supplemental Fire Protection Review Criteria for License Renewal, United States Nuclear Regulatory Commission, Revision 5, March 2007.

1.7.15 NUREG-0933, A Prioritization of Generic Safety Issues, U.S. Nuclear Regulatory Commission, August 2008.

1.7.16 Plant Support Engineering: License Renewal Electrical Handbook, Revision 1 to EPRI Report 1003057. EPRI, Palo Alto, CA, 2007. 1013475.

1.7.17 Aging Effects for Structures and Structural Components (Structural Tools), Revision 1. EPRI, Palo Alto, CA, 2003. 1002950.

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

This section describes the process for identifying structures and components subject to aging management review in the Hope Creek Generating Station license renewal integrated plant assessment. For the 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 those structures and components subject to Aging Management Review (AMR). 10 CFR 54.21(a)(2) further requires that the methods used to implement the requirements of 10 CFR 54.21(a)(1) be described and justified. Section 2 of this application satisfies these requirements.

The process is performed in two steps. *Scoping* refers to the process of identifying the plant systems and structures that are to be included in the scope of license renewal in accordance with 10 CFR 54.4. The intended functions that are the bases for including the systems and structures in the scope of license renewal are also identified during the scoping process. *Screening* is the process of determining which components associated with the in scope systems and structures are subject to an aging management review in accordance with 10 CFR 54.21(a)(1) requirements. A detailed description of the Hope Creek scoping and screening process is provided in Section 2.1.

The scoping and screening methodology is consistent with the guidelines presented in NEI-95-10, Industry Guidelines for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule, Rev. 6 (reference 1.7.2). The plant level scoping results identify the systems and structures within the scope of license renewal in Section 2.2. The screening results identify structures and components subject to aging management review in the following LRA sections:

- Section 2.3 for mechanical systems
- Section 2.4 for structures
- Section 2.5 for electrical/I&C systems

2.1 SCOPING AND SCREENING METHODOLOGY

2.1.1 INTRODUCTION

This introduction provides an overview of the scoping and screening process used at the Hope Creek Generating Station. Subsequent sections provide details of how the process was implemented.

The methodology began with scoping. The initial step in the scoping process was to define the entire plant in terms of systems and structures. These systems and structures were evaluated against the scoping criteria in 10 CFR 54.4(a)(1), (a)(2), and (a)(3), to determine if they perform or support a safety related intended function, or perform functions that demonstrate compliance with the requirement of one of the five license renewal regulated events. For the systems and structures determined to be in scope, the intended functions that are the bases for including them in scope were also identified. Scoping evaluations are documented in a System and Structure Scoping Report.

If any portion of a system or structure met the scoping criteria of 10 CFR 54.4, the system or structure was included in the scope of license renewal. Mechanical systems and structures were then further evaluated, to determine those mechanical and structural components that perform or support the identified intended functions. The in scope boundaries of mechanical systems and structures were developed and are described in Sections 2.3 and 2.4. These boundaries are also depicted on the license renewal Boundary Drawings. The in scope boundaries of the mechanical systems and structures are highlighted in color. In scope structures and mechanical components are shown in green, except nonsafety-related mechanical components that are in scope to preclude physical or spatial interaction, or provide structural support to safety-related SSCs, which are shown in red. Additional details on scoping evaluations and boundary drawing development are provided in Section 2.1.5.

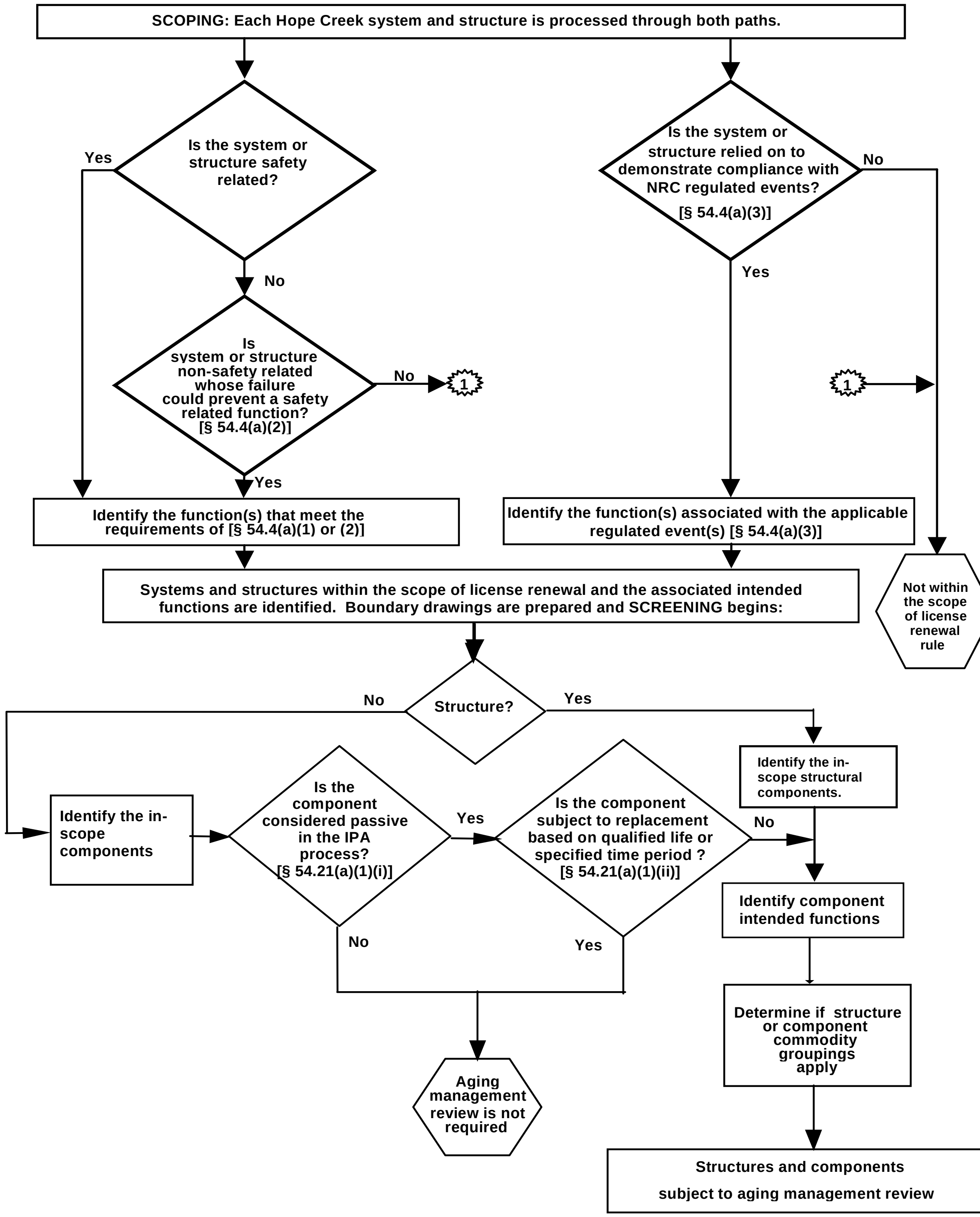
All electrical components within in scope mechanical and electrical systems were included in the scope of license renewal as electrical commodities. Consequently, further system evaluations to determine which electrical components were required to perform or support the system intended functions were not required. Additional details on electrical and I&C system scoping are provided in Section 2.1.5.

After completion of the scoping and boundary evaluations, the screening process evaluated the in scope structures and components to identify the long-lived, passive structures and components subject to an aging management review, along with the structure and component passive intended functions. Additional details on the screening process are provided in Section 2.1.6.

Selected components, such as component supports and passive electrical components, were more effectively scoped and screened as commodities. As such, they were not evaluated with the individual system or structure, but were evaluated collectively as a commodity group. Commodity groups are identified in Table 2.2-1. The passive electrical commodities are identified in Section 2.5. Commodity groups utilized are consistent with NUREG-1800 Table 2.1-5 and previous license renewal applications accepted by the NRC.

Figure 2.1-1 provides a flowchart of the general scoping and screening process for mechanical systems, structures and electrical systems.

FIGURE 2.1-1
Hope Creek Scoping and Screening Flowchart



2.1.2 INFORMATION SOURCES USED FOR SCOPING AND SCREENING

A number of different current license basis (CLB) and design basis information sources were utilized in the scoping and screening process. The CLB for Hope Creek is consistent with the definition provided in 10 CFR 54.3. The significant source documentation is discussed below.

These source documents are available in hard copy or electronic format. Document records such as licensing correspondence and NRC Safety Evaluation Reports are available in a searchable database, such that applicable documents can be identified and located by searching the appropriate topic.

2.1.2.1 Updated Final Safety Analysis Report

The Hope Creek Updated Final Safety Analysis Report (UFSAR) follows the established guidelines published in NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,” dated July 1981. The Hope Creek UFSAR has since been updated regularly in accordance with the requirements of 10 CFR 50.71(e). The UFSAR provided significant input for system and structure descriptions and functions.

2.1.2.2 Fire Hazards Analysis Report

The Fire Hazards Analysis Report (FHAR) describes the fire protection configuration for the confinement, detection, and extinguishment of fires, and demonstrates the capability to achieve and maintain safe shutdown conditions in the event of a fire, in support of the Fire Protection Program functions.

2.1.2.3 Environmental Qualification Master List

The scope of the electrical equipment and components that must be environmentally qualified for use in a harsh environment at Hope Creek is identified in the SAP database. The database includes a listing of equipment and components, and includes fields that identify specific equipment information such as manufacturer, plant location and qualification level. The Environmental Qualification (EQ) data is located in the Component Data Module of the SAP database, which is discussed in section 2.1.2.6. The SAP database EQ data field is a design quality field, which means the data is controlled and has been verified accurate.

2.1.2.4 Maintenance Rule Database

The Maintenance Rule Database documents the results of Maintenance Rule scoping for Hope Creek systems and structures. The Maintenance Rule Database provided an additional source of information to identify system and structure functions.

2.1.2.5 Configuration Baseline Documents

System Configuration Baseline Documents are available for selected Hope Creek systems. The Configuration Baseline Documents are historical documents that provide detailed descriptions of the associated system design basis, including system functions and design requirements, with references to controlled source documents. The system Configuration Baseline Document and source documents were reviewed during the system scoping review.

2.1.2.6 Controlled Plant Component Database

Hope Creek maintains a controlled plant component database that contains component level design and maintenance information. The plant component database is called the *Systeme, Anwendungen und Produkte in der Datenverarbeitung* ["Systems, Applications and Products in Data Processing"] (SAP). The SAP database lists plant components at the level of detail for which discrete maintenance or modification activities typically are performed. At Hope Creek, the SAP database provides a comprehensive listing of plant components. Component type and unique component identification numbers identify each component in the database.

2.1.2.7 Other CLB References

NRC Safety Evaluation Reports include NRC staff review of Hope Creek licensing submittals. Some of these documents may contain licensee commitments.

Licensing correspondence includes relief requests, Licensee Event Reports, and responses to NRC communications such as NRC bulletins, generic letters or enforcement actions. Some of these documents may contain licensee commitments.

Engineering drawings provide system, structure and component configuration details for Hope Creek. These drawings were used in conjunction with the plant component database records to support scoping and screening evaluations.

Engineering evaluations and calculations can provide additional information about the requirements or characteristics associated with the evaluated systems, structures or components.

2.1.3 TECHNICAL BASIS DOCUMENTS

Technical basis documents were prepared in support of the license renewal project. Engineers experienced in nuclear plant systems, programs and operations prepared the basis documents. Basis documents contain technical evaluations and bases for decisions or positions associated with license renewal requirements as described below. Basis documents are prepared, reviewed and approved in accordance with controlled project procedures, and are based on the CLB source documents described in Section 2.1.2.

The following sections describe the technical basis documents associated with the Hope Creek scoping and screening methodology.

2.1.3.1 License Renewal Systems and Structures List

One of the first steps necessary to begin the license renewal scoping process was to identify a comprehensive list of systems and structures to be evaluated for license renewal scoping. While there exists a variety of document sources that identify and list Hope Creek systems and structures, no single source provided the comprehensive list in a format appropriate for 10 CFR 54.4 license renewal system and structure scoping. Therefore, a basis document was prepared to establish a comprehensive list of license renewal systems and structures, and to document the basis for the list. Starting with the systems and structures list contained in an approved procedure, the list was reviewed against the SAP database, the Hope Creek UFSAR, plant design drawings, the maintenance rule database, and other plant design documents. Plant systems and structures were arranged into logical groupings for scoping reviews, and the groupings were defined as license renewal systems and structures. Components evaluated as commodity groups were also identified. The basis document assures all plant structures and components included in the scoping review are associated with a system, structure or commodity group.

The basis document grouped license renewal systems and structures into the following categories:

- Reactor Vessel, Internals, and Reactor Coolant System
- Engineered Safety Features
- Auxiliary Systems
- Steam and Power Conversion System
- Electrical and Instrumentation and Control (I&C) Systems
- Containment, Structures, and Component Supports

This grouping of the Hope Creek license renewal systems and structures is based on the Hope Creek UFSAR and the guidance of NUREG-1801 “Generic Aging Lessons Learned (GALL) Report.” The complete list of systems, structures and commodity groups evaluated for license renewal is provided in Section 2.2 of this application.

Certain structures and equipment were excluded at the outset because they are not considered to be systems, structures or components that are part of the CLB, do not have design or functional requirements related to the 10 CFR 54.4(a)(1), (a)(2) or (a)(3) scoping criteria. These include: driveways and parking lots, temporary equipment, health physics equipment, portable measuring and testing equipment, tools and motor vehicles.

2.1.3.2 Identification of Safety-Related Systems and Structures

Safety-related systems and structures are included in the scope of license renewal in accordance with 10 CFR 54.4(a)(1) scoping criterion. Hope Creek plant components that have been classified as safety-related are identified as “Q” in the controlled quality classification data field in the SAP database. Hope

Creek quality classification procedures were reviewed against the license renewal “Safety-related” scoping criterion in 10 CFR 54.4(a)(1), to confirm that Hope Creek safety-related classifications are consistent with license renewal requirements. This review is included in a technical basis document. The basis document also provides a summary list of the systems and structures that are safety-related at Hope Creek. These systems and structures are included in the scope of license renewal under the 10 CFR 54.4(a)(1) scoping criterion.

The Hope Creek quality classification procedure definition of safety-related (Q) is as follows:

All safety-related structures, systems, and components required to assure:

- *Integrity of reactor coolant boundary.*
- *Capability to shut down the reactor and maintain it in a safe shutdown condition.*
- *Capability to prevent or mitigate the consequences of an accident which could result in potential off-site exposure comparable to the guidelines of 10 CFR 100.*
- *Retaining of fuel temperature within design limits by maintaining fuel coolant inventory and temperature within design limits.*
- *Control of the concentration of combustible gases in the containment system within established limits.”*

This definition is technically equivalent to 10 CFR 54.4(a)(1) for the purposes of license renewal scoping. The wording differences are addressed as follows:

Design Basis Events

The Hope Creek procedure definition does not specifically refer to design basis events, while 10 CFR 54.4(a)(1) refers to design basis events as defined in 10 CFR 50.49(b)(1). For Hope Creek license renewal, an additional technical basis document was prepared to confirm that all applicable design basis events were considered. The basis document includes a review of all systems or structures that are relied upon to remain functional during and following design-basis events as defined in 10 CFR 50.49 (b)(1). This includes confirming that design basis internal and external events including design basis accidents, anticipated operational occurrences, and natural phenomena as described in the current licensing basis are considered when scoping for license renewal. Safety-related systems and structures required to support 10 CFR 54.4(a)(1) functions are included in the scope of license renewal under 10 CFR 54.4(a)(1). Nonsafety-related systems and structures required to support 10 CFR 54.4(a)(1) functions are included in the scope of license renewal under 10 CFR 54.4(a)(2).

Exposure Limits

The Hope Creek quality classification procedure definition of safety-related refers to 10 CFR 100 for accident exposure limits. The license renewal rule refers to 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11, as applicable. These different exposure limit requirements appear in three different Code sections to address similar accident analyses performed by licensees for different reasons. The exposure limit requirements in 10 CFR 50.34(a)(1) are applicable to facilities seeking a construction permit, and are therefore not applicable to Hope Creek license renewal. The exposure limit requirements in 10 CFR 50.67(b)(2) are applicable to facilities seeking to revise the current accident source term used in their design basis radiological analyses. The Hope Creek UFSAR refers to both 10 CFR 50.67 and 10 CFR 100 for accident exposure limits. Hope Creek alternate radiological source term methodology was applied (in accordance with Reg. Guide 1.183) to the design basis accident analyses and therefore utilizes 10 CFR 50.67 dose acceptance criteria. The alternate radiological source term methodology for post-accident radiological analysis of certain events allows credit for some nonsafety-related components as plate-out surfaces or holdup volumes. Nonsafety-related components credited in post-accident radiological analyses for plate-out or holdup are included in scope under 10 CFR 54.4(a)(2).

The Hope Creek definition of safety-related includes two additional criteria that are not included in 10 CFR 54.4(a)(1). SSCs required to meet these additional criteria are included in scope for 10 CFR 54.4(a)(1). Therefore, the Hope Creek definition of safety-related is consistent with the 10 CFR 54.4(a)(1) definition for the purposes of identifying the safety-related SSCs that are within the scope of license renewal.

When supplemented with the broad review of CLB design basis events, the Hope Creek quality classification procedure definition of “safety-related" is consistent with 10 CFR 54.4(a)(1), and results in a comprehensive list of safety-related systems and structures that were included in the scope of license renewal. This is consistent with NUREG-1800 Section 2.1.3.1.1.

2.1.3.3 10 CFR 54.4(a)(2) Scoping Criteria

All nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified under 10 CFR 54.4 (a)(1), were included in the scope of license renewal in accordance with 10 CFR 54.4(a)(2) requirements. To assure complete and consistent application of this scoping criterion, a technical basis document was prepared.

This license renewal scoping criteria requires consideration of the following:

1. Nonsafety-related SSCs required to support a safety-related 10 CFR 54.4(a)(1) function.

2. Nonsafety-related systems connected to and providing structural support for a safety-related SSC.

3. Nonsafety-related systems with a potential for spatial interaction with safety-related SSCs.

The first item is addressed during the scoping process, by identifying the nonsafety-related systems and structures required to support the accomplishment of a safety-related intended function under 10 CFR 54.4(a)(1), and then including these supporting systems and structures in scope of license renewal under 10 CFR 54.4(a)(2).

The remaining two items concern nonsafety-related systems with potential physical or spatial interaction with safety-related systems, structures and components. Scoping of these systems is the subject of NEI 95-10 Appendix F. To assure complete and consistent application of 10 CFR 54.4(a)(2) requirements and NEI 95-10, a technical basis document was prepared. The basis document includes a review of the CLB references relevant to physical or spatial interactions.

The basis document describes the Hope Creek approach to scoping of nonsafety-related systems with a potential for physical or spatial interaction with safety-related SSCs. Hope Creek chose to implement the preventive option as described in NEI 95-10. The basis document provides appropriate guidance to assure that license renewal scoping for 10 CFR 54.4(a)(2) met the requirements of the license renewal rule and NEI 95-10. See Section 2.1.5.2 for additional discussion of the application of this scoping criterion.

2.1.3.4 Scoping for Regulated Events

Technical basis documents were prepared to address license renewal scoping of SSCs relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission’s regulations for Fire Protection, Environmental Qualification, Anticipated Transients Without Scram and Station Blackout. The Commission’s regulations for pressurized thermal shock are not applicable to the Hope Creek boiling water reactor design. These basis documents are summarized below:

Fire Protection

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) are included in the scope of license renewal in accordance with 10 CFR 54.4(a)(3) requirements.

The scope of systems and structures required for the fire protection program to comply with the requirements of 10CFR50.48 includes:

- Systems and structures required to demonstrate post-fire safe shutdown capabilities
- Systems and structures required for fire detection and suppression

- Systems and structures required to meet commitments made to Appendix A of Branch Technical Position (BTP) APCSB 9.5-1

Recent NRC guidance, including NUREG-0800 Section 9.5.1 Appendix B (reference 1.7.14) states that the scope of 10 CFR 50.48 goes beyond the protection of safety-related equipment, and also includes fire protection systems, structures and components needed to minimize the effects of a fire and to prevent the release of radioactive material to the environment. Fire protection system and structure scoping for Hope Creek is performed consistent with this guidance, and is documented in the technical basis document.

The fire protection technical basis document summarizes results of a detailed review of the plant's fire protection program documents that demonstrate compliance with the requirements of 10 CFR 50.48. The basis document provides a list of systems and structures credited in the plant's fire protection program documents. For the listed systems and structures, the basis document also identifies appropriate CLB references. The identified systems and structures are included in the scope of license renewal under the 10 CFR 54.4(a)(3) scoping criteria.

The fire detection and suppression systems at Hope Creek are plant-wide systems that protect a wide variety of plant equipment. Not all portions of these systems are required to demonstrate compliance with 10 CFR 50.48. Some portions of the fire detection and suppression systems protect plant areas in which a fire would not impact any equipment important to safety, or significantly increase the risk of radioactive releases to the environment. Portions of the fire suppression and detection systems that are not included in the scope of license renewal are identified in the technical basis document. Those portions of fire detection and suppression systems that are not included in scope can be isolated from the remaining in scope system by closing the associated isolation valve. The isolation valve is included within the scope of license renewal.

Environmental Qualification

Criterion 10 CFR 54.4(a)(3) requires that 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 environmental qualification (10 CFR 50.49) be included in the scope of license renewal.

The Hope Creek Environmental Qualification (EQ) program includes safety-related electrical equipment, nonsafety-related electrical equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions of the safety-related equipment, and certain post-accident monitoring equipment, as defined in 10 CFR 50.49(b)(1), 10 CFR 50.49(b)(2), and 10 CFR 50.49(b)(3) respectively. This equipment is included in the scope of license renewal.

The environmental qualification basis document summarizes the results of a review of Hope Creek EQ program documents. The EQ basis document provides a list of systems that include EQ components. The EQ basis document also provides a list of structures that provide the physical boundaries for the postulated harsh environments, and contain environmentally qualified electrical equipment. These systems and structures are included in the scope of license renewal under the 10 CFR 54.4(a)(3) scoping criteria.

Anticipated Transients Without Scram

Criterion 10 CFR 54.4(a)(3) requires that 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 anticipated transients without scram (10 CFR 50.62) be included in the scope of license renewal.

An Anticipated Transient Without Scram (ATWS) is a postulated operational transient that generates an automatic scram signal, accompanied by a failure of the reactor protection system to shutdown the reactor.

For boiling water reactors (BWR), the following requirements apply:

1. Each BWR must have an alternate rod injection (ARI) system with redundant scram air header exhaust valves. The ARI system must be independent of the existing reactor trip system.

2. Each BWR must have a standby liquid control system with defined boron injection capabilities. Standby liquid control system automatic initiation is not required for plants issued a construction permit before July 26, 1984, unless already installed.

3. Each BWR must have equipment to trip the recirculation pumps automatically under conditions indicative of an ATWS.

The ATWS basis document summarizes the results of a review of the Hope Creek current licensing basis with respect to ATWS. Hope Creek has a Redundant Reactivity Control System (RRCS) that is designed to mitigate the potential consequences of an ATWS event. The system consists of remote control panels, their associated ATWS detection and actuation logic and the necessary interface logic to the Reactor Recirculation System, the Feed water Control System, the Reactor Water Cleanup System, the Standby Liquid Control (SLC) System, and the Alternate Rod Insertion (ARI) components of the Control Rod Drive System required to perform specific functions in response to an ATWS event. Hope Creek also has an adequately sized standby liquid control system that is initiated automatically by the RRCS logic when needed.

The ATWS basis document provides a list of the systems required by 10 CFR 50.62 to reduce the risk from ATWS events. The basis document also provides a list of structures that provide physical support and protection for the ATWS systems. These systems and structures are included in the scope of license renewal under the 10 CFR 54.4(a)(3) scoping criteria.

Station Blackout

Criterion 10 CFR 54.4(a)(3) requires that all 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) be included in the scope of license renewal.

A station blackout (SBO) event is a complete loss of alternating current (AC) electric power to the essential and nonessential switchgear buses in a nuclear power plant (i.e., loss of the offsite electric power system concurrent with generator trip and unavailability of the onsite emergency AC power sources). SBO does not include the loss of available AC power to buses fed by station batteries through inverters or by alternate AC sources, nor does it assume a concurrent single failure or design basis accident.

The Hope Creek satisfies the requirement of 10 CFR 50.63 as an AC-independent, 4-hour coping plant. Hope Creek capabilities, commitments and analyses that demonstrate compliance with 10 CFR 50.63 are documented in UFSAR Section 1.15.1 and in NRC safety evaluation reports and correspondence related to the SBO rule.

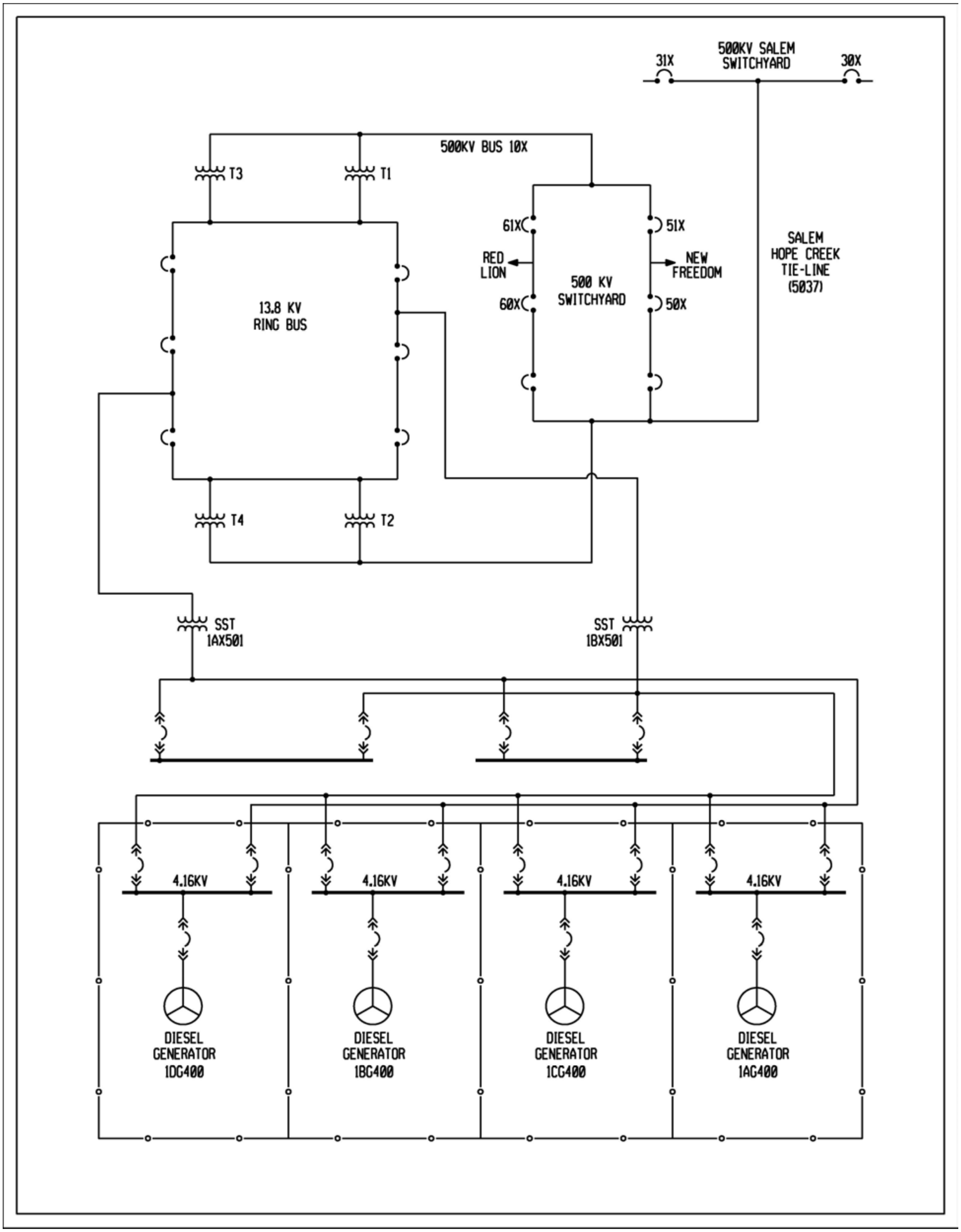
The NUREG-1800 guidance on scoping of equipment relied on to meet the requirements of the SBO rule (10 CFR 50.63) for license renewal has been incorporated into the Hope Creek scoping methodology. In accordance with the NUREG-1800 requirements, the SSCs required to recover from the SBO event are included in the scope of license renewal. Recovery is defined as the repowering of the plant AC distribution system from offsite sources or onsite emergency AC sources.

For Hope Creek, this includes the portion of the plant electrical system used to connect the in scope AC distribution system equipment to offsite power and by definition recover from an SBO event. For Hope Creek, the boundary between the electrical transmission network and the plant electrical distribution system and equipment has been defined at the circuit breakers between the switchyard bus and the offsite transmission lines. These connections are at the 30X, 31X, 50X, 51X, 60X, and 61X 500kV circuit breakers. These circuit breakers are the isolation devices between the plant electrical distribution system and the offsite electrical transmission network and are in scope. Included in the scope of license renewal on the plant side of this boundary are: switchyard bus and connections, transmission conductors and connections, high voltage insulators, substation structures and supports, inaccessible medium voltage cables, metal enclosed bus, insulated cables and connections, and cable connections (metallic parts). See Figure 2.1-2.

The SBO basis document summarizes the results of a review of the Hope Creek current licensing basis with respect to station blackout. The basis document provides lists of systems and structures credited in Hope Creek SBO evaluations. For the listed systems and structures, the basis document also identifies appropriate CLB references. These systems and structures are included in the scope of license renewal under the 10 CFR 54.4(a)(3) scoping criteria.

Figure 2.1-2

Hope Creek Offsite Power for SBO



2.1.4 INTERIM STAFF GUIDANCE DISCUSSION

The NRC has encouraged applicants for license renewal to address proposed Interim Staff Guidance (ISG) issues in license renewal applications. The following is the complete list of ISG issues that have not been incorporated in current license renewal guidance documents as of March 2009.

LR-ISG-19B	Cracking of Nickel-alloy Components in the Reactor Coolant Pressure Boundary
LR-ISG-2006-01	Corrosion of the Mark I Steel Containment Drywell Shell
LR-ISG-2006-02	Staff Guidance on Acceptance Review for Environmental Requirements
LR-ISG-2006-03	Staff Guidance for Preparing Severe Accident Mitigation Alternatives (SAMA) Analyses
LR-ISG-2007-01	Updating the LR-ISG Process to Include References to the Environmental Review Guidance Documents, References for the Recent Publication of Revision 1 of the License Renewal Guidance Documents, and Minor Revisions to Be Consistent with Current Staff Practices
LR-ISG-2007-02	Changes to Generic Aging Lesson Learned (GALL) Report Aging Management Program (AMP) XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements"

The following sections provide a summary discussion of each of the ISG issues:

2.1.4.1 Cracking of Nickel-alloy Components in the Reactor Coolant Pressure Boundary (LR-ISG-19B)

This ISG is only applicable to pressurized water reactors and is therefore not applicable to the Hope Creek boiling water reactor.

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

This LR-ISG provides interim guidance to applicants for license renewal for a plant with a BWR Mark I steel containment to provide a plant-specific aging management program that addresses the potential loss of material due to corrosion in the inaccessible areas of their Mark I steel containment drywell shell for the period of extended operation. In conducting the aging management review and developing the plant-specific aging management program for the drywell shell, the LR-ISG requires the applicant to consider six (6) recommended actions based upon plant design and operating experience. Hope Creek conducted an aging review of inaccessible areas of its Mark I containment considering plant design and operating experience, discussed above. Hope Creek concluded that plant-specific activities are required to ensure loss of material in inaccessible areas of the drywell shell is adequately managed or mitigated consistent with the LR-ISG-2006-01 guidance. This review is discussed in Section 3.5.2.2.1.4.

2.1.4.3 Staff Guidance on Acceptance Review for Environmental Requirements (LR-ISG-2006-02)

The NRC staff has promulgated for public comment proposed guidance for this issue. The guidance of this LR-ISG consists of an environmental report (ER) acceptance review checklist for use by the NRC staff. Hope Creek has prepared the license renewal environmental report in accordance with the requirements summarized in LR-ISG-2006-02.

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

The NRC staff has issued final guidance for this issue. The Hope Creek severe accident mitigation alternatives analysis provided as a part of Appendix E to this application is consistent with the guidance of NEI 05-01, Severe Accident Mitigation Alternatives (SAMA) Analysis Guidance Document, as discussed in this Interim Staff Guidance.

2.1.4.5 Updating the LR-ISG Process to Include References to the Environmental Review Guidance Documents, References for the Recent Publication of Revision 1 of the License Renewal Guidance Documents, and Minor Revisions to Be Consistent with Current Staff Practices (LR-ISG-2007-01)

The NRC staff is developing this ISG. No guidance has yet been promulgated.

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

The NRC staff has promulgated for public comment proposed guidance for this issue. Hope Creek has addressed the September 6, 2007 draft of LR-ISG-2007-02 in the aging management program Electrical Cable Connections not Subject to 10 CFR 50.49 Environmental Qualification Requirements, which is described in Appendix B.2.1.39.

2.1.5 SCOPING PROCEDURE

The scoping process is the systematic process used to identify the Hope Creek systems, structures and components within the scope of the license renewal rule. The scoping process was initially performed at the system and structure level, in accordance with the scoping criteria identified in 10 CFR 54.4(a). System and structure functions and intended functions were identified from a review of the source CLB documents. In scope boundaries were established and documented in the scoping evaluations, based on the identified intended functions. The in scope boundaries form the basis for identification of the in scope components, which is the first step in the screening process described in Section 2.1.6. System and structure scoping evaluations are documented and have been retained in a license renewal database. The system and structure scoping results are provided in Section 2.2.

The Hope Creek scoping process began with the development of a comprehensive list of plant systems and structures, as described in Section 2.1.3.1. The systems and structures were grouped into one of the following categories:

- Reactor Vessel, Internals, and Reactor Coolant System
- Engineered Safety Features
- Auxiliary Systems
- Steam and Power Conversion System
- Electrical and Instrumentation and Control (I&C) Systems
- Containment, Structures, and Component Supports

Each Hope Creek system and structure was then scoped for license renewal using the criteria of 10 CFR 54.4(a). These criteria are briefly identified as follows:

- Title 10 CFR 54.4(a)(1) – Safety-related
- Title 10 CFR 54.4(a)(2) – Non-safety-related affecting safety-related
- Title 10 CFR 54.4(a)(3) – The five regulated events:
    - Fire Protection (10 CFR 50.48)
    - Environmental Qualification, EQ (10 CFR 50.49)
    - Pressurized Thermal Shock (10 CFR 50.61) (PWRs only)
    - Anticipated Transient Without Scram, ATWS (10 CFR 50.62)
    - Station Blackout, SBO (10 CFR 50.63)

The application of each of these criteria is discussed in Section 2.1.5.1, Section 2.1.5.2 and Section 2.1.5.3 below:

2.1.5.1 <u>Safety-Related – 10 CFR 54.4(a)(1)</u>

In accordance with 10 CFR 54.4(a)(1), the systems, structures and components within the scope of license renewal include:

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

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

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

(iii) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to those referred to in 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11, as applicable.

At Hope Creek, the safety-related plant components are identified in the SAP database. The safety-related classifications in the Hope Creek SAP database were established using a controlled procedure, with classification criteria nearly identical to the above 10 CFR 54.4(a)(1) criteria. The classification criteria differences were evaluated in a license renewal basis document (see Section 2.1.3.2) and accounted for during the license renewal scoping process.

Safety-related classifications for systems and structures are based on system and structure descriptions and analyses in the UFSAR, or on design basis documents such as engineering drawings, evaluations or calculations. Safety-related structures are those structures listed in the UFSAR and classified as Seismic Category I. Systems and structures that are identified as safety-related in the UFSAR or in design basis documents have been classified as satisfying criteria of 10 CFR 54.4(a)(1) and have been included within the scope of license renewal. Safety-related components in the SAP database were also reviewed and the system or structure associated with the safety-related component was included in scope under 10 CFR 54.4(a)(1) criterion. The review also confirmed that all plant conditions, including conditions of normal operation, abnormal operational transients, design basis accidents, internal and external events, and natural phenomena for which the plant must be designed, were considered for license renewal scoping.

2.1.5.2 <u>Nonsafety-Related Affecting Safety-Related – 10 CFR 54.4(a)(2)</u>

In accordance with 10 CFR 54.4(a)(2), the systems, structures and components within the scope of license renewal include –

- All nonsafety-related systems, structures and components whose failure could prevent satisfactory accomplishment of any of the functions identified in 10 CFR 54.4(a)(1)(i), (ii) or (iii).

This scoping criterion requires an assessment of nonsafety-related SSCs with respect to the following application or configuration categories:

- Functional support for safety-related SSC 10 CFR 54.4(a)(1) functions
- Connected to and provide structural support for safety-related SSCs
- Potential for spatial interactions with safety-related SSCs

- Mitigative plant design features used to exclude SSCs from the scope of license renewal

Each of these four categories are discussed below:

Functional Support for Safety-Related SSC 10 CFR 54.4(a)(1) Functions

This category addresses nonsafety-related SSCs that are required to function in support of a safety-related SSC intended function. The functional requirement distinguishes this category from the other categories, where the nonsafety-related SSCs are required only to maintain adequate integrity to preclude structural failure or spatial interactions. The nonsafety-related SSCs that were included in scope under this review, to support a safety-related SSC in performing a 10 CFR 54.4(a)(1) intended function, are identified on the license renewal boundary drawings in green.

The Hope Creek UFSAR and other CLB documents were reviewed to identify nonsafety-related systems or structures required to support satisfactory accomplishment of a safety-related function. Nonsafety-related systems or structures credited in CLB documents to support a safety-related function have been included within the scope of license renewal. Hope Creek classifies systems that are required to perform or support a safety-related function as safety-related, with the following exceptions:

- The normal compressed air supply to the fuel pool gate seals is nonsafety-related. Nonsafety-related compressed air cylinders provide a back up source of air that is automatically isolated from the normal supply by check valves.

- Nonsafety-related Main Steam piping downstream of the outboard main steam isolation valves up to the turbine stop valves is credited for plate-out surface in some post-accident radiological analyses.

- The nonsafety-related Main Condenser is credited for holdup volume in some post-accident radiological analyses.

These nonsafety-related systems were included in the scope of license renewal under 10 CFR 54.4(a)(2).

As an additional confirmation of scoping under this 10 CFR 54.4(a)(2) category, a supporting system review was completed as part of the scoping process. The scoping process was performed on a system and structure basis. The scoping evaluation for each system and structure was documented on a System and Structure Scoping Report. When a system was included in scope under 10 CFR 54.4(a)(1), the scoping evaluation included the identification of any additional systems required to support the safety-related system intended functions. It was then confirmed that these identified supporting systems were also included in scope. Except as identified above, the Hope Creek systems required to support 10 CFR 54.4(a)(1) functions are classified safety-related at Hope Creek, and as such included in the scope of license renewal under 10 CFR 54.4(a)(1). The identification of supporting systems was not required for structures, as structural intended functions do not rely on supporting systems.

The next three 10 CFR 54.4(a)(2) scoping categories are the subject of NEI 95-10 Appendix F. The guidance requires that, when demonstrating that failures of nonsafety-related systems would not adversely impact the ability to maintain intended functions, a distinction must be made between nonsafety-related systems that are connected to safety-related systems and those that are not connected to safety-related systems. For a nonsafety-related piping system that is connected and provides structural support to a safety-related piping system, the nonsafety-related piping and supports should be included within the scope of license renewal up to and including the first anchor point past the safety-nonsafety interface.

For nonsafety-related systems which are not connected to safety-related piping or components, or are beyond the first seismic anchor past the safety/nonsafety interface, but have a spatial relationship such that their failure could adversely impact on the performance of a safety-related SSC's intended function, there are two scoping options: a mitigative option or a preventive option. When mitigative features (e.g., pipe whip restraints, jet impingement shields, spray and drip shields, seismic supports, flood barriers) are provided to protect safety-related SSCs from failures of nonsafety-related SSCs, this demonstration should show that mitigating devices are adequate to protect safety-related SSCs from failures of nonsafety-related SSCs regardless of failure location. If this level of protection can be demonstrated, then only the mitigative features need to be included within the scope of license renewal. However, if it cannot be demonstrated that the mitigative features are adequate to protect safety-related SSCs from the consequences of failures of nonsafety-related SSCs, then the preventive option is used, which requires that the nonsafety-related SSC be brought into the scope of license renewal.

The methodology for identification of Hope Creek SSCs that satisfy the 10 CFR 54.4(a)(2) scoping criterion was based on a review of applicable CLB documents, as well as plant specific and industry operating experience. The preventive option is used to demonstrate that safety-related SSCs are adequately protected from failure of nonsafety-related SSCs.

Connected to and Provide Structural Support for Safety-Related SSCs

For nonsafety-related piping connected to safety-related piping, the nonsafety-related piping was assumed to provide structural support to the safety-related piping, unless otherwise confirmed by a review of the installation details.

The nonsafety-related piping was included in scope for 10 CFR 54.4(a)(2), up to one of the following:

1. The first seismic anchor. Only true anchors that ensure forces and moments are restrained in three orthogonal directions are credited.
2. An anchored component (e.g., pump, heat exchanger, tank, etc.) that is designed not to impose loads on connecting piping. The anchored component is included in the scope of license renewal as it has a structural support function for the safety-related piping.

3. A flexible connection that is considered a pipe stress analysis model end point when the flexible connection effectively decouples the piping system (i.e., does not support loads or transfer loads across it to connecting piping).

4. A free end of nonsafety-related piping, such as a drain pipe that ends at an open floor drain.

5. For nonsafety-related piping runs that are connected at both ends to safety-related piping, the entire run of nonsafety-related piping is included in scope.

6. A branch line off of a header where the moment of inertia of the header is greater than 15 times the moment of inertia of the branch. The header is treated as an anchor.

These scoping boundaries are determined from review of the physical installation details, design drawings or seismic analysis calculations.

Failure in the nonsafety-related piping beyond the above anchor locations would not impact structural support for the safety-related piping. The associated piping and components included in the scope of license renewal are identified on the license renewal boundary drawings in red. Note that if the connected nonsafety-related piping system contains water, steam or oil, then the in scope boundary may extend beyond the locations described above due to potential spatial interaction.

Potential for Spatial Interactions with Safety-Related SSCs

Nonsafety-related systems that are not connected to safety-related piping or components, or are beyond the first seismic anchor past the safety/nonsafety interface, and have a spatial relationship such that their failure could adversely impact the performance of a safety-related SSC intended function, must be evaluated for license renewal scope in accordance with 10 CFR 54.4(a)(2) requirements. As described in NEI 95-10 Appendix F, there are two options when performing this scoping evaluation: a mitigative option and a preventive option.

The mitigative option involves crediting plant mitigative features (e.g., pipe whip restraints, jet impingement shields, spray and drip shields, seismic supports, flood barriers) to protect safety-related SSCs from failures of nonsafety-related SSCs. This option requires a demonstration that the mitigating features are adequate to protect safety-related SSCs from failures of nonsafety-related SSCs regardless of failure location. If this level of protection can be demonstrated, then only the mitigative features need be included within the scope of license renewal.

The preventive option involves identifying the nonsafety-related SSCs that have a spatial relationship such that failure could adversely impact the performance of a safety-related SSC intended function, and including the identified nonsafety-related SSC in the scope of license renewal without consideration of plant mitigative features.

Hope Creek applied the preventive option for 10 CFR 54.4(a)(2) scoping.

The preventive option as implemented at Hope Creek is based on a “spaces” approach for scoping of nonsafety-related systems with potential for spatial interaction with safety-related SSCs. Potential spatial interaction is assumed in structures that contain active or passive SSCs that have safety-related functions. The structures of concern for potential spatial interaction were identified based on a review of the CLB to determine which structures contained active or passive safety-related SSCs. Plant walkdowns were performed as required to confirm that all structures containing safety-related SSCs are identified. It is assumed that nonsafety-related SSCs within these structures may be located in proximity to safety-related SSCs.

For structures that contain safety-related SSCs, there may be selected rooms within the structure that do not contain any safety-related components within the room. In a few of these cases, spatial interaction was addressed by confirming that no safety-related components are located within the room, thereby eliminating spatial interaction concerns within these rooms. CLB document reviews and plant walkdowns were utilized as appropriate to confirm that these rooms did not contain safety-related SSCs.

Nonsafety-related piping and components that contain water, oil, or steam, and are located inside structures that contain safety-related SSCs, are included in scope for potential spatial interaction under criterion 10 CFR 54.4(a)(2), unless located in an excluded room. High-energy lines located within structures that contain safety-related equipment are included in the scope of license renewal, under 10 CFR 54.4 (a)(1) or (a)(2), depending on their safety classification. Safety-related high-energy lines are in scope under 10 CFR 54.4 (a)(1), and nonsafety-related high-energy lines are in scope under 10 CFR 54.4 (a)(2). Potential spatial interaction due to leakage or spray is assumed for system pressure as low as atmospheric. System piping and components operating below atmospheric pressure, i.e., under vacuum conditions, do not pose a potential spray hazard and are therefore not included in the scope of license renewal for potential spatial interaction with safety-related equipment. Supports for all nonsafety-related SSCs within these structures are included in scope.

Nonsafety-related piping and components that contain water, oil, or steam are not excluded from scope unless it can be demonstrated that they are not in proximity to safety-related SSCs. This is demonstrated by confirming that there are no safety-related SSCs located within the same space (structure, room or enclosure) as the nonsafety-related piping or component containing water, oil, or steam. This demonstration is based on confirming that there are physical barriers (floors, walls) completely separating the nonsafety-related piping or component from safety-related SSCs, thereby preventing the potential spatial interaction. The structural barrier components are included in scope. No credit is taken for separation by distance alone without a physical barrier capable of preventing the spatial interaction.

Air and gas systems (non-liquid) are not a hazard to other plant equipment, and have therefore been determined not to have spatial interactions with safety-related SSCs. SSCs containing air or gas cannot adversely affect safety-related SSCs due to leakage or spray, since gas systems contain no liquids that could spray or leak onto safety-related systems to cause shorts or other malfunctions. Gas systems at Hope Creek do not contain sufficient energy to cause pipe whip or jet impingement. Thus the nonsafety-related systems containing air or gas are not included in the scope of license renewal for spatial interaction. The supports are included in scope to prevent the nonsafety-related piping from falling down and potentially impacting safety-related SSCs.

The piping systems included in the scope of license renewal under 10 CFR 54.4(a)(2) for potential spatial interaction with safety-related SSCs are identified on the license renewal Boundary Drawings in red.

Mitigative Plant Design Features Used to Exclude SSCs from the Scope of License Renewal

None.

2.1.5.3 Regulated Events – 10 CFR 54.4(a)(3)

In accordance with 10 CFR 54.4(a)(3), the systems, structures and components within the scope of license renewal include –

> *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 50.61), and station blackout (10 CFR 50.63).*

The regulation for pressurized thermal shock (10 CFR 50.61) is applicable to pressurized water reactors only, and is therefore not applicable the Hope Creek boiling water reactor. For each of the other four applicable regulations, a technical basis document was prepared to provide input into the scoping process. Each of the regulated event basis documents (described in Section 2.1.3.4) identify the systems and structures that are relied upon to demonstrate compliance with the applicable regulation. The basis documents also identify the source documentation used to determine the scope of components within the system that are credited to demonstrate compliance with each of the applicable regulated events. Guidance provided by the technical basis documents was incorporated into the system and structure scoping evaluations, to determine the SSCs credited for each of the regulated events. SSCs credited in the regulated events have been classified as satisfying criteria of 10 CFR 54.4(a)(3) and have been included within the scope of license renewal.

2.1.5.4 System and Structure Intended Functions

For the systems and structures in the scope of license renewal, the intended functions that are the bases for including them within the scope of license renewal are identified and documented in the scoping evaluation. The system or structure intended functions are based on the applicable CLB reference documents. For systems, the system level intended function descriptions associated with 10 CFR 54.4(a)(1) were standardized based on nuclear safety criteria for boiling water reactors as documented in industry standard ANSI/ANS-52.1-1983. This provided for consistent function application and appropriate level of detail for system level function descriptions. The component level passive intended functions are those structure and component passive functions that are necessary to support the system and structure intended functions. The structure and component intended functions are further described in Section 2.1.6.2, below.

2.1.5.5 Scoping Boundary Determination

Systems and structures that are included in the scope of license renewal are then further evaluated to determine the population of in scope structures and components. This part of the scoping process is also a transition from the scoping process to the screening process. The process for evaluating mechanical systems is different from the process for structures, primarily because the plant design document formats are different. Mechanical systems are depicted primarily on the system piping and instrumentation diagram (P&ID) that show the system components and their functional relationships, while structures are depicted on physical drawings. Electrical and I&C components of in scope electrical and in scope mechanical systems are placed into commodity groups and are screened as commodities. Scoping boundaries for mechanical systems, electrical systems and structures are therefore described separately.

Mechanical Systems

For mechanical systems, the mechanical components that support the system intended functions are included in the scope of license renewal and are depicted on the applicable system piping and instrumentation diagram. Mechanical system piping and instrumentation diagrams are marked up to create license renewal boundary drawings showing the in scope components. Components that are required to support a safety-related function, or a function that demonstrates compliance with one of the license renewal regulated events, are identified on the system piping and instrumentation diagrams by green highlighting. Nonsafety-related components that are connected to safety-related components and are required to provide structural support at the safety/non-safety interface, or components whose failure could prevent satisfactory accomplishment of a safety-related function due to spatial interaction with safety-related SSCs, are identified by red highlighting. A computer sort and download of associated system components from the SAP database confirms the scope of components in the system. Plant walkdowns were performed when required for additional confirmation.

Structures

For structures, the structural components that support the intended functions are included in the scope of license renewal. The structural components are identified from a review of applicable plant design drawings of the structure. Plant walkdowns were performed when required for additional confirmation. A single site plan layout drawing is marked up to create a license renewal boundary drawing showing the in scope structures.

Electrical and I&C Systems

Electrical and I&C systems, and electrical components within mechanical systems, did not require further system evaluations to determine which components were required to perform or support the identified intended functions. A bounding scoping approach is used for electrical equipment. All electrical components within in scope systems were included in the scope of license renewal. In scope electrical components were placed into commodity groups and were evaluated as commodities during the screening process as described in Section 2.1.6.

A single electrical boundary drawing was prepared to schematically show the portions of the plant electrical distribution system that are included in the scope of license renewal. The electrical boundary drawing shows the main plant electrical distribution busses, interfaces with the on-site emergency power supplies, and boundary with the electrical transmission network.

2.1.6 SCREENING PROCEDURE

Once the SSCs within the scope of license renewal have been determined, the next step is to determine which structures and components are subject to an aging management review.

2.1.6.1 Identification of Structures and Components Subject to AMR

The requirement to identify structures and components subject to an aging management review is specified in 10 CFR 54.21(a)(1), which states:

Each application must contain the following information:

(a) An integrated plant assessment (IPA). The IPA must –

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

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

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

Structures and components that perform an intended function without moving parts or without a change in configuration or properties are defined as passive for license renewal. Passive structures and components that are not subject to replacement based on a qualified life or specified time period are defined as long-lived for license renewal. The screening procedure is the process used to identify the passive, long-lived structures and components in the scope of license renewal and subject to aging management review.

NUREG-1800, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants” and NEI 95-10, Appendix B were used as the basis for the identification of passive structures and components. Most passive structures and components are long-lived. In the few cases where a passive component is determined not to be long-lived, such determination is documented in the screening evaluation and, if applicable, on the associated license renewal boundary drawing.

The Hope Creek structures and components subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21(a)(1) described above. The process implemented to meet these requirements for mechanical systems, structures and electrical systems and components is described as follows:

Mechanical Systems

The mechanical system screening process began with the results from the scoping process. For in scope mechanical systems, the completed scoping packages include written descriptions and marked up system piping and instrumentation diagrams that clearly identify the in scope system boundary for license renewal. The marked up system piping and instrumentation diagrams are called boundary drawings for license renewal. These system boundary drawings were carefully reviewed to identify the passive, long-lived components, and the identified components were then entered into the license renewal database. Component listings from the SAP database were also reviewed to confirm that all system components were considered. In cases where the system piping and instrumentation diagram did not provide sufficient detail, such as for some large vendor supplied components (e.g., compressors, emergency diesel generators), the associated component drawings or vendor manuals were also reviewed. Plant walkdowns were performed when required for confirmation. Finally, the identified list of passive, long-lived system components was benchmarked against previous license renewal applications containing a similar system.

Mechanical components are screened with the system in which they were scoped. The only exception involves heat exchangers and coolers, which often involve different system fluids on either side of the heat transfer surface. Heat exchangers and coolers are screened as follows:

1. With the exception of heat exchangers and coolers that are in scope only for 10 CFR 54.4 (a)(2) spatial interactions, the materials, environments and aging effects on both sides of the heat transfer surfaces are evaluated with the system that performs the cooling function. This convention was chosen because the significant aging effects and associated aging management program activities are generally associated with the cooling system side.

2. For heat exchangers and coolers that are in scope for 10 CFR 54.4 (a)(2) only, the portions of the heat exchanger or cooler with the potential for spatial interaction are a function of the design and the process fluid. Therefore, each side of the heat exchanger or cooler is evaluated separately with the system associated with the process environment.

Containments, Structures, and Component Supports

The structure screening process also began with the results from the scoping process. For in scope structures, the completed scoping packages include written descriptions of the structure. If only selected portions of the structure are in scope, the in scope portions are described in the scoping evaluation. The associated structure drawings were carefully reviewed to identify the passive, long-lived structures and components, and the identified structures and components were then entered into the license renewal database. Component listings from the SAP database were also reviewed to confirm that all structural components were considered. Plant walkdowns were performed when required for confirmation. Finally, the identified list of passive, long-lived structures and components was benchmarked against previous license renewal applications.

Electrical and I&C Components

Screening of electrical and I&C components used a bounding approach as described in NEI 95-10. Electrical commodity groups were identified without regard to system. Electrical and I&C components/commodity groups are subject to aging management review, unless they are determined to not be in scope at the system level. The commodity groups subject to an aging management review are identified by applying the criteria of 10 CFR 54.21(a)(1). This method provides the most efficient means for determining the electrical commodity groups subject to an aging management review since many electrical and I&C components/commodity groups are active.

The sequence of steps and special considerations for identification of electrical components that require an aging management review is as follows:

1. Electrical and I&C components in use in license renewal in scope systems at Hope Creek were identified and listed. The listing provided by NEI 95-10 Appendix B is the basis for this list. Electrical and I&C components were organized into commodity groups such as circuit breakers, switches, and cables. Individual components were not identified. The electrical and I&C component commodity groups were identified from a review of plant documents, controlled drawings, the plant equipment database (SAP), and interface with the parallel mechanical and civil/structural screening efforts.

2. Following the identification of the electrical component commodity groups, the criterion of 10 CFR 54.21(a)(1)(i) was applied to identify component commodity groups that perform their functions without moving parts or without a change in configuration or properties (referred to as “passive” components). These components were identified utilizing the guidance of NEI 95-10 and the EPRI License Renewal Electrical Handbook.

3. Electrical commodity groups that perform no license renewal intended functions were not considered further because they do not require aging management review.

4. The screening criterion found in 10 CFR 54.21(a)(1)(ii) excludes those components or commodity groups that are subject to replacement based on a qualified life or specific time period from the requirements of an aging

management review. The 10 CFR 54.21(a)(1)(ii) screening criterion was applied to those components and commodity groups that were not previously eliminated by the application of the 10 CFR 54.21(a)(1)(i) screening criterion. Components and commodity groups included in the plant environmental qualification (EQ) program are replaced on a specified interval based on a qualified life. Components and commodity groups in the EQ program do not meet the "long-lived" criteria of 10 CFR 54.21(a)(1)(ii) and are "short-lived" per the regulatory definition, and are therefore not subject to an aging management review.

5. Components which support or interface with electrical components, for example, cable trays, conduits, instrument racks, panels and enclosures, are assessed as civil/structural components in Section 2.4.

The electrical components that require an aging management review are the separate electrical components that are not a part of a larger active component. For example, the wiring, terminal blocks, and connections located internal to a circuit breaker cubicle were considered to be part of the circuit breaker. Accordingly, the circuit breaker is screened, but not the individual internal parts.

The passive commodity groups that are not subject to replacement based on a qualified life or specified time period are subject to an aging management review. For Hope Creek, the electrical commodity groups that require an AMR are identified in Section 2.5.

2.1.6.2 Passive Intended Function Definitions

The intended functions that the components and structures must fulfill are those functions that are the bases for including them within the scope of license renewal. A component function is an intended function if it must perform that function for the system to be able to perform the system intended function(s). For example, pressure boundary failure of a component would cause loss of inventory from the system, and the system would subsequently be unable to perform its intended function(s). Structures and components may have multiple intended functions. Hope Creek has considered multiple intended functions where applicable, consistent with the staff guidance provided in Table 2.1-3 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (Reference 1.7.4).

Table 2.1-1 provides expanded definitions of structure and component passive intended functions identified in this application.

Table 2.1-1 Passive Structure and Component Intended Function Definitions

Passive Intended Function	Definition
Absorb Neutrons	Absorb neutrons
Direct Flow	Provide spray shield or curbs for directing flow
Electrical Continuity	Provide electrical connections to specified sections of an electrical circuit to deliver voltage, current, or signals
Expansion/Separation	Provide for thermal expansion and/or seismic separation
Filter	Provide filtration
Fire Barrier	Provide rated fire barrier to confine or retard fire from spreading to or from adjacent areas of the plant
Flood Barrier	Provide flood protection barrier (internal and external flood event)
Heat Transfer	Provide heat transfer
HELB/MELB Shielding	Provide shielding against high energy line breaks (HELB), and protective features for medium energy line breaks (MELB)
Insulation - Electrical	Insulate and support an electric conductor
Leakage Boundary	Nonsafety-related component that maintains mechanical and structural integrity to prevent spatial interactions that could cause failure of safety-related SSCs. This function includes the required structural support when the nonsafety-related leakage boundary piping is also attached to safety-related piping.
Maintain Adhesion	Provides adhesion to the substrate
Mechanical Closure	Provide closure of components. Typically used with bolting.
Missile Barrier	Provide missile barrier (internal or external missiles)
Pipe Whip Restraint	Provide pipe whip restraint
Pressure Boundary	Provide pressure-retaining boundary so that sufficient flow at adequate pressure is delivered, or provide fission product barrier for containment pressure boundary, or provide containment isolation for fission product retention. This intended function also includes the containment, holdup and plateout function for the Main Steam and Main Condenser systems.

Table 2.1-1 Passive Structure and Component Intended Function Definitions

Passive Intended Function	Definition
Pressure Relief	Provide overpressure protection
Shelter, Protection	Provide shelter/protection for structures and components within the scope for 10 CFR 54.4(a)(1), (a)(2), or (a)(3).
Shielding	Provide shielding against radiation
Spray	Convert fluid into spray
Structural Pressure Boundary	Provide pressure boundary or essentially leak tight barrier to protect public health and safety in the event of any postulated design basis events.
Structural Support	Provide structural support for structures and components within the scope for 10 CFR 54.4(a)(1), (a)(2), or (a)(3) or provide structural integrity to preclude nonsafety-related component interactions that could prevent satisfactory accomplishment of a safety-related function.
Structural Support to maintain core configuration and flow distribution	Provide structural support of fuel assemblies, control rods, and incore instrumentation, to maintain core configuration and flow distribution.
Thermal Insulation	Control of heat loss to preclude overheating of nearby safety-related SSCs, 10 CFR 54.4 (a)(2)
Throttle	Provide flow restriction
Vibration Isolation	Provide flexible support to minimize the impact of vibration
Water retaining boundary	Provide an essentially water leak tight boundary

2.1.6.3 <u>Stored Equipment</u>

Equipment that is stored on site for installation in response to a design basis event is considered to be within the scope of license renewal. At Hope Creek, certain fire scenarios utilize stored portable ventilation equipment to facilitate smoke removal following a fire. The stored portable ventilation equipment is listed in controlled station procedures. These components are confirmed available and in good operating condition by periodic surveillance test and inspections. Tools and supplies used to place the stored equipment in service are not in the scope of license renewal.

2.1.6.4 Consumables

The evaluation process for consumables is consistent with the guidance provided in NUREG-1800 Table 2.1-3. Consumables have been divided into the following four categories for the purpose of license renewal: (a) packing, gaskets, component seals, and O-rings; (b) structural sealants; (c) oil, grease, and component filters; and (d) system filters, fire extinguishers, fire hoses, and air packs.

- Group (a) subcomponents (packing, gaskets, seals, and O-rings): Based on ANSI B31.1 and the ASME B&PV Code Section III, the subcomponents of pressure retaining components as shown above are not pressure-retaining parts. Therefore, these subcomponents are not relied on to form a pressure-retaining function and are not subject to an AMR.
- Group (b) structural sealants: AMRs were required for structural sealants in in scope structures. A summary of the AMR results is presented in Section 2.4.
- Group (c) subcomponents (oil, grease, and component filters): These components are short lived and are periodically replaced. Various plant procedures are used in the replacement of oil, grease, and filters in components that are in scope for license renewal. These components are not subject to an AMR.
- Group (d) consumables (system filters, fire extinguishers, fire hoses, and air packs): System Ventilation filters are replaced in accordance with plant procedures based on vendor manufacturers' requirements and system testing. Fire extinguishers, self-contained breathing air packs and fire hoses are within the scope of license renewal, but are not subject to aging management because they are replaced based on condition. These components are periodically inspected in accordance with National Fire Protection Association (NFPA) standards. These standards require replacement of equipment based on their condition or performance during testing and inspection. The periodic inspections are implemented by controlled Hope Creek procedures. These components are subject to replacement based on NFPA standards implemented by controlled procedures, and are therefore not long-lived and not subject to an aging management review.

2.1.7 GENERIC SAFETY ISSUES

In accordance with the guidance in NEI 95-10 and Appendix A.3 of NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," review of NRC generic safety issues (GSIs) as part of the license renewal process is required to satisfy 10 CFR 54.29. This guidance suggests that GSIs involving issues related to license renewal aging management reviews or TLAAs should be addressed in the license renewal Application. Based on Nuclear Energy Institute (NEI) and NRC guidance, NUREG-0933 and previous license renewal applicants, the following GSIs are addressed for Hope Creek license renewal:

- GSI-156.6.1, Pipe Break Effects on Systems and Components - This GSI involves assumed high energy line breaks in which the effects of the resulting pipe break prevent the operation of mitigating systems, such as the containment or safety injection systems, that are required to mitigate the effects of the break. The GSI is only indirectly related to aging of piping systems, because the probability of failure of a piping system is affected by degradation, including metal fatigue that occurs over time. The aspects of pipe breaks that are associated with degradation are addressed in the aging management review tables associated with mechanical systems in Chapter 3.0 and in the TLAA evaluations of piping components in Chapter 4.0.

- GSI 168, Environmental Qualification of Electrical Equipment – This GSI has been closed by the NRC, as stated in Letter ACRSR-2028 from John T. Larkins, Executive Director of the Advisory Committee on Reactor Safeguards to William D. Travers, Executive Director for Operations, USNRC. EQ is addressed as a TLAA in Section 4.4.

- GSI 190, Fatigue Evaluation of Metal Components for 60-year Plant Life – This GSI addresses fatigue life of metal components and was closed by the NRC. In the closure letter, however, the NRC concluded that licensees should address the effects of reactor coolant environment on component fatigue life as aging management programs are formulated in support of license renewal. Accordingly, the issue of environmental effects on component fatigue life is addressed in Section 4.3.

NUREG-0933 (Reference 1.7.15) was reviewed and there are no new generic issues that involve issues related to license renewal aging management reviews or TLAAs.

2.1.8 CONCLUSION

The scoping and screening methodology described above was used for the Hope Creek IPA to identify the systems, structures, and components that are within the scope of license renewal and require an aging management review. The methodology is consistent with and satisfies the requirements of 10 CFR 54.4 and 10 CFR 54.21(a)(1).

2.2 PLANT LEVEL SCOPING RESULTS

Table 2.2-1 lists the Hope Creek systems, structures and commodity groups that were evaluated to determine if they were within the scope of license renewal, using the methodology described in Section 2.1. A reference to the section of the application that contains the scoping and screening results is provided for each in-scope mechanical system, structure and commodity group in the Table. A reference to the applicable Hope Creek UFSAR Section is provided for electrical systems and not in scope mechanical systems.

Table 2.2-1 Plant Level Scoping Results

System, Structure or Commodity Group	In Scope for License Renewal?	Comments
Reactor Vessel, Internals, and Reactor Coolant System		
Control Rods	Yes	2.3.1.1
Fuel Assemblies	Yes	2.3.1.2
Nuclear Boiler Instrumentation	Yes	2.3.1.3
Reactor Internals	Yes	2.3.1.4
Reactor Pressure Vessel	Yes	2.3.1.5
Reactor Recirculation System	Yes	2.3.1.6
Engineered Safety Features		
Automatic Depressurization System (ADS)	Yes	2.3.2.1
Containment Hydrogen Recombiner System	Yes	2.3.2.2
Core Spray System	Yes	2.3.2.3
Filtration, Recirculation, and Ventilation System	Yes	2.3.2.4
High Pressure Coolant Injection (HPCI) System	Yes	2.3.2.5
Hydrogen and Oxygen Analyzer System	Yes	2.3.2.6
Reactor Core Isolation Cooling (RCIC) System	Yes	2.3.2.7
Residual Heat Removal (RHR) System	Yes	2.3.2.8
Vacuum Relief Valve System	Yes	2.3.2.9
Auxiliary Systems		
Auxiliary Building Service and Radwaste HVAC Systems	No	UFSAR Section 9.4.3.1
Auxiliary Steam System	No	UFSAR Section 9.5.9
Chilled Water System	Yes	2.3.3.1
Closed Cycle Cooling Water System	Yes	2.3.3.2
Compressed Air System	Yes	2.3.3.3
Containment Inerting and Purging System	Yes	2.3.3.4

Table 2.2-1 Plant Level Scoping Results

System, Structure or Commodity Group	In Scope for License Renewal?	Comments
Control Area Chilled Water System	Yes	2.3.3.5
Control Rod Drive System	Yes	2.3.3.6
Control Room and Control Area HVAC Systems	Yes	2.3.3.7
Cranes & Hoists	Yes	2.3.3.8
Drywell Air Cooling System	No	UFSAR Section 9.4.5
Elevators & Manlifts	No	UFSAR Section 9.5
Equipment and Floor Drainage System	Yes	2.3.3.9
Fire Protection System	Yes	2.3.3.10
Fire Pump House Ventilation System	Yes	2.3.3.11
Fresh Water Supply System	Yes	2.3.3.12
Fuel Handling and Storage System	Yes	2.3.3.13
Fuel Pool Cooling and Cleanup System	Yes	2.3.3.14
Hardened Torus Vent System	Yes	2.3.3.15
Hydrogen Water Chemistry System	Yes	2.3.3.16
Leak Detection and Radiation Monitoring System	Yes	2.3.3.17
Makeup Demineralizer System	Yes	2.3.3.18
Miscellaneous Ventilation Systems	No	UFSAR Section 9.4
Primary Containment Instrument Gas System	Yes	2.3.3.19
Primary Containment Leakage Rate Testing System	Yes	2.3.3.20
Process and Post-Accident Sampling Systems	Yes	2.3.3.21
Radwaste System	Yes	2.3.3.22
Reactor Building Ventilation System	Yes	2.3.3.23
Reactor Water Cleanup System	Yes	2.3.3.24
Remote Shutdown Panel Room HVAC System	Yes	2.3.3. 25
Service Water Intake Ventilation System	Yes	2.3.3.26

Table 2.2-1 Plant Level Scoping Results

System, Structure or Commodity Group	In Scope for License Renewal?	Comments
Service Water System	Yes	2.3.3.27
Sewage Treatment System	No	UFSAR Section 9.2.4
Standby Diesel Generator Area Ventilation Systems	Yes	2.3.3.28
Standby Diesel Generators and Auxiliary Systems	Yes	2.3.3.29
Standby Liquid Control System	Yes	2.3.3.30
Torus Water Cleanup System	Yes	2.3.3.31
Traversing Incore Probe System	Yes	2.3.3.32
Steam and Power Conversion System		
Circulating Water System	No	UFSAR Section 10.4.5
Condensate Storage and Transfer System	Yes	2.3.4.1
Condensate System	No	UFSAR Section 10.4
Feedwater System	Yes	2.3.4.2
Main Condenser Air Extraction System	No	UFSAR Section 10.4.2
Main Condenser System	Yes	2.3.4.3
Main Generator and Auxiliary System	No	UFSAR Section 10.2.2.
Main Steam System	Yes	2.3.4.4
Main Turbine and Auxiliary System	No	UFSAR Section 10.2
Containment, Structures, and Component Supports		
Auxiliary Boiler Building	Yes	2.4.1
Auxiliary Building Control/Diesel Generator Area	Yes	2.4.2
Auxiliary Building Service/Radwaste Area	Yes	2.4.3
Circulating Water Structures	No	Comment 1
Component Supports Commodity Group	Yes	2.4.4
Fire Water Pump House	Yes	2.4.5

Table 2.2-1 Plant Level Scoping Results

System, Structure or Commodity Group	In Scope for License Renewal?	Comments
Fresh Water Pump Houses	No	Comment 2
Fuel Oil Storage Facilities	No	Comment 3
Gas Station and Fuel Storage Facilities	No	Comment 4
Hazardous Materials Storage Facilities	No	Comment 5
Maintenance Buildings and Shops	No	Comment 6
Materials Storage Facilities	No	Comment 7
Meteorological Tower Structures	No	Comment 8
Office Buildings	No	Comment 9
Piping and Component Insulation Commodity Group	Yes	2.4.6
Primary Containment	Yes	2.4.7
Radwaste Storage Facilities	No	Comment 10
Reactor Building	Yes	2.4.8
Security Structures	No	Comment 11
Service Water Intake Structures	Yes	2.4.9
Sewage Treatment Plant Facilities	No	Comment 12
Shoreline Protection and Dike	Yes	2.4.10
Storage Facilities	No	Comment 13
Switchyard	Yes	2.4.11
Telephone Structures	No	Comment 14
Turbine Building	Yes	2.4.12
Yard Structures	Yes	2.4.13
Electrical and Instrumentation and Control (I&C) Systems		
120 VAC Vital Power System	Yes	UFSAR Section 8.3.1
13.8 KV Station Power System	Yes	UFSAR Section 8.2
24/125/250 V Station DC Power System	Yes	UFSAR Section 8.3.2

Table 2.2-1 Plant Level Scoping Results

System, Structure or Commodity Group	In Scope for License Renewal?	Comments
4.16 KVAC System	Yes	UFSAR Section 8.3.1
480 V Auxiliary System	Yes	UFSAR Section 8.3.1
7.2 KVAC System	No	UFSAR Section 8.3.1
Communication System	Yes	UFSAR Section 9.5.2
Containment Isolation System	Yes	UFSAR Section 7.3.1
Control Room Complex System	Yes	UFSAR Section 7.1
Electrical Commodities	Yes	2.5.2.5
Freeze Protection System	Yes	UFSAR Section 9.5
Grounding & Cathodic Protection Systems	Yes	UFSAR Section 8.3.1.1.5
Lighting System	Yes	UFSAR Section 9.5.3
Miscellaneous Instruments & Control Systems	No	UFSAR Section 7.7
Neutron Monitoring System	Yes	UFSAR Section 7.6.1.4
Offsite 500 KVAC Power System	Yes	UFSAR Section 8.2.1
Reactor Protection System	Yes	UFSAR Section 7.2
Redundant Reactivity Control System	Yes	UFSAR Section 7.6
Remote Shutdown System	Yes	UFSAR Section 7.4.1
Security System	No	UFSAR Section 13.7
Source Range Monitoring System	No	UFSAR Section 7.7.1.1.2.2

Comments:

1. The Circulating Water Structures are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The purpose of the Circulating Water Structures is to provide physical support, shelter, and protection for the Circulating Water System components that provide cooling water to the main condenser. The Circulating Water Structures do not perform an intended function for license renewal and are not in the scope of license renewal.

2. The Fresh Water Pump Houses are classified nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The purpose of the Fresh Water Pump Houses is to provide structural support, shelter and protection for the nonsafety-related Fresh Water Supply System components and its supporting systems. The Fresh Water Pump Houses do not perform an intended function for license renewal and are not in the scope of license renewal.

3. The Fuel Oil Storage Facilities are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The purpose of the Fuel Oil Storage Facilities is to provide physical support, shelter and protection, and fluid containment for the fuel oil tanks and fuel oil system components. The Fuel Oil Storage Facilities do not perform an intended function for license renewal and are not in the scope of license renewal.

4. The Gas Station and Fuel Storage Facilities are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The purpose of the Gas Station and Fuel Storage Facilities is to provide physical support, shelter and protection, and fluid containment for the gasoline and diesel refuel tanks and pump stations of the Salem Units 1 and 2 and Hope Creek Generating Stations. The Gas Station and Fuel Storage Facilities do not perform an intended function for license renewal and are not in the scope of license renewal.

5. The Hazardous Materials Storage Facilities are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The purpose of the Hazardous Materials Storage Facilities is to provide support, shelter, and protection for storage and handling of hazardous materials for both the Salem Units 1 and 2 and Hope Creek Generating Stations. The Hazardous Materials Storage Facilities do not perform an intended function for license renewal and are not in the scope of license renewal.

6. The Maintenance Buildings and Shops are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The purpose of the Maintenance Buildings and Shops is to provide support, shelter, and protection for site maintenance personnel and their office space and shop area in support of the Salem Units 1 and 2 and Hope Creek Generating Stations. The Maintenance Buildings and Shops do not perform an intended function for license renewal and are not in the scope of license renewal.

7. The Materials Storage Facilities are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The purpose of the Materials Storage Facilities is to provide support, shelter, and protection for stored plant material and equipment, records storage, office space, conference

rooms and supporting facilities, the plant simulators and a fitness center of the Salem Units 1 and 2 and Hope Creek Generating Stations. The Materials Storage Facilities do not perform an intended function for license renewal and are not in the scope of license renewal.

8. The Meteorological Tower Structures are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The purpose of the Meteorological Tower Structures is to provide support, shelter and protection for the various meteorological instrumentations utilized to obtain the site meteorological data for the Salem Units 1 and 2 and Hope Creek Generating Stations. The Meteorological Tower Structures do not perform an intended function for license renewal and are not in the scope of license renewal.

9. The Office Buildings are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The purpose of the Office Buildings is to provide support, shelter, and protection for plant personnel and facilities that utilize office space, conference rooms and their supporting facilities for the Salem Units 1 and 2 and Hope Creek Generating Stations. The Office Buildings do not perform an intended function for license renewal and are not in the scope of license renewal.

10. The Radwaste Storage Facilities include the Low Level Radwaste Storage Facility and the Independent Spent Fuel Storage Installation. The Low Level Radwaste Storage Facility is nonsafety-related and separated from safety-related systems, structures, and components such that its failure would not impact a safety-related function. The purpose of the Low Level Radwaste Storage Facility is to provide a safe, secure space for temporary storage of low level radwaste generated by the Salem Units 1 and 2 and Hope Creek Generating Stations. The Low Level Radwaste Storage Facility does not perform an intended function and is not in scope for license renewal.

    The Independent Spent Fuel Storage Installation (ISFSI), used by both by the Salem Units 1 and 2 and Hope Creek Generating Stations, consists of reinforced concrete storage pads, a cask fab and staging pad, drainage system, temperature monitoring system, security systems, perimeter intrusion detection system and commercial grade enclosure founded on a concrete foundation. The ISFSI is designed to 10 CFR 72.212 requirements, licensed under general provisions of 10 CFR 72.210, and is not subject to 10 CFR 54 requirements.

11. The Security Structures are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The purpose of the Security Structures is to provide support, shelter, and protection for the plant security force and equipment required to control access into the protected area, surrounded by a perimeter fence, as required by 10 CFR 73. The Security Center also provides access and security control point to the protected area. The

Security Structures do not perform an intended function for license renewal and are not in the scope of license renewal.

12. The Sewage Treatment Plant Facilities are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The purpose of the Sewage Treatment Plant Facilities is to provide support, shelter and protection for the process systems for treating sanitary waste generated by the Salem Units 1 and 2 and Hope Creek Generating Stations. The Sewage Treatment Plant Facilities do not perform an intended function for license renewal and are not in the scope of license renewal.

13. The Storage Facilities are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The purpose of the Storage Facilities is to provide physical support, shelter, and protection for the asphalt storage tank, the boiler and their supporting system components. The Storage Facilities do not perform an intended function for license renewal and are not in the scope of license renewal.

14. The Telephone Structures are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The purpose of the Telephone Structures is to provide support, shelter, and protection for the Salem Units 1 and 2 and Hope Creek Generating Stations telecommunication systems. The Telephone Structures do not perform an intended function for license renewal and are not in the scope of license renewal.

2.3 SCOPING AND SCREENING RESULTS: MECHANICAL

2.3.1 REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM

The following systems are addressed in this section:

Control Rods (2.3.1.1)
Fuel Assemblies (2.3.1.2)
Nuclear Boiler Instrumentation (2.3.1.3)
Reactor Internals (2.3.1.4)
Reactor Pressure Vessel (2.3.1.5)
Reactor Recirculation System (2.3.1.6)

2.3.1.1 Control Rods

System Purpose

The Control Rods are replaceable, mechanical components consisting of cruciform-shaped stainless steel assemblies containing neutron-absorbing material, designed to be used for flux shaping and for reactivity control during reactor startup, power level changes, and shutdown. The Hope Creek reactor contains 185 control rods. The purpose of the control rod is to absorb neutrons in the reactor core, thereby providing the means to adjust core power shape, compensate for reactivity changes caused by fuel and burnable poison depletion, and fully shutdown the nuclear reaction. They accomplish this purpose, in conjunction with their positioning system (evaluated with the Control Rod Drive System), by providing continuous regulation of the core excess reactivity and reactivity distribution, and by providing sufficient reactivity compensation to render the reactor adequately subcritical from its most reactive condition.

System Operation

The Control Rods are comprised of four stainless steel wings assembled in a cruciform configuration. Each wing assembly is constructed of stainless steel material with boron carbide and/or hafnium as absorbing material. Each control rod has a handle assembly located at the top, and a velocity limiter at the bottom. The velocity limiter is designed to limit control rod free-fall velocity yet have a minimal restricting effect on motion during control rod insertion. The velocity limiter is a fabricated conically shaped assembly permanently attached to the bottom of the absorber section of the control rod, and contains the socket assembly for attachment of the control rod to the control rod drive. The velocity limiter acts as a large clearance piston in the control rod guide tube (evaluated with Reactor Internals) to restrict free-fall velocity of the control rod. In this manner, the energy release associated with the positive reactivity insertion during a control rod drop accident can not exceed an evaluated maximum, which results in no system damage and presents minimal offsite dose consequences. The restrictive force presented by the velocity limiter during control rod insertion is sufficiently low that a reactor scram will result in a high rate of negative reactivity insertion.

The Control Rod Drive System positions the control rods axially in the core, from fully inserted to fully withdrawn or to any of a number of intermediate positions. Each control rod location is in the center of a group of four fuel assemblies (evaluated with Fuel Assemblies), comprising a "cell". Each control rod is capable of being individually positioned, but the usual practice is to position groups of control rods throughout the core to provide reactivity adjustment and flux shaping for optimum power distribution and fuel utilization. Near the end of an operating cycle when core excess reactivity is at a minimum, all control rods are withdrawn to maintain rated reactor power (or highest achievable power if lower than rated) until scheduled shutdown for refueling. Control rod absorption of neutrons chemically depletes the absorber material, and control rod lifetime is monitored. Upon reaching prescribed thresholds, control rods are scheduled for replacement during refueling outages.

For more detailed information, see UFSAR Sections 4.1, 4.2 and 4.6.

System Boundary

The Control Rod license renewal boundary consists of the entire control rod and velocity limiter assembly.

Not included in the scoping boundary of the Control Rods is the Control Rod Drive System and the Fuel Assemblies, which are separately evaluated as license renewal systems, and the control rod guide tubes, which are evaluated with Reactor Internals.

Reason for Scope Determination

The Control Rods meet 10 CFR 54.4(a)(1) because they are safety-related components that are relied upon to remain functional during and following design basis events. The Control Rods are not in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the Control Rods would not prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The Control Rods are not in scope under 10 CFR 54.4(a)(3) because they are not 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), Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Introduce negative reactivity to achieve or maintain subcritical reactor condition. Control Rods are inserted in the reactor core to introduce negative reactivity. 10 CFR 54.4(a)(1)

UFSAR References

4.1
4.2
4.6

License Renewal Boundary Drawings

Not Required

Table 2.3.1-1 Control Rods
Components Subject to Aging Management Review

Component Type	Intended Function
Control Rods (Short-lived)	Control Rods are short-lived and are not subject to aging management review

Aging management review results are not applicable for these components.

2.3.1.2 Fuel Assemblies

System Purpose

The Fuel Assemblies are high integrity components containing the fissionable material that sustains the nuclear reaction when the reactor core is made critical. The purpose of the fuel assemblies is to allow efficient heat transfer from the nuclear fuel to the reactor coolant and to maintain structural integrity providing a controllable, coolable bundle geometry and fission product barrier. They accomplish this purpose by satisfying the thermal-mechanical, nuclear, and hydraulic requirements of the nuclear fuel design conditions within the reactor.

The Hope Creek reactor contains 764 fuel assemblies. During each refueling outage, approximately one-third of the highest depletion bundles are replaced and the positions of the remaining bundles are shuffled as required by the nuclear core design to optimize cycle energy, operating conditions, and fuel economics. Cycle-specific evaluations of the thermal-mechanical design known as supplemental reload licensing submittals are produced to assure that the safety and operational requirements of the fuel product line are met.

System Operation

Each Fuel Assembly is comprised of a fuel bundle and a channel that surrounds it. The fuel rods of each bundle are spaced and supported in a square array by the stainless steel upper and lower tie plates and intermediately placed Zircaloy spacer assemblies. The upper tie plate has a handle used for transferring the bundle from one location to another. The lower tie plate has a nosepiece, which supports the fuel assembly in the reactor. The lower tie plate may incorporate a debris filter grid. The fuel rods used in the assembly consist of high-density ceramic uranium dioxide fuel pellets stacked within Zircaloy cladding, evacuated and backfilled with helium and sealed with welded Zircaloy end plugs. The core reload design specifies the U-235 pellet enrichments used to reduce local peak-to-average fuel rod power ratios. Selected fuel rods within each reload bundle may also incorporate gadolinium as burnable poison. Three types of fuel rods may be used in a fuel bundle; a standard fuel rod with pin-type ends, tie rods with threaded ends that engage the lower tie plate and extend through the upper tie plate to be fastened with nuts and lock tabs, and part-length rods that by design do not extend the full length of the bundle. Water rods may be located in the center of the bundle array, and are used to provide increased neutron moderation.

The bundle channel is fabricated from Zircaloy and provides the flow path outer periphery for bundle coolant flow, supplies structural stiffness to the bundle and transmits seismic loadings to the core internal structures, provides a heat sink during a LOCA, and supplies a surface for control rod guidance within the reactor core. A channel fastener attaches the channel to the bundle at the upper tie plate. Finger springs may be used at the channel-to-lower tie plate interface to control bypass flow. Channels may be a uniform thickness or a thick-thin design with heavier gauge corners and lighter gauge side surfaces. Channel spacing is provided by means of spacer buttons located on the upper portion of the channel.

The above description is representative of fuel assemblies from a typical fuel vendor utilized in the reactor core. Fuel assemblies manufactured by other fuel vendors are used in the reactor core but are not specially described here since the differences in the fuel assemblies construction would not affect the scoping results for fuel assemblies.

For more detailed information, see UFSAR Sections 3.9.5, 4.1.2.1 and 4.2.

System Boundary

The Fuel Assembly license renewal boundary consists of the entire fuel bundle and channel assembly.

Not included in the scoping boundary of the Fuel Assemblies are the fuel support pieces, top guide, or other core internal structures, which are evaluated with Reactor Internals.

Reason for Scope Determination

The Fuel Assemblies meet 10 CFR 54.4(a)(1) because they are safety-related components that are relied upon to remain functional during and following design basis events. The Fuel Assemblies are not in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the Fuel Assemblies would not prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The Fuel Assemblies are not in scope under 10 CFR 54.4(a)(3) because they are not 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), Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Maintain reactor core assembly geometry. The Fuel Assemblies assure integrity of the nuclear fuel configuration, maintaining a coolable geometry and providing a cladding barrier to contain the fission products released from the fuel throughout the design life of the fuel rod. 10 CFR 54.4(a)(1)

UFSAR References

3.9.5
4.1.2.1
4.2

License Renewal Boundary Drawings

Not Required

Table 2.3.1-2 Fuel Assemblies
Components Subject to Aging Management Review

Component Type	Intended Function
Fuel Assemblies (Short-lived)	Fuel Assemblies are short-lived and are not subject to aging management review

Aging management review results are not applicable for these components.

2.3.1.3 Nuclear Boiler Instrumentation

System Purpose

Nuclear Boiler Instrumentation is an instrumentation system designed to provide the means to measure parameters of reactor vessel level, pressure, temperature, core flow, core plate differential pressure, primary containment (drywell) pressure, main condenser pressure, and main turbine first stage pressure.

The purpose of Nuclear Boiler Instrumentation is to provide signals to the Reactor Protection System, Redundant Reactivity Control System and the various emergency core cooling system logic, for initiation of protective system functions such as reactor scram, emergency core cooling and engineered safety feature systems, primary containment isolation, recirculation pump trip, and alternate rod insertion. Additionally, Nuclear Boiler Instrumentation provides reactor vessel level inputs to the feedwater control system for reactor vessel level control. Nuclear Boiler Instrumentation also provides the operator with indications to support procedural activities performed during normal and post-accident operation. It accomplishes these purposes by utilizing specific instruments to monitor reactor vessel level, pressure, temperature, core flow, core plate differential pressure, primary containment pressure, main condenser pressure, and main turbine first stage pressure.

System Operation

Nuclear Boiler Instrumentation is comprised of sensing lines, flow restricting orifices, isolation valves, excess flow check valves, transmitters, condensing chambers, and instruments.

Reactor vessel level is measured by comparing the actual water level in the reactor vessel (variable leg) to a constant height of water column in the reference leg. Both the variable leg and the reference leg experience the same applied steam pressure from the reactor vessel. Steam from the vessel enters the reference leg and condenses in a chamber to keep the reference leg filled with water, with overflow returned to the vessel. The Control Rod Drive System also provides a constant source of make-up water (backfill) to the reference legs to prevent displacement of reference leg water when non-condensable gases come out of solution. Instrument calibrations compensate for temperature-induced variations in the reference legs as required. The difference in the measured pressures is processed into the reactor vessel level measurement.

Reactor vessel pressure is measured by pressure instruments utilizing the same piping that is used to measure the pressure in the reactor vessel level instrument reference legs.

Reactor vessel temperature is measured through thermocouples mounted in specific locations on the reactor vessel shell, heads, flange, skirt, and feedwater nozzles to provide indication of the vessel metal temperature (evaluated with the Miscellaneous Instruments & Control Systems).

Core plate differential pressure is measured by instrumentation that compares pressures below and above the core plate. The pressure below core plate is also used as the common jet pump discharge pressure (high pressure) for determination of jet pump flow and for the high pressure input for reactor bottom head drain differential pressure. The pressure above core plate is used by the Control Rod Drive System for indication of reactor vessel pressure.

Core flow is measured by instrumentation that determines the total flow through the jet pumps. Each jet pump flow is measured through a tap on the jet pump diffuser below the slip fit section (low pressure). This low pressure is compared to the common jet pump discharge pressure (high pressure) to produce a pressure differential that is converted to a flow signal. The signals for the ten jet pumps in each recirculation loop are summed by the jet pump loop flow summer to determine the jet pump loop flow. The two jet pump loop flows are summed to determine the core flow. Each of the four fully calibrated jet pumps (two per recirculation loop) has one additional pressure tap that is located on the bottom of the jet pump diffuser (high pressure). This high pressure is compared to the low pressure from the tap on the pump diffuser below the slip fit section to produce a pressure differential that is converted to a flow signal. These flow signals are used in the calibration of the two jet pump loop flow summers.

Primary containment (drywell) pressure is measured by pressure transmitters connected to sensing lines open to primary containment atmosphere.

Main condenser pressure is measured by pressure transmitters connected to sensing lines.

Main turbine first stage pressure is measured by pressure transmitters connected to sensing lines.

For more detailed information, see UFSAR Section 5.1.

System Boundary

The boundary of the Nuclear Boiler Instrumentation license renewal system begins at the individual reactor vessel nozzles and other attachment points, continues through the condensing chambers (for reference legs), instrument piping and tubing, and ends with the instrument(s) to which the sensing lines are routed. The boundary for the wide range level instrument reference leg begins with its condensing chamber, since the Main Steam System includes the reactor vessel head vent piping up to the condensing chamber (evaluated with the Main Steam System).

For attachment points on the Reactor Pressure Vessel, the associated instrument nozzle is evaluated separately for license renewal with the Reactor Pressure Vessel license renewal system.

The boundary for the core plate differential pressure instrumentation begins at the sensing line attachment point on the Reactor Pressure Vessel. The core plate differential pressure sensing line is a pipe-in-pipe arrangement that has an inner and outer pipe. The inner pipe begins below the core plate while the outer pipe begins above the core plate. The sensing line continues through the instrument piping and tubing and ends with the associated instruments. The Nuclear Boiler Instrumentation license renewal system includes the portion of the sensing line external of the Reactor Pressure Vessel. The portion of the sensing line internal to the Reactor Pressure Vessel is evaluated separately for license renewal with the Reactor Internals license renewal system.

The boundary for the primary containment (drywell) pressure instrumentation begins at the sensing line attachment points to the primary containment. These sensing lines continue through the instrument piping and tubing and end with the pressure transmitters.

The boundary for the main condenser pressure instrumentation begins at the sensing line attachment points to the main condenser. These sensing lines continue through the instrument piping and tubing and end with the pressure transmitters.

The boundary for the main turbine first stage pressure instrumentation begins at the sensing line attachment points to the high pressure turbine. These sensing lines continue through the instrument piping and tubing and end with the pressure transmitters.

The Nuclear Boiler Instrumentation license renewal system boundary includes all associated piping, condensing chambers, isolation valves, excess flow check valves and instruments for monitoring the specific parameters. All associated piping, components, and instrumentation contained within the flow path described above are included in the system boundary.

Also included in the license renewal scoping boundary of Nuclear Boiler Instrumentation are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor Building. Included in this boundary are pressure retaining components relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the license renewal boundary drawings for identification of this boundary, shown in red.

Not included in the scoping boundary of the Nuclear Boiler Instrumentation license renewal system are the instruments that provide signals for steam line pressure (evaluated with the Main Steam System) and instrumentation associated with reactor head seal leakage (evaluated with the Main Steam System). The thermocouples monitoring reactor vessel temperature are evaluated with the Miscellaneous Instruments & Control Systems and are not included in the scoping boundary of the Nuclear Boiler Instrumentation license renewal system. As previously discussed, not included in the scoping boundary of the Nuclear Boiler Instrumentation license renewal system is the reactor vessel head vent piping up to the wide range level instrument condensing chamber, since this piping is evaluated with the Main Steam System. Also not included in the scoping boundary of the Nuclear Boiler Instrumentation license renewal system are the instruments that provide signals to the Reactor Water Cleanup System and the post accident liquid and gas sampling system (evaluated with the Process and Post-Accident Sampling System).

Not included in the scoping boundary of the Nuclear Boiler Instrumentation System are the following interfacing systems, which are separately evaluated as license renewal systems:

Control Rod Drive System
Main Steam System
Process and Post-Accident Sampling System
Reactor Internals
Reactor Pressure Vessel
Reactor Water Cleanup System

Reason for Scope Determination

Nuclear Boiler Instrumentation meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48), Environmental Qualification (10 CFR 50.49), Anticipated Transient Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide reactor coolant pressure boundary. Reactor Vessel pressure and differential pressure sensing lines attach to reactor vessel nozzles or other reactor coolant pressure boundary piping. 10 CFR 54.4(a)(1)

2. Sense process conditions and generate signals for reactor trip or engineered safety features actuation. Provides input signals to reactor protection system, emergency core coolant system, and containment isolation for reactor control to prevent safety limits from being exceeded. 10 CFR 54.4(a)(1)

3. Provide primary containment boundary. Sensing lines penetrating primary containment are provided with isolation valves and excess flow check valves. 10 CFR 54.4(a)(1)

4. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety related function. 10 CFR 54.4(a)(2)

5. 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). Nuclear Boiler Instrumentation provides process variables for monitoring and controls to ensure that safe shutdown of the reactor can be achieved during fire conditions. 10 CFR 54.4(a)(3)

6. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). Nuclear Boiler Instrumentation has components that are in the Environmental Qualification Program. 10 CFR 54.4(a)(3)

7. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Anticipated Transients Without Scram (10 CFR 50.62). Nuclear Boiler Instrumentation piping is used by the Redundant Reactivity Control System to generate signals for Alternate Rod Insertion. 10 CFR 54.4(a)(3)

8. 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). Nuclear Boiler Instrumentation provides input signals for High Pressure Coolant Injection System and Reactor Core Isolation Cooling System initiations. 10 CFR 54.4(a)(3)

UFSAR References

5.1
7.4
7.7.1.3
Appendix 9.A

License Renewal Boundary Drawings

LR-M-01-1, Sheet 1
LR-M-38-0, Sheet 1
LR-M-42-1, Sheet 1
LR-M-44-1, Sheet 1
LR-M-46-1, Sheet 2

Table 2.3.1-3 Nuclear Boiler Instrumentation
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Bolting (Class 1)	Mechanical Closure
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary
Condensing Chamber (Class 1)	Pressure Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Restricting Orifices (Class 1)	Pressure Boundary
Restricting Orifices (Class 1)	Throttle
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary
Valve Body (Class 1)	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.1.2-1 Nuclear Boiler Instrumentation
Summary of Aging Management Evaluation

2.3.1.4 Reactor Internals

System Purpose

The Reactor Internals are a mechanical system, whose components are contained within the reactor pressure vessel and extend beyond the reactor pressure vessel to form a portion of the reactor coolant pressure boundary.

The Reactor Internals consist of the core shroud, core plate, core spray lines and spargers, fuel supports, control rod drive assemblies, instrumentation dry tubes, jet pump assemblies, steam dryer assembly, and the top guide.

The purpose of the reactor internals system is to provide support for the core and other internal components, maintain the fuel in a coolable geometry during normal and accident conditions, provide proper distribution of the coolant delivered to the vessel, provide a floodable volume, and maintain the reactor coolant pressure boundary. It accomplishes this by providing support and spacing of the fuel, control rod blades, and control rod drives, to assure both coolant flow and capability to add negative reactivity. It also accomplishes this by providing delivery of emergency core cooling to the reactor fuel through its piping and distribution components. A floodable volume is maintained by the configuration of the internal components. It also extends beyond the reactor pressure vessel to form a pressure boundary for connecting the control rod drives and the incore neutron flux monitoring devices.

System Operation

The shroud is a stainless steel cylinder that surrounds the reactor core and provides a barrier to separate the upward flow of the coolant through the reactor core from the downward recirculation flow. Bolted on top of the shroud is the steam separator assembly, which forms the top of the core discharge plenum. This provides a mixing chamber before the steam-water mixture enters the steam separator. The steam dryer is located above the steam separator. It is supported by steam dryer support brackets welded to the reactor pressure vessel wall and is held down by steam dryer hold down brackets in the reactor vessel top head.

The shroud support (which is composed of a cylinder, plate and legs), join the bottom of the shroud to the vessel wall. The shroud support provides an annular baffle between the reactor pressure vessel and the shroud. The shroud support carries all the vertical weight of the shroud, shroud head and steam separators, top guide, core plate, the peripheral fuel assemblies, and the jet pump diffusers. The jet pump assemblies provide a continuous internal circulation of reactor coolant. The jet pump diffusers penetrate the shroud support to introduce the coolant to the inlet plenum below the core. The combination of the shroud, shroud support and jet pump assemblies ensure a floodable volume for the reactor core should a break occur in the recirculation piping.

The core plate is a circular stainless steel plate with bored holes, which is stiffened with a rim and beam structure. The core plate provides lateral support and guidance for the control rod guide tubes, in-core flux monitor guide tubes, peripheral fuel supports, and startup neutron sources. The entire assembly is bolted to a support ledge on the lower portion of the shroud.

The top guide is formed by a series of stainless steel beams joined at right angles to form square openings and fastened to a peripheral rim of the core shroud. Each opening provides lateral support for the fuel assemblies. Wedge blocks between the top guide and the shroud wall provide lateral restraint. The control rod guide tubes extend up from the control rod drive housing through holes in the core plate. Each tube is designed as a lateral guide for the control rod and as the vertical support for the fuel support piece, which holds the four fuel assemblies surrounding the control rod. Except for the weight of the peripheral fuel assemblies, the entire weight of the fuel is carried by the guide tubes, and is transmitted to the bottom head through the Control Rod Drive (CRD) housings and stub tubes. For more detail see UFSAR Section 3.9.5.

System Boundary

The boundary for the reactor internals includes all components that are inside the reactor vessel except the fuel assemblies and the control blades, both of which are short-lived components and are evaluated separately in the Fuel Assemblies and Control Rods license renewal systems. This includes the major components described above plus additional components such as the feedwater spargers, the core spray piping and spargers, low pressure coolant injection couplings, core plate differential pressure sensing line, incore nuclear instrumentation tubes, and reactor internals modification/repair hardware. The incore instrumentation (SRM - Source Range Monitoring, IRM - Intermediate Range Monitoring, LPRM - Local Power Range Monitor, and TIP - Traveling In-core Probe) is evaluated as separate license renewal systems.

The following components of reactor internals perform a safety related function and therefore are within the scope of license renewal: the shroud, shroud support and access hole cover, core spray piping and spargers, low pressure coolant injection couplings, core plate and core plate bolts, fuel supports, control rod guide tubes and housings, top guide, jet pumps, and incore flux monitor guide tubes and housings. The steam dryer is also included in the scope of license renewal. The steam dryer does not perform a safety related function (based on industry experience), however, it is included in the license renewal scope, because failure of the steam dryer could potentially prevent satisfactory accomplishment of the safety related functions.

The following components of reactor internals are not required to support intended functions and are not included within the scope of license renewal: the feedwater sparger; the shroud head and steam separator assembly, core plate differential sensing lines, the standby liquid control / core dp internal piping, and the surveillance sample holders. A safety assessment for these components has been performed and reported in BWRVIP-06. The evaluation concluded that these components do not perform a safety related function. This report also concluded that failure of these components will not result in consequential failure of any safety related equipment.

The control rod drive mechanisms are separately evaluated with the license renewal system Control Rod Drive System. The reactor vessel, vessel nozzles, vessel instrumentation penetrations, control rod drive stub tubes, and thermal sleeves are separately evaluated with the license renewal system Reactor Pressure Vessel. The incore neutron flux monitors are evaluated separately with the Neutron Monitoring System.

Reason for Scope Determination

The Reactor Internals System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is 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), Anticipated Transients Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63). The Reactor Internals System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49).

System Intended Functions

1. Provide reactor coolant pressure boundary. The control rod drive housings and incore flux monitor housings are part of the reactor coolant pressure boundary. 10 CFR 54.4(a)(1)

2. Maintain reactor core assembly geometry and a floodable volume. The reactor internal components in conjunction with the reactor vessel are designed to provide physical support for the fuel, steam dryer and other components and to maintain fuel configuration and clearances during normal and accident conditions. Maintain geometry within the reactor to ensure core reactivity control and core flooding, and core cooling capability. 10 CFR 54.4(a)(1)

3. Provide emergency core cooling where the equipment provides coolant directly to the core. The core spray piping and spargers and low pressure coolant injection couplings distribute emergency core cooling flow to the reactor core. 10 CFR 54.4(a)(1)

4. Resist non-safety related SSC failure that could prevent satisfactory accomplishment of a safety related function. Nonsafety-related portions of the system that are required for structural support could interact with safety-related portions of the system. 10 CFR 54.4(a)(2)

5. 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). The core spray sparger and piping inside the reactor vessel is credited for cooling in the fire safe shutdown analysis. 10 CFR 54.4(a)(3)

6. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Anticipated Transients Without Scram (10CFR50.62). Standby Liquid Control System injects through the core spray piping and spargers. 10 CFR 54.4(a)(3)

7. 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). High pressure coolant injection injects through the core spray piping and spargers. 10 CFR 54.4(a)(3)

UFSAR References

1.2.4.1
3.9.5
5.1.6
5.3
5.4.1
9A.5

License Renewal Boundary Drawings

Not Required

Table 2.3.1-4 Reactor Internals
Components Subject to Aging Management Review

Component Type	Intended Function
Core Shroud and Core Plate (Access hole cover-welded covers)	Structural Support to maintain core configuration and flow distribution
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Pressure Boundary
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Structural Support
Core Shroud and Core Plate (Core plate, core plate bolts, peripheral fuel supports)	Structural Support to maintain core configuration and flow distribution
Core Shroud and Core Plate (LPCI coupling)	Direct Flow
Core Shroud and Core Plate (Shroud support cylinder, plate, column)	Pressure Boundary
Core Shroud and Core Plate (Shroud support cylinder, plate, column)	Structural Support to maintain core configuration and flow distribution
Core Spray Lines and Spargers (Core spray lines (headers), spray rings, spray nozzles, thermal sleeve)	Direct Flow
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Pressure Boundary
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Structural Support to maintain core configuration and flow distribution
Fuel Supports and Control Rod Drive Assemblies (Control rod guide tube)	Structural Support to maintain core configuration and flow distribution
Fuel Supports and Control Rod Drive Assemblies (Orificed fuel support)	Structural Support to maintain core configuration and flow distribution
Instrumentation (IRM dry tubes, SRM dry tubes)	Pressure Boundary
Instrumentation (IRM dry tubes, SRM dry tubes)	Structural Support
Instrumentation (Incore neutron flux monitor guide tubes)	Structural Support
Instrumentation (Incore neutron flux monitor housing)	Pressure Boundary
Instrumentation (Incore neutron flux monitor housing)	Structural Support

Component Type	Intended Function
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support
Steam Dryers	Structural Support
Top Guide	Structural Support to maintain core configuration and flow distribution

The aging management review results for these components are provided in:

Table 3.1.2-2 Reactor Internals
Summary of Aging Management Evaluation

2.3.1.5 Reactor Pressure Vessel

System Purpose

The Reactor Pressure Vessel contains the reactor core, the reactor internals, and reactor core coolant moderator.

The Reactor Pressure Vessel is a normally operating system designed to contain the reactor coolant and facilitate the transfer of heat from the core. The Reactor Pressure Vessel, in conjunction with the reactor internals, provides a floodable volume to assure adequate core cooling in the event of a breach in the coolant boundary external to the reactor pressure vessel. The Reactor Pressure Vessel also provides support for the connected reactor coolant pressure boundary piping.

The Reactor Pressure Vessel consists of the following major components: the cylindrical vessel shell and flange, the top head and flange, the bottom head, welds, nozzles, safe ends, closure studs, internal supports, and external supports, including the steel skirt assembly. The Reactor Pressure Vessel is in scope for license renewal. The Reactor Pressure Vessel has interfaces with other systems that are not in the license renewal boundary of the Reactor Pressure Vessel, and are evaluated separately. These systems are the Core Spray, Feedwater, Main Steam, Nuclear Boiler Instrumentation, Reactor Internals, Reactor Recirculation, Reactor Water Cleanup, and the Residual Heat Removal System.

The purpose of the Reactor Pressure Vessel is to form part of the reactor coolant boundary and to serve as a radioactive material barrier during normal operations and following abnormal operational transients and accidents. The Reactor Pressure Vessel accomplishes its purpose through its cylindrical vessel shell and flange, the top head and flange, the bottom head, welds, nozzles, safe ends, closure studs, internal supports, and external supports, including the steel skirt assembly.

The top of the skirt is welded to the bottom of the vessel. The base of the skirt is continuously supported by a ring girder fastened to a concrete foundation, which carries the load through the drywell to the Reactor Building foundation slab.

System Operation

The Reactor Pressure Vessel is comprised of the cylindrical vessel shell and flange, the top head and flange, the bottom head, welds, nozzles, safe ends, closure studs, internal supports, and external supports, including the steel skirt assembly.

The vessel flanges are sealed with two concentric metal seal rings designed to permit no detectable leakage.

The nozzle for the Standby Liquid Control pipe was designed to minimize thermal shock effects on the reactor vessel. However, the Standby Liquid Control system discharge has not been routed to this nozzle as the standby liquid control system utilizes core spray loop "A" to inject poison. The control rod drive return nozzle was capped and was not used for its original design function and the reactor head spray piping and spray nozzle have been removed as part of a modification and a blind flange installed.

For additional details see UFSAR Sections 1.2.4, 3.9.5, 4.1, 5.1, 5.3, and 9A.5.

System Boundary

The boundary for the Reactor Pressure Vessel includes the vessel shell and flange, top head and flange, bottom head, vessel closure studs and nuts, vessel nozzles (bottom head drain, core spray, control rod drive return, feedwater, head spray, head vent, instrumentation, jet pump instrumentation, low pressure coolant injection, main steam, recirculation inlet and outlet, seal leak detection, spare, and standby liquid control/core DP), nozzle safe ends and welds, nozzle thermal sleeves (core spray, feedwater, low pressure coolant injection and recirculation inlet), vessel penetrations (control rod drive stub tubes and incore housings), vessel skirt, vessel shell course welds, and the vessel attachment welds.

Not included in the scoping boundary of the Reactor Pressure Vessel are the following interfacing systems that are evaluated separately:

Core Spray System
Feedwater System
Main Steam System
Nuclear Boiler Instrumentation System
Reactor Internals
Reactor Recirculation System
Reactor Water Cleanup System
Residual Heat Removal System

Reason for Scope Determination

The Reactor Pressure Vessel meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. The Reactor Pressure Vessel is not in scope under 10 CFR 54.4(a)(2) because there are no nonsafety-related components whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The Reactor Pressure Vessel is in scope under 10 CFR 54.4(a)(3) because it is 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), Anticipated Transients Without Scram (10 CFR 50.62) and Station Blackout (10 CFR 50.63). The Reactor Pressure Vessel is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Environmental Qualification (10 CFR 50.49).

System Intended Functions

1. Provide reactor coolant pressure boundary. The reactor pressure vessel maintains the integrity of the reactor coolant pressure boundary. The reactor pressure vessel provides structural support for connected reactor coolant pressure boundary piping. 10CFR54.4(a)(1)

2. Maintain reactor core assembly geometry. The reactor pressure vessel in conjunction with the reactor internals provides physical support for the core and other reactor vessel internals. The arrangement provides a means to distribute coolant to the fuel assemblies in the core, it provides a floodable volume to ensure the core can be adequately cooled in the event of a

breach in the coolant boundary external to the reactor pressure vessel, and also ensures deformation is limited to ensure control rods and emergency cooling systems can perform their intended safety functions. 10CFR54.4(a)(1)

3. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection (10CFR50.48). The reactor pressure vessel is credited in the fire safe shutdown analysis. 10CFR54.4(a)(3)

4. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Anticipated Transients Without Scram (10 CFR 50.62). The reactor pressure vessel is credited in the Anticipated Transients Without Scram analysis. 10CFR54.4(a)(3)

5. 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). The reactor pressure vessel is credited in the Station Blackout analysis. 10CFR54.4(a)(3)

UFSAR References

1.2.4
3.9.5
4.1
5.1
5.3
9A.5

License Renewal Boundary Drawings

Not Required

Table 2.3.1-5 Reactor Pressure Vessel
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting (Class 1) Head Spray, Spare Flanges, CRDs, and Incore Neutron Monitors	Mechanical Closure
Bolting (Class 1) Top Head Studs and Nuts	Mechanical Closure
Nozzle (Bottom Head Drain)	Pressure Boundary
Nozzle (CRD Return)	Pressure Boundary
Nozzle (Core Spray)	Pressure Boundary
Nozzle (Feedwater)	Pressure Boundary
Nozzle (Head Spray)	Pressure Boundary
Nozzle (Head Vent)	Pressure Boundary
Nozzle (Instrumentation - Beltline)	Pressure Boundary
Nozzle (Instrumentation)	Pressure Boundary
Nozzle (Jet Pump Instrumentation)	Pressure Boundary
Nozzle (Low Pressure Coolant Injection)	Pressure Boundary
Nozzle (Main Steam)	Pressure Boundary
Nozzle (Recirculation Inlet & Outlet)	Pressure Boundary
Nozzle (Seal Leak Detection)	Pressure Boundary
Nozzle (Spare on Head)	Pressure Boundary
Nozzle (Standby Liquid Control / Core DP)	Pressure Boundary
Nozzle Safe Ends and Welds (Core Spray)	Pressure Boundary
Nozzle Safe Ends and Welds (Feedwater)	Pressure Boundary
Nozzle Safe Ends and Welds (Head Spray)	Pressure Boundary
Nozzle Safe Ends and Welds (Jet Pump Instrumentation)	Pressure Boundary
Nozzle Safe Ends and Welds (Low Pressure Coolant Injection)	Pressure Boundary
Nozzle Safe Ends and Welds (Main Steam)	Pressure Boundary
Nozzle Safe Ends and Welds (Recirculation Inlet and Outlet)	Pressure Boundary
Nozzle Safe Ends and Welds (Seal Leak Detection, Spare, & Head Vent)	Pressure Boundary

Component Type	Intended Function
Nozzle Safe Ends and Welds (Standby Liquid Control / Core DP)	Pressure Boundary
Nozzle Thermal Sleeves (Core Spray)	Direct Flow
Nozzle Thermal Sleeves (Feedwater)	Direct Flow
Nozzle Thermal Sleeves (Low Pressure Coolant Injection)	Direct Flow
Nozzle Thermal Sleeves (Recirculation Inlets)	Direct Flow
Penetration (CRD Stub Tubes)	Pressure Boundary
Penetration (CRD Stub Tubes)	Structural Support
Penetration (Incore Housings)	Pressure Boundary
Reactor Coolant Pressure Boundary Components	Pressure Boundary
Reactor Vessel (Bottom Head)	Pressure Boundary
Reactor Vessel (External Attachments)	Structural Support
Reactor Vessel (Intermediate, Lower Intermediate and Lower Shell Sections)	Pressure Boundary
Reactor Vessel (Internal Attachments)	Structural Support
Reactor Vessel (Shell Flange, Upper and Upper Intermediate Shell Sections)	Pressure Boundary
Reactor Vessel (Top Head and Flange)	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.1.2-3 Reactor Pressure Vessel
Summary of Aging Management Evaluation

2.3.1.6 Reactor Recirculation System

System Purpose

The Reactor Recirculation System is a normally operating mechanical system that provides forced circulation of reactor coolant through the core for heat removal and the ability to maintain a reactor vessel floodable volume in the event of a piping integrity failure. The system consists of the Reactor Recirculation main loop piping, recirculation pumps and motors, recirculation motor generator sets, recirculation system flow control, and recirculation pump trip logic. The main loop piping, recirculation pumps, and recirculation pump trip are in scope for license renewal. However the motor generator sets, recirculation pump motor, and flow control portions of the system are not required to perform intended functions and are not in scope. System components within the reactor vessel are described in the Reactor Internals.

The purpose of the Reactor Recirculation System is to provide forced circulation of reactor coolant through the core, providing a means to control reactor power within a limited range without the need for manipulation of the control rods. It accomplishes this purpose by delivering recirculated drive water flow to the reactor vessel through two separate pumped loops, each with an individually controllable variable speed pump, five jet pump risers, and ten jet pumps.

System Operation

The Reactor Recirculation System is comprised of two separate recirculation loops and has been sized to provide a total drive flow capacity required to develop the necessary core flow at rated load. Each loop contains suction and discharge piping, a motor operated suction isolation valve, motor driven recirculation pump, motor operated discharge isolation valve, and associated instrumentation and drain valves. Each recirculation pump is a centrifugal unit with a mechanical cartridge-type two-stage shaft seal. Each recirculation pump is driven by a variable speed motor powered by a recirculation motor generator set, comprised of a constant speed motor, synchronous generator, interconnecting variable speed fluid coupling, and associated instrumentation and controls. Under normal reactor power conditions, both recirculation loops are in operation, with both pumps operating at the same speed.

The flowpath for recirculated coolant through each of the loops is as follows: reactor coolant enters the vessel annulus region, the area between the shroud and the vessel wall, and then exits the Reactor Vessel through the loop's outlet nozzle and into the recirculation pump suction piping. The coolant then passes through the recirculation pump and exits to a distribution header. From the distribution header, flow is split between five jet pump risers. Each jet pump riser enters the vessel and discharges through two jet pump nozzles as drive flow. This drive flow mixes with coolant from the annulus region (driven flow) in the jet pump throat and exits the jet pump in the lower head area as total flow. Flow then passes through orifices at the bottom of the core and flows upward through the core where bulk boiling produces steam. The steam-water mixture enters the moisture separators and the steam dryers. The water separated from the steam flows downward to the annulus region where it mixes with the incoming feedwater. The coolant flows downward in the annulus region to the outlet nozzles, repeating the flow path. The recirculation pump motor oil cooler and recirculation pump seal cooler are provided cooling water from the reactor auxiliaries cooling plant system that is part of the Closed Cycle Cooling Water System. These coolers are not in the scope of license renewal because these coolers are physically enclosed and do not have the potential for spatial interaction with components. The motor air cooler receives cooling water from the Chilled Water System and is evaluated with the Chilled Water System.

Recirculation pump speed and flow control is accomplished by varying the speed of the motor generator set generator. This is performed by a speed control unit consisting of an operator for each fluid coupling scoop tube, an electric tachometer on each generator shaft, a remote manual speed controller for each motor generator set, a master remote control device for both pumps, and associated electronic equipment. The operating speed of both pumps is normally adjusted individually with the manual speed controller. The tachometer on each generator shaft provides a feedback signal for comparison of actual versus selected speeds.

Recirculation Pump Trip is an instrument-controlled function of the Reactor Recirculation System that decreases the pressure and temperature transient during certain transients or an Anticipated Transient Without Scram event by tripping circuit breakers between the motor generator set and the reactor coolant pump. The Reactor Protection System and Redundant Reactivity Control System (separately evaluated as license renewal systems) each supply a signal to the Recirculation Pump Trip Logic causing a trip of both recirculation pumps.

For more detailed information, see UFSAR sections 5.1.7, 5.4.1, 6.2.4.1, 7.6.1, and 7.7.1.

System Boundary

The Reactor Recirculation System includes the main recirculation flowpath, which begins at the attachment points to the reactor vessel outlet nozzles, continues through the suction piping, suction valves, recirculation pump casings, discharge valves and discharge piping back to the attachment points to the inlet nozzles on the vessel. All associated piping, components and instrumentation within the flowpath described above are included in the system evaluation. Also included are the recirculation pump seals and associated piping and instrument lines up to and including the instruments outside of containment.

Included in the Reactor Recirculation System license renewal scoping boundary is the recirculation pump trip logic. The recirculation pump trip logic is an instrument-controlled function of the Redundant Reactivity Control System and the Reactor Protection System. This portion of the system supports performance of the Reactor Recirculation System intended function and is in scope for license renewal. The components of the recirculation pump trip logic are evaluated as electrical commodities.

Included in the license renewal scoping boundary of the Reactor Recirculation System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor Building and Primary Containment. Included in this boundary are pressure retaining components relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the License Renewal Boundary Drawings for identification of this boundary, shown in red.

Not included in the Reactor Recirculation System boundary is piping inside the reactor vessel and jet pumps that are being evaluated with the Reactor Internals. Also not included in this system boundary is the recirculation pump motor air cooler that is being evaluated with the Chilled Water System.

Not included in the scope of license renewal are the recirculation pump motor oil cooler and recirculation pump seal cooler because these coolers are physically enclosed and do not have the potential for spatial interaction with components.

Not included in the Reactor Recirculation System scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Residual Heat Removal System
Reactor Water Cleanup System
Closed Cycle Cooling Water System
Chilled Water System
Equipment and Floor Drainage System
Process and Post-Accident Sampling System
Control Rod Drive System

Not included in the scope of license renewal are the recirculation motor generator sets, located in the turbine building, as this portion of the system does not perform an intended function and is not located within an area in proximity of components performing a safety-related function. Components that are not required to support the leakage boundary intended function or any other intended function are not included in the scope of license renewal.

Reason for Scope Determination

The Reactor Recirculation System meets 10 CFR 54.4(a)(1) because it is a safety related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analyses and 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) and Anticipated Transient Without Scram (10 CFR 50.62). Pressure boundary integrity of the Reactor Recirculation System is also relied upon in the safety analyses and plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Station Blackout (10 CFR 50.63).

The function of the motor generator set and recirculation flow control portions of the Reactor Recirculation System is to provide regulated electrical power to operate the recirculation pump motors. These portions of the system are not in scope under 10 CFR 54.4(a)(1) because they are nonsafety-related systems that are not relied upon to remain functional during and following design basis events. The motor generator set portion is not in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could not prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The motor generator set and recirculation flow control portions are not in scope under 10 CFR 54.4(a)(3) because they are not relied upon in safety analyses and 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), Anticipated Transient Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide reactor coolant pressure boundary. The Reactor Recirculation System connects directly to the Reactor Pressure Vessel. 10 CFR 54.4(a)(1)

2. Sense process conditions and generate signals for reactor trip or engineered safety features actuations. Provides flow biasing to the neutron monitoring portion of the Reactor Protection System. 10 CFR 54.4(a)(1)

3. Provides primary containment boundary. Piping from instrument taps exit the containment and have dual automatic or one manual globe isolation valve with either excess flow check valves or swing check valves. 10 CFR 54.4(a)(1)

4. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Reactor Recirculation System includes nonsafety-related water filled lines in the Reactor Building that have the potential for spatial interaction (spray or leakage) with safety-related SSCs. 10 CFR 54.4(a)(2)

5. 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). The recirculation pump discharge valves must be closed to support shutdown cooling operation. 10 CFR 54.4(a)(3)

6. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Reactor Recirculation system includes environmentally qualified electrical components. 10 CFR 54.4(a)(3)

7. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Anticipated Transients Without Scram (10 CFR 50.62). The Recirculation Pump Trip breakers are tripped to minimize the transient. 10 CFR 54.4(a)(3)

8. 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). The Reactor Recirculation System flow instrumentation is credited in the Station Blackout analysis. 10 CFR 54.4(a)(3)

UFSAR References

1.15.1
5.1.7
5.4.1
6.2.4.1
7.6.1
7.7.1

License Renewal Boundary Drawings

LR-M-23-1, Sheet 2
LR-M-43-1, Sheet 1
LR-M-51-1, Sheet 1
LR-M-51-1, Sheet 2
LR-M-53-1, Sheet 1
LR-M-87-1, Sheet 2

Table 2.3.1-6 Reactor Recirculation System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Bolting (Class 1)	Mechanical Closure
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary
Flow Device	Leakage Boundary
Heat Exchanger Components (Motor Air Cooler)	Evaluated with the Chilled Water System
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings (Class 1)	Pressure Boundary
Pump Casing (Class 1)	Pressure Boundary
Restricting Orifices (Class 1)	Pressure Boundary
Restricting Orifices (Class 1)	Throttle
Thermowell (Class 1)	Pressure Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary
Valve Body (Class 1)	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.1.2-4 Reactor Recirculation System
Summary of Aging Management Evaluation

2.3.2 ENGINEERED SAFETY FEATURES SYSTEMS

The following systems are addressed in this section:

2.3.2.1 Automatic Depressurization System (ADS)

System Purpose

The Automatic Depressurization System (ADS) is a standby emergency core cooling system (ECCS) designed to automatically depressurize the reactor pressure vessel (RPV) during a small break loss of coolant accident (LOCA), in the event the High Pressure Coolant Injection System is inoperable or cannot maintain water level in the RPV. The ADS also reduces RPV pressure to allow the low pressure emergency core cooling systems (Core Spray System and the low pressure coolant Injection mode of the Residual Heat Removal System) to restore reactor pressure vessel level and maintain adequate core cooling.

The purpose of the ADS is to provide automatic depressurization of the RPV in the event of a small break in the reactor coolant pressure boundary where coolant inventory cannot be maintained and reactor pressure vessel pressure remains above the design capability of the low pressure emergency core cooling systems. It accomplishes this purpose by opening of five of the fourteen nuclear pressure relief system safety relief valves to depressurize the reactor pressure vessel to the suppression pool.

Operation of ADS is credited in the 10 CFR 50 Appendix K evaluation. No single failure in the system will prevent the ADS from performing its design basis function.

System Operation

The Automatic Depressurization System (ADS) is comprised of logic relays, timers and instrumentation that receive process signal input and provide actuation signals to the five Nuclear Pressure Relief System Safety Relief Valves (SRVs). Each safety relief valve assembly consists of a main valve, a pilot valve and a solenoid operator.

The ADS automatic depressurization function and the manual operation of the SRVs are all controlled through the ADS logic network. During normal reactor operation (ADS in standby), the SRVs are closed. ADS initiation for automatic depressurization begins after sensing simultaneous occurrence of high drywell pressure, low-low-low water level in the reactor pressure vessel, and high discharge pressure from either core spray or residual heat removal pumps. There is a time delay before the SRVs open to allow for operator action to prevent ADS-initiated opening of the SRVs if appropriate.

When the ADS energizes the SRV pilot solenoids, Primary Containment Instrument Gas (PCIG) pressure is admitted to the pneumatic actuator of the SRV pilot assembly, causing the valve to open. Steam flows down the discharge header (evaluated with the Main Steam System) to the torus and exits below the surface of the water through quenchers (evaluated with the Main Steam System). The 125 VDC portion of the 24/125/250 V Station DC Power System provides the source of electrical power to the ADS relay logic and the SRV solenoids.

A valve position monitoring system allows the status of the SRVs to be ascertained from the Control Room. Accelerometers and temperature monitoring instrumentation are used to determine whether SRVs are relieving steam to the torus.

For more detailed information, see UFSAR Section 7.3.1.1.1.2.

System Boundary

The Automatic Depressurization System boundary is electrical, and is comprised of the logic relays, sensors, timers, and instrumentation that receive process signal input and provide actuation signals to the five (5) safety relief valves. The mechanical system boundary, which includes the safety relief valves, vacuum breakers, inlet and discharge piping, quenchers in the torus, and associated components are evaluated with the Main Steam System. The mechanical system boundary also includes the pneumatic piping, accumulators, solenoid valves and associated components that are evaluated with the Primary Containment Instrument Gas System.

Not included in the Automatic Depressurization System license renewal scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Primary Containment Instrument Gas System
Core Spray System
Main Steam System
Residual Heat Removal System

Reason for Scope Determination

The Automatic Depressurization System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It does not meet 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could not prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It meets 10 CFR 54.4(a)(3) because it is 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), Environmental Qualification (10 CFR 50.49), and Station Blackout (10 CFR 50.63). The Automatic Depressurization System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide emergency core cooling where the equipment provides coolant directly to the core. ADS reduces reactor coolant pressure to allow other low-pressure systems to inject into the core. 10 CFR 54.4(a)(1)

2. Sense process conditions and generate signals for reactor trip or engineered safety features actuation. ADS includes reactor water level sensors and the associated activation logic. 10 CFR 54.4(a)(1)

3. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection (10 CFR 50.48). Operation of the ADS associated SRVs is credited in the safe shutdown analysis. 10 CFR 54.4(a)(3)

4. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). Components from the ADS system are in the EQ program. 10 CFR 54.4(a)(3)

5. 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). The ADS system valves are used to initiate cooldown during shutdown and system instrumentation is used to monitor plant conditions during coping. 10 CFR 54.4(a)(3)

UFSAR References

7.3.1.1.1.2
6.3

License Renewal Boundary Drawings

Not Required

Table 2.3.2-1 Automatic Depressurization System (ADS) Components Subject to Aging Management Review

Component Type	Intended Function
No Mechanical Components	Not Applicable

Aging management review results are not applicable for this system.

2.3.2.2 Containment Hydrogen Recombiner System

System Purpose

The Containment Hydrogen Recombiner System is a license renewal system designed to control hydrogen and oxygen concentrations in the Primary Containment postulated to be generated following a beyond design basis accident. Buildup of hydrogen and oxygen concentrations could result in hydrogen burns and/or hydrogen detonations that could jeopardize primary containment integrity. The Containment Hydrogen Recombiner System accomplishes this purpose by processing the drywell gas and recombining available oxygen with available hydrogen by thermal recombination. The Containment Hydrogen Recombiner System is part of the containment atmosphere control plant system.

The Containment Hydrogen Recombiner System is a manually initiated safety-related system that will automatically isolate on a containment isolation signal. The isolation signal can be overridden to re-open the isolation valves.

System Operation

The Containment Hydrogen Recombiner System is comprised of two separate and redundant trains, each capable of recombining hydrogen and oxygen at a rate in excess of their expected post loss-of-coolant-accident production. Each containment hydrogen recombiner train has a blower assembly, which provides the motive force to transport the drywell atmosphere to the recombiner reaction chamber for processing and then provides a return flow path to the torus. The main heater in each containment hydrogen recombiner train is used to raise the operating temperature to the reaction temperature required to allow spontaneous recombination of hydrogen and oxygen. During operation of the Containment Hydrogen Recombiner System, the drywell pressure would lower and the torus pressure would increase due to taking suction from the drywell and providing a return flowpath to the torus. The torus to drywell vacuum breakers of the Vacuum Relief Valve System limit the differential pressure increase. Exhaust gases are cooled by the mixing of these gases with a water spray in the throat region of a venturi. The mixing water spray is provided by the Residual Heat Removal System. The hot exhaust gases from the main heaters are cooled while the mixing water spray absorbs enough heat to produce water vapor. The exhaust gases, and newly formed water vapor are directed to the water separator. The recirculation line is taken off the top of the water separator to ensure mostly dry gases are returned to the blower suction or torus. The remaining exhaust gases and water vapor for each hydrogen recombiner train are discharged through a sloped piping line, through two automatic containment isolation valves, and return to the torus through two piping attachment points. The train "A" hydrogen recombiner return goes to an attachment point on the containment prepurge cleanup system supply line to the torus. The train "B" hydrogen recombiner return goes to an attachment point on the containment prepurge cleanup system return line from the torus.

The power source for each containment hydrogen recombiner skid and the containment hydrogen recombiner containment isolation valves is from the 480 V Auxiliary System. The power source for the heaters is from the 120 VAC Vital Power System.

The containment isolation valves within the Containment Hydrogen Recombiner System, as well as the Residual Heat Removal System water supply isolation valves automatically close upon receiving an isolation signal from the Primary Containment Isolation System. Signals that generate valve isolations are: high containment pressure, low-low reactor water level, and reactor building high radiation. These isolating signals can be overridden to allow reestablishing the hydrogen recombining process.

The Containment Hydrogen Recombiner System is started and removed from service manually.

For more detailed information, see UFSAR Section 6.2.5.2.4.

System Boundary

The Containment Hydrogen Recombiner System boundary begins at an attachment point to the containment prepurge cleanup system drywell supply and return lines. The Containment Hydrogen Recombiner System has two separate trains. The train "A" of the containment hydrogen recombiner supply line tees off at an attachment point upstream of the containment prepurge cleanup system return line inboard isolation valve, at the top region of the drywell. The train "B" of the containment hydrogen recombiner system supply line tees off at an attachment point downstream of the containment prepurge cleanup system supply line inboard isolation valve, at mid elevation of the drywell. The system boundary from each drywell suction point continues through two in-series containment isolation valves to each hydrogen recombiner skid, which includes a motor operated valve, blower, spiral/coiled heater pipe, reaction chamber, spray cooler, eductor and water separator. The system boundary continues from each hydrogen recombiner skid through two independent containment isolation valves and the boundary terminates through an attachment point on the containment prepurge cleanup system supply and return paths to and from the torus, respectively. The attachment point from train "A" to the containment prepurge cleanup system supply line to the torus is downstream of the two containment isolation valves. The attachment point from the train "B" return to the containment prepurge cleanup system return line from the torus is upstream of the two containment isolation valves.

In addition the system boundary includes the portion of the cooling water piping from the Residual Heat Removal System attachment point to the containment hydrogen recombiner system spray coolers.

All associated piping, components, and instrumentation contained within the flow path described above are included in the Containment Hydrogen Recombiner System boundary.

Not included in the Containment Hydrogen Recombiner System scoping boundaries are the following interfacing systems, which are separately evaluated as license renewal systems:

Containment Inerting and Purging System
Reactor Building Ventilation System
Residual Heat Removal System

Reason for Scope Determination

The Containment Hydrogen Recombiner System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. The Containment Hydrogen Recombiner System is not in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system would not prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The Containment

Hydrogen Recombiner System meets 10 CFR 54.4(a)(3) because it is relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Containment Hydrogen Recombiner System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48), Anticipated Transient Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide primary containment boundary. The Containment Hydrogen Recombiner System includes primary containment isolation valves that close on high drywell pressure, low-low reactor water level, and Reactor Building exhaust high radiation. 10 CFR 54.4(a)(1)

2. Control combustible gas mixtures in the primary containment atmosphere. The Containment Hydrogen Recombiner System is used to control and reduce hydrogen and oxygen concentrations under post Loss-of-Coolant-Accident conditions. 10 CFR 54.4 (a)(1)

3. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The limit switches associated with the Primary Containment isolation valves within the Containment Hydrogen Recombiner System are Environmentally Qualified. 10 CFR 54.4(a)(3)

UFSAR References

6.2.5
7.3.1.1.6

License Renewal Boundary Drawings

LR-M-57-1, Sheet 1
LR-M-58-1, Sheet 1

Table 2.3.2-2 Containment Hydrogen Recombiner System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Eductor	Pressure Boundary
Fan Housing	Pressure Boundary
Flow Element	Pressure Boundary
Piping and Fittings	Pressure Boundary
Spray Nozzles	Pressure Boundary
Spray Nozzles	Spray
Strainer Body	Pressure Boundary
Tanks (Reaction Chamber)	Pressure Boundary
Tanks (Water Separator)	Pressure Boundary
Thermowell	Pressure Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.2.2-1 Containment Hydrogen Recombiner System
Summary of Aging Management Evaluation

2.3.2.3 Core Spray System

System Purpose

The Core Spray System is a standby low pressure emergency core cooling system designed to provide cooling water for removal of decay heat from the reactor core following a postulated Loss-of-Coolant Accident (LOCA). Large-to-intermediate pipe breaks in the reactor coolant system result in a reactor pressure reduction sufficient to permit the Core Spray System to achieve its rated injection flow to limit fuel clad maximum temperature. To accommodate the remaining intermediate-to-small pipe breaks the Core Spray System also functions, in conjunction with the Automatic Depressurization System, to limit fuel clad temperature during a LOCA when the reactor vessel is not rapidly depressurized and the High Pressure Coolant Injection System, Reactor Core Isolation Cooling System, Feedwater System or Control Rod Drive System cannot adequately cool the reactor core. In this manner, the Core Spray System provides core cooling such that the maximum allowable fuel clad temperature limit is not reached for the entire spectrum of postulated LOCAs. The Core Spray System provides a supply of cooling water to the reactor core that is independent of the High Pressure Coolant Injection System, Reactor Core Isolation Cooling System, Feedwater System or Control Rod Drive System and the Core Spray System can be operated on emergency power.

The purpose of the Core Spray System is to provide for the post-LOCA removal of decay heat from the reactor core so that fuel clad temperature limits are maintained for the entire spectrum of postulated LOCAs. The Core Spray System accomplishes this purpose by delivering a low-pressure spray pattern over the fuel following a LOCA, which limits peak clad temperature. The Core Spray System operation is initiated automatically by either reactor low water level or high drywell pressure, or can be initiated manually.

The Core Spray System is a two-loop system. No single failure in the Core Spray System can cause both loops to malfunction. Operation of the Core Spray System loops is credited in the 10 CFR 50 Appendix K evaluation.

System Operation

The Core Spray System is comprised of two independent cooling loops, each providing 100 percent capacity. Each loop consists of two centrifugal pumps, each with a suction header from the torus that contains one suction isolation valve, a common discharge header, two motor operated isolation valves, one air operated check valve, a spray sparger in the reactor vessel just above the core, associated piping, valves, instrumentation and controls. The core spray pumps suction is through strainers located in the torus. The discharge is through the system isolation valves into spray spargers (evaluated with Reactor Internals). Each Core Spray System loop contains full flow test, minimum flow pump protection features, and a discharge header over-pressure protection relief valve. Flow and pressure instrumentation are provided in the control room for each loop. All motor operated valves in the main flowpath of each loop are normally open during system standby, with the exception of a downstream motor isolation valve in the discharge header located outside the drywell. The core spray system piping and components in the pressure boundary are considered an extension of the primary containment boundary.

During normal plant operation, the Core Spray System is in a ready standby condition. In this mode the Residual Heat Removal System's jockey pump runs continuously to maintain the core spray pump discharge line filled with water.

Upon receipt of the initiation signal, all core spray pumps in each Core Spray System loop start. Initiation of both loops of the Core Spray System occurs upon receipt of a high drywell pressure or low reactor vessel level signal. These signals also start standby diesel generators, in order to supply power to the core spray pumps in the event of loss of normal electric power supply. The Core Spray System can also be initiated manually. Once the reactor pressure drops below a preset value and the Core Spray System actuation signal is present, the motor operated isolation valves in the discharge headers receive a permissive signal to open. Opening of the motor operated isolation valves in the discharge headers completes the flowpath, and injection water from the two loops enters the vessel through two penetrations. The two core spray headers (evaluated with Reactor Internals) enter the Reactor Pressure Vessel through penetration nozzles inside the reactor vessel. Each core spray header internal pipe (also evaluated with Reactor Internals) then divides into a semicircular header with a downcomer at each end which turns through the core shroud near the top. A semicircular sparger is attached to each of the four outlets to make two nearly complete circles, one above the other. Short, elbow nozzles are spaced around the spargers to spray the water radially onto the tops of the fuel assemblies.

The main flow path for each Core Spray System loop takes suction from the torus through two core spray pumps, continuing through the two outboard motor isolation valves, through the inboard air operated stop check valve, and into the reactor vessel for discharge onto the core through the associated spray sparger.

After Core Spray System flow has been established into the vessel, the torus provides an essentially unlimited supply of cooling water. Water discharged from a pipe break inside the drywell will overflow through the drywell vents into the torus. An alternate supply of cooling water for the Core Spray System is the condensate storage tank through closed manual valves located at the suction of each core spray pump. The condensate storage tank is evaluated with the Condensate Storage and Transfer System. During Core Spray System operation, the heat being absorbed by the water that flows back to the torus is transferred to the ultimate heat sink by the heat exchangers in the Residual Heat Removal System.

The equipment area cooling system, which is part of the Reactor Building Ventilation System, is an engineered safeguard ventilation system that provides standby supplementary cooling to the each Core Spray pump room. Each Core Spray System pump room is provided with two coolers sized to extract the heat generated by pump operation. Cooling water supplied to these coolers from the safety and turbine auxiliary cooling system and is evaluated with the Closed Cycle Cooling Water System. Air flow path for these coolers is evaluated with the Reactor Building Ventilation System. Operation of these coolers is required to support the Core Spray System safety-related function.

For more detailed information, see UFSAR Sections 6.3.2 and 6.3.2.2.3.

<u>System Boundary</u>

The Core Spray System scoping boundary begins with the strainers in the torus and includes the Core Spray pumps that take suction through individual suction headers from each strainer, continuing through the suction isolation valves, through the pump to the discharge piping into two common headers each containing two outboard motor operated isolation valves outside of containment, continues through the inboard air operated stop check valve inside containment, and terminates where each core spray loop spray sparger is attached to the reactor vessel nozzle. Included in this boundary is a full flow test line on each loop and pressure relief valve line on each common discharge header that goes back to the torus. All associated piping, components, and instrumentation contained within the flowpath discussed above are included in the system boundary.

Included in the license renewal boundary of the Core Spray System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor Building. Included in this boundary are pressure retaining components relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included are the piping and spargers located inside the reactor vessel, which are included in the Reactor Internals scoping boundary.

Not included in the Core Spray System license renewal scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Automatic Depressurization System
Residual Heat Removal System
High Pressure Coolant Injection System
Primary Containment Instrument Gas System
Primary Containment
Condensate Storage and Transfer System
Reactor Internals
Reactor Pressure Vessel

Reason for Scope Determination

The Core Spray System meets the scoping requirements of 10 CFR 54.4(a)(1) because it is a safety-related system which is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It does meet 10 CFR 54.4(a)(3) because it is relied upon in the 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), Anticipated Transient Without Scram (10 CFR 50.62) and Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide reactor coolant pressure boundary. The Core Spray System provides isolation from the reactor coolant pressure boundary. 10 CFR 54.4(a)(1)

2. Sense process conditions and generate signals for reactor trip or engineered safety features actuation. The Core Spray System includes the associated actuation logic. 10 CFR 54.4(a)(1)

3. Provide emergency core cooling where the equipment provides coolant directly to the core. The Core Spray System provides the emergency core cooling system function to limit peak clad temperatures below 2200 deg F, maintain local oxidization of clad to a thickness not exceeding seventeen percent of unoxidized clad, limit hydrogen generation from the metal-water reaction to not greater than one percent of the calculated value for the total metal-water reaction hydrogen generation, maintain a coolable geometry, and provide long term cooling. Minimum flow capability provides pump protection to assure capability of emergency core cooling system function. Core Spray System operates with Automatic Depressurization System to accommodate entire spectrum of postulated LOCA breaks. 10 CFR 54.4(a)(1)

4. Provide primary containment boundary. The Core Spray System injection piping contains valves, which are considered containment isolation devices. 10 CFR 54.4(a)(1)

5. Resist nonsafety-related system, stucture or component failure that could prevent satisfactory accomplishment of a safety-related function. The Core Spray System includes nonsafety-related water filled lines in the Reactor Building that have the potential for spatial interactions (spray or leakage) with safety-related system, stucture or components. 10 CFR 54.4(a)(2)

6. 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). Core Spray System is part of Appendix R shut down method. 10 CFR 54.4(a)(3)

7. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). Core Spray System has components that are in the Environmental Qualification program. 10 CFR 54.4(a)(3)

8. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Anticipated Transients Without Scram (10 CFR 50.62). Core Spray System provides a flow path for Standby Liquid Control System injection. 10 CFR 54.4(a)(3)

9. 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). Core Spray System lines provide a flow path for High Pressure Coolant Injection System. 10 CFR 54.4(a)(3)

<u>UFSAR References</u>

6.3.2
6.3.2.2.3

<u>License Renewal Boundary Drawings</u>

LR-M-41-1, Sheet 1
LR-M-52-1, Sheet 1
LR-M-55-1, Sheet 1

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

Component Type	Intended Function
Bolting	Mechanical Closure
Bolting (Class 1)	Mechanical Closure
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary
Cyclone Separator (on Core Spray pump)	Pressure Boundary
Flow Element	Pressure Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings (Class 1)	Pressure Boundary
Pump Casing (Core Spray)	Pressure Boundary
Restricting Orifices	Pressure Boundary
Restricting Orifices	Throttle
Restricting Orifices (Class 1)	Pressure Boundary
Restricting Orifices (Class 1)	Throttle
Strainer	Filter
Strainer	Pressure Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary
Valve Body (Class 1)	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.2.2-2 Core Spray System
Summary of Aging Management Evaluation

2.3.2.4 Filtration, Recirculation, and Ventilation System

System Purpose

The Filtration, Recirculation & Ventilation System (FRVS) is a plant engineered safety feature (ESF) ventilation system that recirculates, filters and exhausts the air in the Reactor Building following a loss of coolant accident (LOCA), or other high radioactivity accident, to reduce the concentration of radioactive halogens and particulates.

The Filtration, Recirculation, and Ventilation System consists of two subsystems, the recirculation system and the ventilation system, that are required to perform post-accident, safety-related functions simultaneously. The recirculation system, located inside the Reactor Building, is designed to recirculate and filter the air in the Reactor Building following a LOCA, or other high radioactivity accident, to reduce the reduces offsite doses significantly below 10 CFR 100 guidelines. Upon Reactor Building isolation, the recirculation system is actuated and recirculates the Reactor Building air through filters for cleanup. This is the initial cleanup system before discharge is made via the ventilation system. The ventilation system, also located inside the Reactor Building, maintains the building at a negative pressure with respect to the outdoors. The system takes suction from the discharge duct of the recirculation system and discharges the air through filters to the outdoors via a vent at the top of the Reactor Building.

During normal operation, the Reactor Building Ventilation System is operating and the FRVS is in standby. During a postulated accident or abnormal occurrence, the FRVS is automatically actuated. The FRVS can also be started manually from the main control room. The FRVS is supplied with diesel generator power automatically during a LOCA coincident with loss of offsite power (LOP).

System Operation

The recirculation system consists of six 25 percent capacity recirculation fans and filter trains connected to ducts, controls, and instrumentation. It is connected in parallel with the Reactor Building Ventilation System (RBVS), to the extensive supply and exhaust duct network within the Reactor Building. All six FRVS recirculation units include fan inlet vanes and isolation dampers, moisture separators to recirculate the Reactor Building air, electric heating coils, high efficiency particulate air (HEPA) filters, charcoal filters, HEPA afterfilters, and water cooling coils. Upon a LOCA signal, all six FRVS recirculation units start and handle the total building free volume at three percent per minute. There are two designed standby units that are manually stopped and re-aligned to "Auto" mode. The standby units start automatically upon loss of flow of any one of the four operating units. Four of the six FRVS recirculation units recirculate the Reactor Building air for at least 10 minutes after a LOCA signal. Cooling provided by the four operating FRVS recirculation units limit the expansion and temperature of the Reactor Building air following a LOCA.

Upon receipt of a FRVS recirculation fan start signal, the associated fan's air supply and exhaust dampers automatically open, in addition the fan's inlet vane automatically operates to maintain the required flow through the filter units. The safety auxiliaries cooling plant system (SACS) cooling water valve to the unit's cooling coils automatically opens to provide cooling. The cooling coils are provided with water from SACS, which is evaluated with the Closed Cycle Cooling Water System. One of the two SACS cooling water loops supplies water to the three cooling coils while the redundant loop supplies the three remaining coils. The arrangement ensures that even with one of the SACS cooling water loop failure, three FRVS recirculating cooling coils will continue to function.

The ventilation system consists of two 100 percent capacity centrifugal fans, filter trains, ducts, controls, and instrumentation. Each fan is provided with inlet vanes and isolation dampers. One ventilation unit runs while the other is on standby. Each ventilation unit takes the discharge from the FRVS recirculation system and processes the air through a charcoal filter and HEPA filter. It exhausts to the outdoors through a vent located at the top of the Reactor Building to maintain a negative pressure relative to the atmosphere greater or equal to 0.25 inches of water column. The exhaust is monitored for radioactivity before release to the environment.

The ventilation system automatically starts upon receipt of a reactor isolation signal. Upon receipt of a start signal, the associated fan's air supply and exhaust dampers automatically open, in addition the fan's inlet vane automatically operates to maintain the required air flow through the filter unit. The unit's heater is automatically energized. The air exhaust dampers and air bypass dampers automatically control air flow to either the environment or back to the FRVS recirculation system. The air exhaust and bypass dampers operate to maintain the Reactor Building at a negative 0.25 inches of water column.

For more detailed information, see UFSAR Section 6.8.

System Boundary

The Filtration, Recirculation & Ventilation System (FRVS) boundary begins at the main exhaust header of the Reactor Building Ventilation System where it is drawn into the FRVS recirculation system. It continues through the recirculation fans and filter trains to the FRVS ventilation system, continuing through the ventilation fan, ventilation filter and associated ductwork. The boundary ends at the vent located at the top of the reactor building or can be re-circulated back to the FRVS recirculation system via air exhaust dampers or air bypass dampers.

Not included in the Filter, Recirculation and Ventilation System license renewal scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Closed Cycle Cooling Water System
Reactor Building Ventilation System

Reason for Scope Determination

The Filtration, Recirculation & Ventilation System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It does not meet 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system would not prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49) and Station Blackout (10 CFR 50.63). The Filtration, Recirculation & Ventilation System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the

Commission's regulation for Fire Protection (10 CFR 50.48) and Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide secondary containment boundary. Provides for controlled, elevated release of filtered building atmosphere under accident conditions. 10 CFR 54.4(a)(1)

2. Control and treat radioactive materials released to the secondary containment. Minimize ground level release of airborne radioactive materials by maintaining a negative pressure in the Reactor Building. 10 CFR 54.4(a)(1)

3. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Filtration, Recirculation, and Ventilation System includes environmentally qualified components. 10 CFR 54.4(a)(3)

4. 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). The Filtration, Recirculation, and Ventilation System is designed to satisfy its designed safety function on loss of power. 10 CFR 54.4(a)(3)

UFSAR References

6.8

License Renewal Boundary Drawings

LR-M-76-1, Sheet 1
LR-M-83-1, Sheet 1
LR-M-84-1, Sheet 1

Table 2.3.2-4 Filtration, Recirculation, and Ventilation System Components Subject to Aging Management Review

Component Type	Intended Function
Bird Screen	Filter
Bolting	Mechanical Closure
Damper Housing	Pressure Boundary
Door Seal	Pressure Boundary
Ducting and Components	Pressure Boundary
Fan Housing	Pressure Boundary
Filter Housing	Pressure Boundary
Flexible Connection	Pressure Boundary
Flow Element	Pressure Boundary
Heat Exchanger Components (FRVS Recirc cooling coils)	Evaluated with the Closed Cycle Cooling Water System
Piping and Fittings	Pressure Boundary
Tanks (Drum Trap)	Pressure Boundary
Thermowell	Pressure Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.2.2-3 Filtration, Recirculation, and Ventilation System Summary of Aging Management Evaluation

2.3.2.5 High Pressure Coolant Injection (HPCI) System

System Purpose

The High Pressure Coolant Injection (HPCI) System is a standby high pressure Emergency Core Cooling System (ECCS) designed to ensure that the reactor core is not uncovered if there is a small break in the reactor coolant pressure boundary that does not result in rapid depressurization of the reactor vessel. This permits the plant to be safely shut down, by maintaining sufficient reactor vessel water inventory while the reactor vessel is depressurized. The HPCI System continues to operate until the reactor vessel is depressurized to the point at which low pressure coolant injection and/or core spray system operation can maintain core cooling. The HPCI System also fulfills the objectives of the Reactor Core Isolation Cooling (RCIC) System, in the event RCIC becomes isolated or otherwise inoperative. The HPCI System provides a supply of cooling water to the reactor core, which maintains the reactor vessel water level above the top of the core and prevents Automatic Depressurization System actuation. The HPCI System supplies make-up water to the reactor vessel through one of the core spray spargers and one of the feedwater headers. HPCI can be operated on DC emergency power without the need for AC emergency power.

The HPCI System consists of the following plant systems: High Pressure Coolant Injection System and the High Pressure Coolant Injection Turbine Steam System. The HPCI System is in scope for License Renewal. However, portions of the HPCI System are not required to perform intended functions and are not in scope. The HPCI System has several interfaces with other systems that are not in the license renewal boundary of the HPCI System.

The primary purpose of the HPCI System is to provide sufficient coolant to the reactor vessel to prevent excessive fuel clad temperatures in the event of a small break LOCA that does not result in rapid depressurization of the reactor vessel. The HPCI System accomplishes this purpose by delivering sufficient high pressure flow to maintain reactor vessel inventory and ensures that the reactor core is not uncovered. The HPCI System operation is initiated automatically by either reactor low-low water level or high drywell pressure, or can be initiated manually.

The HPCI System is a single loop system that is not single failure proof. Operation of the HPCI System is credited in the 10 CFR 50 Appendix K evaluation.

System Operation

The High Pressure Coolant Injection (HPCI) System consists of a steam turbine driven HPCI pump assembly and associated system piping, valves, controls, and instrumentation. The HPCI pump assembly consists of a single stage booster pump and a double stage main pump. Both pumps are mounted on a common skid and connected in series in the system flow path. The booster pump is driven through a reduction gear mechanism by the HPCI turbine that drives the HPCI pump.

The HPCI booster pump takes suction from either the condensate storage tank or the suppression pool, through the suppression pool strainer, and discharges to the suction of the HPCI pump. The HPCI pump discharges to the reactor pressure vessel through the core spray sparger connected to core spray pumps A and C. The HPCI pump also discharges to the reactor pressure vessel through feedwater line "A" header. A minimum flow bypass system is provided to protect the pump while operating against a closed discharge valve. This minimum flow bypass directs the HPCI pump discharge to the suppression pool.

During normal plant operation, the HPCI System is in a ready 'standby' condition. In this mode the HPCI jockey pump runs continuously to maintain the HPCI pump discharge line filled with water. The Condensate Storage and Transfer System supplies demineralized water for filling of the HPCI System and can also be used to maintain HPCI pump discharge piping full if the jockey pump is out of service. Additionally, the turbine steam supply line is kept warm by admitting reactor steam up to the HPCI turbine steam supply shutoff valve. Condensate is drained to the main condenser through a drain pot and steam trap.

Initiation of the HPCI System occurs upon receipt of a high drywell pressure or low-low reactor water level signal. The HPCI System can also be manually initiated. Once the HPCI System actuation signal is present, the vacuum pump starts and the auxiliary oil pump starts to open the HPCI turbine stop valve, which delivers steam to the HPCI turbine driving the HPCI pump assembly. In addition, the actuation signal also provides a permissive signal to open the following motor operated valves: turbine steam supply valve, turbine control valve, condensate storage tank suction valve, HPCI pump discharge valve, HPCI pump discharge valve to Core Spray header, HPCI pump discharge valve to feedwater header, barometric condenser/lube oil cooler cooling water supply valve and the HPCI minimum flow valve. Additionally, the HPCI test return valve to the condensate storage tank, HPCI/RCIC test return valve to the condensate storage tank, and the vacuum pump discharge valve to the main condenser all close upon receipt of an initiation signal.

The HPCI System main flow path initially takes suction from the condensate storage tank. If the water level in the condensate storage tank falls below a predetermined level or the suppression pool water level is high, the pump suction is automatically transferred to the suppression pool. This transfer may also be made from the main control room using manual controls. When the pump suction has been transferred to the suppression pool, a closed loop is established for recirculation of water escaping from a break in the reactor coolant pressure boundary following a postulated LOCA.

The heat being absorbed by the water in the torus is transferred to the ultimate heat sink by the heat exchangers in the Residual Heat Removal System and the Closed Cycle Cooling Water System. After the HPCI System flow has been established into the vessel, the suppression pool provides an essentially unlimited supply of cooling water.

The HPCI turbine is driven by steam from the reactor vessel generated by decay and residual heat. The steam is extracted from main steam line "C" upstream of the main steam isolation valves. The inboard and outboard HPCI containment isolation valves in the steam line to the HPCI turbine are normally open. This keeps the piping to the turbine at an elevated temperature to permit rapid startup of the HPCI System. The inboard isolation valve has a bypass line containing a normally closed valve. This bypass line permits pressure equalization and drainage around the isolation valve and downstream line warm-up prior to opening of the isolation valve.

A condensate drain pot is provided upstream of the HPCI turbine steam supply shutoff valve to prevent this line from filling with water. The drain pot normally routes the condensate to the main condenser. However, upon receipt of an HPCI System initiation signal, or upon loss of control air pressure, isolation valves on the condensate line automatically close to prevent loss of steam.

Exhaust steam from the HPCI turbine is discharged below the surface of the suppression pool. Condensate from the turbine exhaust line and from the turbine casing, ring, seat and chest drains is collected in the turbine exhaust drain pot. The collected condensate is discharged through an orifice to the HPCI barometric condenser. Steam from the HPCI turbine gland seals is vented to and condensed in the barometric condenser. The HPCI gland seal condenser vacuum pump maintains the barometric condenser under vacuum conditions and removes non-condensable gases, which are normally pumped to the Filtration, Recirculation, and Ventilation System. During HPCI System testing, the non-condensable gases can be routed to the main condenser. The barometric condenser, gland seal condenser vacuum pump and associated piping and valves prevent contaminated steam from leaking into the HPCI room atmosphere during turbine operation, and are not required to support HPCI System operation. The gland seal condenser vacuum pump and associated piping and valves contain non-condensable gasses and are not required to support any intended functions. Therefore, the gland seal condenser vacuum pump and associated piping and valves are not in scope for license renewal.

A full-flow test line is provided to permit transfer of condensate water from and to the condensate storage tank for testing of the HPCI System during normal plant operation.

The HPCI System is provided with pump room coolers to extract the heat generated by pump and turbine operation. Cooling water supplied to these coolers is evaluated with the Closed Cycle Cooling Water System. The airflow path for these coolers is evaluated with the Reactor Building Ventilation System. Operation of these coolers is required to support the HPCI System safety-related function.

For more detailed information, see UFSAR Section 6.3.

System Boundary

The HPCI System boundary for water injection begins with the HPCI suction lines from the condensate storage tank and the suppression pool strainer. It continues through to the HPCI booster pump and HPCI main pump. The discharge path runs from the output side of the HPCI main pump to the Core Spray System Train "A" sparger and the Feedwater System "A" line connections outside the primary containment. Included are all piping and components that feed the HPCI booster pump and the HPCI main pump. The discharge path also includes a minimum flow line to the torus and a flow test return line to the condensate storage tank.

Also included in the HPCI System boundary is the keep fill jockey pump that takes suction from the condensate storage tank and discharges to the HPCI supply header.

The HPCI boundary for the steam supply begins with the HPCI steam supply attachment piping at the "C" main steam line and continues through the inboard and outboard HPCI containment isolation valves, HPCI steam admission stop and control valves, continues through the HPCI turbine, and the HPCI turbine exhausts to the torus. Auxiliary subsystems include gland seal, drain pots, turbine oil, and turbine cooling water.

All associated piping, components and instrumentation, contained within flow paths and subsystems described above are included in the HPCI System evaluation boundary.

Also included in the HPCI System boundary is the suppression pool level instrumentation and the condensate storage tank level instrumentation necessary to provide signals to initiate the automatic swap of the HPCI suction source from the condensate storage tank to the suppression pool.

Included in the license renewal boundary of the HPCI System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor Building. Included in the boundary are pressure retaining components located in the Reactor Building relied upon to preserve the leakage boundary intended function of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the scope of license renewal are the piping and components associated with the HPCI gland seal condenser vacuum pump. This includes the suction piping from the barometric condenser vacuum tank through the HPCI gland seal condenser vacuum pump to the reactor building exhaust and main condenser, including the recirculation piping from the vacuum pump back to the vacuum tank. This portion of the system is not safety-related and is not required to function to support operability of the HPCI System. In addition, since this portion of the system contains gas it does not support the system's leakage boundary intended function. Therefore, this portion of the HPCI System is not required to perform an intended function and is not included in the scope of license renewal.

Not included in the HPCI license renewal scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Condensate Storage and Transfer System
Core Spray System
Feedwater System
Main Steam System
Primary Containment

Reason for Scope Determination

The High Pressure Coolant Injection System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the 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), and Station Blackout (10 CFR 50.63). The High Pressure Coolant Injection System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide reactor coolant pressure boundary. The High Pressure Coolant Injection System steam supply includes reactor coolant pressure boundary piping. 10 CFR 54.4(a)(1)

2. Provide emergency core cooling where the equipment provides coolant directly to the core. The High Pressure Coolant Injection System provides high pressure coolant flow to the reactor vessel. 10 CFR 54.4(a)(1)

3. Provide primary containment boundary. The High Pressure Coolant Injection System includes piping and valves that are part of the primary containment boundary. 10 CFR 54.4(a)(1)

4. Sense process conditions and generate signals for reactor trip or engineered safety features actuation. The High Pressure Coolant Injection System includes suppression pool and condensate storage tank level instrumentation to perform automatic swap of the High Pressure Coolant Injection system suction source from the condensate storage tank to the suppression pool. 10 CFR 54.4(a)(1)

5. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The High Pressure Coolant Injection System includes nonsafety-related water filled lines in the Reactor Building that have the potential for spatial interactions (spray or leakage) or structurally interact with safety-related SSCs. 10 CFR 54.4(a)(2)

6. 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). The High Pressure Coolant Injection System supports Appendix R Safe Shutdown. 10 CFR 54.4(a)(3)

7. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The High Pressure Coolant Injection System includes environmentally qualified electrical components. 10 CFR 54.4(a)(3)

8. 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). The High Pressure Coolant Injection System can be operated without AC power during a station blackout event to provide coolant to the reactor vessel. 10 CFR 54.4(a)(3)

<u>UFSAR References</u>

UFSAR 6.3
5.4.6

<u>License Renewal Boundary Drawings</u>

LR-M-08-0, Sheet 1
LR-M-41-1, Sheet 1
LR-M-49-1, Sheet 1
LR-M-51-1, Sheet 1
LR-M-55-1, Sheet 1
LR-M-56-1, Sheet 1

Table 2.3.2-5 <u>High Pressure Coolant Injection (HPCI) System</u> Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Bolting (Class 1)	Mechanical Closure
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary
Condensing Chamber (Class 1)	Pressure Boundary
Filter Housing	Pressure Boundary
Flow Element	Pressure Boundary
Flow Element (HPCI Steam Flow Venturi) (Class 1)	Pressure Boundary
Gearbox	Pressure Boundary
Heat Exchanger Components (Lube Oil Cooler)	Heat Transfer
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary
Hoses	Pressure Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Piping and Fittings (Class 1)	Pressure Boundary
Pump Casing (HPCI booster pump)	Pressure Boundary
Pump Casing (HPCI pump)	Pressure Boundary
Pump Casing (Jockey Pump)	Pressure Boundary
Pump Casing (Turbine Aux Oil Pump)	Pressure Boundary
Pump Casing (Turbine Main Oil Pump)	Pressure Boundary
Pump Casing (Vacuum Tank Condensate Pump)	Leakage Boundary
Restricting Orifices	Leakage Boundary
Restricting Orifices	Pressure Boundary
Restricting Orifices	Throttle
Restricting Orifices (Class 1)	Pressure Boundary
Restricting Orifices (Class 1)	Throttle
Sight Glasses	Leakage Boundary
Sight Glasses	Pressure Boundary
Sparger	Spray
Strainer	Filter

Component Type	Intended Function
Strainer	Pressure Boundary
Strainer Body	Pressure Boundary
Tank (Turbine Lube Oil Reservoirs)	Pressure Boundary
Tank (Vacuum Tank)	Leakage Boundary
Thermowell	Pressure Boundary
Turbine Casing	Pressure Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary
Valve Body (Class 1)	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System Summary of Aging Management Evaluation

2.3.2.6 Hydrogen and Oxygen Analyzer System

System Purpose

The Hydrogen and Oxygen Analyzer System is a license renewal system and is part of the containment atmosphere control plant system. The Hydrogen and Oxygen Analyzer System is a safety-related system and is in scope for license renewal. However, portions of the Hydrogen and Oxygen Analyzer System are not required to perform intended functions and are not in scope. The Hydrogen and Oxygen Analyzer System has several interfaces with other systems that are not in the license renewal boundary of the Hydrogen and Oxygen Analyzer System.

The Hydrogen and Oxygen Analyzer System is a gas sampling system, consisting of two identical redundant trains, designed to monitor the hydrogen and oxygen concentration in the Primary Containment during accident conditions. The Hydrogen and Oxygen Analyzer System includes a permanently connected torus supplementary oxygen analyzer panel in the "A" train between the torus sample incoming and return lines. Additionally, the Hydrogen and Oxygen Analyzer System includes a portable drywell supplementary oxygen analyzer panel that can be connected through the Leak Detection and Radiation Monitoring System.

The purpose of the Hydrogen and Oxygen Analyzer System is to monitor the primary containment atmosphere to ensure that oxygen and hydrogen levels do not approach flammability limits. The Hydrogen and Oxygen Analyzer System accomplishes this purpose post accident and during normal power operations. During post accident operation, the Hydrogen and Oxygen Analyzer System processes a drywell atmosphere sample through one of two redundant hydrogen and oxygen analyzer loops. During normal power operation, the Hydrogen and Oxygen Analyzer System is in the standby mode, except for calibration or maintenance, and the supplementary oxygen monitoring portion of the Hydrogen and Oxygen Analyzer System is in service to monitor the oxygen concentration of the atmosphere in the drywell and torus areas. The purpose of the supplementary oxygen analyzers is to provide an alternate method of monitoring torus and drywell oxygen concentration.

The Hydrogen and Oxygen Analyzer System is started and removed from service manually.

System Operation

The Hydrogen and Oxygen Analyzer System is comprised of two identical redundant analyzer trains and two supplementary oxygen analyzer panels as backup to the redundant channels. Each redundant train consists of a hydrogen and oxygen analyzer cell, sample pump, indicators, recorder, system trouble alarm, calibration and reagent gas bottles and valves, and a control switch with indicating lights for the manual containment isolation valves. The indicators, recorders, alarms and control switches are located in the main control room. The Hydrogen and Oxygen Analyzer System is initiated manually. Sample gases are drawn from drywell head region, drywell cylindrical region and torus airspace through the analyzer cells by a diaphragm pump located in each analyzer panel. Each analyzer train can only sample one sample point at one time, at the discretion of the operator. All sample lines are electrically heat traced.

Two supplementary oxygen analyzers provide backup to the hydrogen and oxygen analyzers for the purpose of drywell oxygen monitoring and torus oxygen monitoring. Oxygen monitoring during normal operation is accomplished by analyzing grab samples taken either through the supplementary torus oxygen analyzer, or through the supplementary drywell oxygen analyzer. The supplementary torus oxygen analyzer is permanently connected in the "A" train between the torus sample incoming and return lines of the hydrogen and oxygen analyzer panel, which can be utilized for torus oxygen sampling. The supplementary drywell oxygen analyzer is portable, and attaches directly to the drywell noble gas monitor grab sampler using quick disconnects within the Leak Detection and Radiation Monitoring System.

The supplementary torus oxygen analyzer is comprised of an oxygen analyzer, and a diaphragm sample pump, which draws and pressurizes the gas sample. Additionally the torus oxygen analyzer has a refrigerant and dryer assembly to remove moisture from sample stream.

Containment isolation valves for the Hydrogen and Oxygen Analyzer System automatically close upon high drywell pressure, low-low reactor water level, or reactor building ventilation exhaust high radiation. Closure of the containment isolation valves will result in isolation of the redundant hydrogen and oxygen analyzers, as well as the supplementary oxygen analyzer for the torus. The containment isolation valves can be individually opened manually from the main control room to reestablish a sample flow path to the Hydrogen and Oxygen Analyzer System.

For more detailed information, see UFSAR Section 6.2.5.2.5.

System Boundary

The Hydrogen and Oxygen Analyzer System boundary for each hydrogen and oxygen analyzer train begins at the sample line inlets located at two regions in the drywell, one in the drywell head region and one in the drywell cylindrical region, and one region in the torus air space, and continues through the hydrogen and oxygen analyzers. Flow from each region passes through two motor operated containment isolation valves, and then enters the corresponding hydrogen and oxygen analyzer train through electrically heat traced sample lines. Containment sample gases are then routed through parallel hydrogen and oxygen analyzer cells located within the analyzer train in the Reactor Building. Sample gases are drawn through the analyzer cells by a diaphragm pump located in the analyzer panel. Sample gas and recombined moisture exhaust is then routed back to the containment through a return line to the torus, where the Hydrogen and Oxygen Analyzer System boundary ends. The return line to the torus airspace is equipped with two motor operated containment isolation valves followed by a hand operated normally open globe valve. Included in the system boundary is a supplementary oxygen analyzer installed permanently between the sample line from the torus and discharge line to the torus on the "A" hydrogen and oxygen analyzer train. The primary containment isolation valves, which isolate this hydrogen and oxygen analyzer train, also isolate the supplementary oxygen analyzer. All associated piping, components, and instrumentation contained within the boundaries described above are included within the system evaluation boundary.

Not included in the Hydrogen and Oxygen Analyzer System license renewal scoping boundaries are the following systems or structures, which are evaluated separately:

Primary Containment
Leak Detection and Radiation Monitoring System (plant leak detection system)
Containment Isolation System

The supplementary oxygen analyzer portion of the Hydrogen and Oxygen Analyzer System, exclusive of its containment isolation boundaries, does not support the intended functions of the Hydrogen and Oxygen Analyzer System and is not included within the scope of license renewal.

Reason for Scope Determination

The Hydrogen and Oxygen Analyzer System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. The Hydrogen and Oxygen Analyzer System is not in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system would not prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49) and Station Blackout (10 CFR 50.63). The Hydrogen and Oxygen Analyzer System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48), or Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide primary containment boundary. The Hydrogen and Oxygen Analyzer System includes primary containment isolation valves that close on high drywell pressure, low-low reactor water level, and reactor building exhaust high radiation. 10 CFR 54.4(a)(1)

2. Control combustible gas mixtures in the primary containment atmosphere. The Hydrogen and Oxygen Analyzer System analyzes the primary containment post loss-of-coolant-accident for hydrogen and oxygen concentration. 10 CFR 54.4 (a)(1)

3. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The limit switches associated with the primary containment isolation valves within the Hydrogen and Oxygen Analyzer System are environmentally qualified. 10 CFR 54.4(a)(3)

4. 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). Provides miscellaneous instrumentation used by plant station blackout procedure to monitor plant conditions during coping, shutdown and restoration. 10 CFR 54.4(a)(3)

UFSAR References

6.2.5.2.5
7.3.1.1.6.3

License Renewal Boundary Drawings

LR-M-57-1, Sheet 1

Table 2.3.2-6 **Hydrogen and Oxygen Analyzer System**
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Filter Housing	Pressure Boundary
Flow Device	Pressure Boundary
Heat Exchanger Components (Air Cooled - H2O2 Analyzer)	Heat Transfer
Heat Exchanger Components (Air Cooled - H2O2 Analyzer)	Pressure Boundary
Piping and Fittings	Pressure Boundary
Pump Casing (H2O2 Analyzer)	Pressure Boundary
Restricting Orifices	Pressure Boundary
Restricting Orifices	Throttle
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.2.2-5 Hydrogen and Oxygen Analyzer System
Summary of Aging Management Evaluation

2.3.2.7 Reactor Core Isolation Cooling (RCIC) System

System Purpose

The Reactor Core Isolation Cooling (RCIC) System is a standby high pressure safety-related system designed to ensure that sufficient reactor water inventory is maintained in the reactor vessel to allow for adequate core cooling. This prevents reactor fuel from overheating when (1) the reactor is isolated and maintained in the hot standby condition, (2) the reactor is isolated and accompanied by loss of the coolant flow from the feedwater system or (3) the reactor is shutdown under condition of loss of the normal feedwater system and prior to operation of the shutdown cooling system. The RCIC System supplies make-up water to the reactor vessel through a connection to the feedwater line when the reactor vessel is isolated from the main condenser. The water is distributed through the feedwater spargers to obtain mixing with the hot water or steam within the reactor vessel. RCIC can be operated on DC emergency power without the need for AC emergency power.

The RCIC System consists of the following plant systems: reactor core isolation cooling system and the reactor core isolation cooling turbine steam system. The RCIC System is in scope for License Renewal. However, portions of the RCIC System are not required to perform intended functions and are not in scope. The RCIC System has several interfaces with other systems that are not in the license renewal boundary of the RCIC System.

The primary purpose of the RCIC System is to provide sufficient coolant to the reactor vessel to prevent excessive fuel clad temperatures during a reactor shutdown in which feedwater flow is not available. The RCIC System accomplishes this purpose by delivering sufficient high pressure flow to maintain reactor vessel inventory and to ensure that the reactor core is not uncovered. The RCIC System operation is initiated automatically by reactor low low water level or can be initiated manually.

The RCIC System is a single loop system that is not single failure proof. Operation of the RCIC System is not credited in the 10 CFR 50 Appendix K evaluation.

System Operation

The Reactor Core Isolation Cooling (RCIC) System consists of a steam turbine, turbine driven pump, piping, valves, controls, and instrumentation.

The RCIC pump takes suction from either the condensate storage tank, through a common line to the HPCI pump suction, or the suppression pool, through the suppression pool strainer. The RCIC pump discharges to the reactor pressure vessel through the 'B' main feedwater line. A minimum flow bypass line is provided to protect the pump while operating against a closed discharge valve. This minimum flow bypass flowpath directs the RCIC pump discharge to the suppression pool.

During normal plant operation, the RCIC System is in a ready 'standby' condition. In this mode the RCIC jockey pump runs continuously to maintain the RCIC pump discharge line filled with water. The Condensate Storage and Transfer System supplies demineralized water for the filling of the RCIC System and can also be used to maintain RCIC pump discharge piping full if the jockey pump is out of service. Additionally, the turbine steam supply line is kept warm by admitting reactor steam up to the RCIC turbine steam supply shutoff valve. Condensate is drained to the main condenser through a drain pot and steam trap.

Initiation of the RCIC System occurs upon receipt of a reactor low water level signal. The RCIC System can also be manually initiated. Once the RCIC System actuation signal is present, the turbine steam supply valve opens and the turbine ramps up to speed to drive the RCIC pump assembly. In addition, the test bypass valve to the condensate storage tank receives a close signal, the vacuum pump discharge drain valve closes and the vacuum pump starts.

The RCIC System main flow path initially takes suction from the condensate storage tank. If the water level in the condensate storage tank falls below a predetermined level or the suppression pool water level is high, the pump suction is automatically transferred to the suppression pool. This transfer may also be made from the main control room using manual controls.

The RCIC turbine is driven by steam from the reactor vessel generated by decay and residual heat. The steam is extracted from main steam line "A" upstream of the main steam isolation valves. The inboard and outboard RCIC containment isolation valves in the steam line to the RCIC turbine are normally open. This keeps the piping to the turbine at an elevated temperature to permit rapid startup of the RCIC System. The inboard isolation valve has a bypass line containing a normally closed valve. This bypass line permits pressure equalization and drainage around the isolation valve and downstream line warm-up prior to opening of the isolation valve.

A condensate drain pot is provided upstream of the RCIC turbine steam supply shutoff valve to prevent this line from filling with water. The drain pot normally routes the condensate to the main condenser. However, upon receipt of an RCIC System initiation signal, or upon loss of control air pressure, isolation valves on the condensate line automatically close to prevent loss of steam.

Exhaust steam from the RCIC turbine is discharged below the surface of the suppression pool. Condensate from the turbine exhaust line and from the turbine casing, ring, seat and chest drains is collected in the turbine exhaust drain pot. The collected condensate is discharged through an orifice to the RCIC gland seal condenser. Steam from the RCIC turbine gland seals is vented to and condensed in the gland seal condenser. The RCIC gland seal condenser vacuum pump maintains the gland seal condenser under vacuum conditions and removes non-condensable gases, which are normally pumped to the Filtration, Recirculation, and Ventilation System. The barometric condenser vacuum tank condensate pump maintains condensate level in the barometric condenser. The vacuum tank condensate pump takes suction from the vacuum tank and discharges to the suction of the RCIC pump when the RCIC System is in operation, or to the clean radwaste when the system is in the standby mode. The vacuum tank condensate pump automatically starts on a high level signal from the condenser vacuum tank and will automatically shut off when the high level signal is no longer present. The pump can also be manually started.

The gland seal condenser, gland seal condenser vacuum pump and associated piping and valves prevent contaminated steam from leaking into the RCIC room atmosphere during turbine operation.

A full-flow test line is provided to permit transfer of demineralized water from and to the condensate storage tank for testing of the RCIC System during normal plant operation.

The RCIC System is provided with pump room coolers to extract the heat generated by pump and turbine operation. Cooling water supplied to these coolers is evaluated with the Closed Cycle Cooling Water System. The airflow path for these coolers is evaluated with the Reactor Building Ventilation System. Operation of these coolers is required to support the RCIC System safety-related function.

For more detailed information, see UFSAR Section 5.4.6.

System Boundary

The RCIC System boundary for the water injection begins with the RCIC suction lines from the condensate storage tank and the suppression pool strainer. It continues through to the RCIC pump. The discharge path runs from the discharge side of the RCIC pump to the 'B' main feedwater line connection outside the primary containment. The discharge path also includes a minimum flow line to the torus and a flow test return line to the condensate storage tank.

Also included in the RCIC System boundary is the keep fill jockey pump that takes suction from the condensate storage tank supply header and discharges to the RCIC pump discharge header.

The RCIC boundary for the steam supply begins with the RCIC steam supply attachment piping at the 'A' Main Steam line and continues through the inboard and outboard RCIC containment isolation valves, RCIC steam admission stop valve and control valves, continues through the RCIC turbine, and the RCIC turbine exhausts to the suppression pool. Auxiliary systems include gland seal, drain pots, turbine oil, and turbine cooling water.

All associated piping, components and instrumentation, contained within flow paths and subsystems described above are included in the RCIC System evaluation boundary.

Also included in the RCIC System boundary is the condensate storage tank level instrumentation necessary to provide signals to initiate the swap of the RCIC suction source from the condensate storage tank to the suppression pool.

Included in the license renewal boundary of the RCIC System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor Building. Included in the boundary are pressure retaining components located in the Reactor Building relied upon to preserve the leakage boundary intended function of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Also included in the license renewal scoping boundary of the RCIC System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor. Included in this boundary are components relied upon to preserve the structural support intended function of this portion of the system, such as the piping and components associated with the RCIC gland seal condenser vacuum pump. This includes the suction piping from the barometric condenser vacuum tank through the RCIC gland seal condenser vacuum pump to the main condenser, including the recirculation piping from the vacuum pump back to the vacuum tank. For more information, refer to the License Renewal Boundary Drawing for identification of this boundary, shown in red.

Not included in the RCIC license renewal scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Condensate Storage and Transfer System
Condensate System
Feedwater System
Main Steam System
Primary Containment

Reason for Scope Determination

The Reactor Core Isolation Cooling system meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the 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), and Station Blackout (10 CFR 50.63). The Reactor Core Isolation Cooling system is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide reactor coolant pressure boundary. The RCIC steam line and the pump discharge line include reactor coolant pressure boundary piping. 10 CFR 54.4 (a)(1)

2. Remove residual heat from the reactor coolant system. The RCIC System provides high pressure coolant flow to the reactor vessel. 10 CFR 54.4 (a)(1)

3. Provide primary containment boundary. The RCIC System includes piping and valves that are part of the primary containment boundary. 10 CFR 54.4(a)(1)

4. Sense process conditions and generate signals for reactor trip or engineered safety features actuation. The RCIC System includes suppression pool and condensate storage tank level instrumentation to perform automatic swap of the RCIC suction source from the condensate storage tank to the suppression pool. 10 CFR 54.4(a)(1)

5. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The RCIC System includes nonsafety-related water filled lines in the Reactor Building that have the potential for spatial interactions (spray or leakage) or structurally interact with safety-related SSCs. 10 CFR 54.4(a)(2)

6. 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) The RCIC System supports Appendix R Safe Shutdown. 10 CFR 54.4(a)(3)

7. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification. (10 CFR 50.49) The RCIC System includes environmentally qualified electrical components. 10 CFR 54.4(a)(3)

8. 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) The RCIC System can be operated without AC power during a station blackout event to provide coolant to the reactor vessel. 10 CFR 54.4(a)(3)

UFSAR References

5.4.6

License Renewal Boundary Drawings

LR-M-08-0, Sheet 1
LR-M-49-1, Sheet 1
LR-M-50-1, Sheet 1
LR-M-51-1, Sheet 2

Table 2.3.2-7 Reactor Core Isolation Cooling (RCIC) System Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Bolting (Class 1)	Mechanical Closure
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary
Drain Traps	Leakage Boundary
Filter Housing	Pressure Boundary
Flow Element	Pressure Boundary
Flow Element (Class 1)	Pressure Boundary
Heat Exchanger Components (Lube Oil Cooler)	Heat Transfer
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary
Hoses	Pressure Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Piping and Fittings (Class 1)	Pressure Boundary
Pump Casing (Jockey Pump)	Pressure Boundary
Pump Casing (RCIC Gland Seal Cond. Vacuum Pump)	Structural Support
Pump Casing (RCIC Pump)	Pressure Boundary
Pump Casing (Turbine Aux Oil Pump)	Pressure Boundary
Pump Casing (Turbine Main Oil Pump)	Pressure Boundary
Pump Casing (Vacuum Tank Condensate Pump)	Leakage Boundary
Restricting Orifices	Pressure Boundary
Restricting Orifices	Throttle
Restricting Orifices (Class 1)	Pressure Boundary
Restricting Orifices (Class 1)	Throttle
Sight Glasses	Leakage Boundary
Sight Glasses	Pressure Boundary
Sparger (Turbine Exhaust)	Spray
Strainer	Filter
Strainer	Pressure Boundary
Strainer Body	Pressure Boundary

Component Type	Intended Function
Tank (Turbine Lube Oil Reservoirs)	Pressure Boundary
Tank (Vacuum Tank)	Leakage Boundary
Thermowell	Pressure Boundary
Turbine Casing	Pressure Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary
Valve Body	Structural Support
Valve Body (Class 1)	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System
Summary of Aging Management Evaluation

2.3.2.8 Residual Heat Removal (RHR) System

System Purpose

Residual Heat Removal System is a low pressure emergency core cooling system designed to provide cooling water for removal of fission product heat from the reactor core and primary containment following postulated design bases events or normal operation. Large-to-intermediate pipe breaks in the reactor coolant system result in a reactor pressure reduction sufficient to permit the Residual Heat Removal System to achieve its rated injection flow to limit fuel clad maximum temperature. To accommodate the remaining intermediate-to-small pipe breaks, the Residual Heat Removal System also functions, in conjunction with the Automatic Depressurization System, to limit fuel clad temperature during a LOCA when the reactor vessel is not rapidly depressurized and the High Pressure Coolant Injection (HPCI) System, Reactor Core Isolation Cooling (RCIC) System, Feedwater System or Control Rod Drive System cannot adequately cool the reactor core. In this manner, the Residual Heat Removal System provides core cooling such that the maximum allowable fuel clad temperature limit is not reached for the entire spectrum of postulated LOCAs. With the exception of the shutdown suction, shutdown return, and head spray line, the entire Residual Heat Removal System is part of the emergency core cooling system and the primary containment cooling function.

The Residual Heat Removal System has three primary and two secondary functions of operation. The first two primary purposes of the Residual Heat Removal System are to provide for the post design bases events fission product heat removal from the reactor core so that fuel clad temperature limits is maintained and remove heat from primary containment to ensure structural pressure and temperature limits are maintained. The Residual Heat Removal System accomplishes the two primary purpose by the low pressure coolant injection and containment spray modes which deliver low-pressure coolant to the reactor vessel, limiting peak clad temperature to less than the maximum allowable limit, and to primary containment, maintaining the structure temperature and pressure less than its maximum design limit. Fission product decay heat is removed from the core and primary containment by the Residual Heat Removal System and is transported to the torus. The Residual Heat Removal heat exchangers remove the heat from the torus and transfer the heat to the safety auxiliary cooling system, which is evaluated in the Closed Cycle Cooling Water System.

The third primary purpose of the Residual Heat Removal System is to remove the decay and sensible heat from the reactor primary system to permit cold shutdown for refueling. The Residual Heat Removal System accomplishes this purpose in the shutdown cooling mode by manually opening valves that have piping interconnections with Reactor Recirculation System suction piping, directing flow through the Residual Heat Removal heat exchangers which removes heat from the reactor and returns the flow to Reactor Recirculation discharge piping, therefore allowing shutdown.

The two secondary purposes of the Residual Heat Removal System are to augment fuel pool cooling by removing decay heat of the spent fuel and to provide an alternate source of water from a non-NSSS intertie between the Station Service Water System and the Residual Heat Removal System piping which allows water to flood the reactor containment during the period following a LOCA.

The emergency core cooling system low pressure coolant injection mode of the Residual Heat Removal System operation is initiated automatically by either reactor low-low-low water level or high drywell pressure, or can be initiated manually. The other modes of the Residual Heat Removal system are manually initiated.

No single failure in the Residual Heat Removal System can cause all four loops to malfunction. Operation of the Residual Heat Removal System loops is credited in the 10 CFR 50 Appendix K evaluations.

System Operation

The Residual Heat Removal System is comprised of four independent loops. Each loop contains a motor driven pump, piping, valves, instrumentation, and controls. Each loop takes suction from the torus and is capable of discharging water to the reactor vessel via separate low-pressure coolant injection nozzles. Each Residual Heat Removal System loop contains full flow test, keep-fill, and minimum flow pump protection features. Flow and pressure instrumentation are provided in the control room for each loop. In addition, there are residual heat removal pump discharge header crossties between loops with two manual isolation valves. The purpose of these crossties is to permit alternate decay heat removal. Two of the residual heat removal loops have heat exchangers that are each cooled by an independent loop of the safety auxiliaries cooling system, which is evaluated in the Closed Cycle Cooling Water System. The two residual heat removal heat exchanger loops can also take suction from the Reactor Recirculation System suction or the fuel pool and can discharge into the reactor recirculation pump discharge, fuel pool cooling discharge, or to the torus and drywell spray spargers

The Residual Heat Removal System has six modes of operation. Each mode is discussed separately to provide clarity. First is operating in the ECCS low pressure coolant injection mode. The Residual Heat Removal System functions in conjunction with other emergency core cooling system to restore and maintain reactor coolant inventory following a LOCA. The low pressure coolant injection mode provides water from the torus directly to the reactor vessel. Second is the primary containment spray mode that supplies water from the torus directly to the free air space of the torus and drywell. Directing spray flow to the air space condenses the steam and thereby reduces containment pressure and temperature. Torus cooling is the third mode. Heat is removed from the torus to ensure the Residual Heat Removal System's ability to perform temperature and pressure suppression and to maintain containment integrity. The fourth mode is shutdown cooling which pumps the water from reactor recirculation suction piping through the residual heat removal heat exchangers and returns the water to the respective recirculation discharge loop. The fuel pool cooling assist mode is the fifth mode of operation. The Residual Heat Removal System can be manually aligned to provide cooling for the spent fuel pool if additional cooling is required. Finally, the sixth mode is alternate injection. If other sources are not available for reactor pressure vessel level restoration or flooding, the Service Water System can be aligned to the Residual Heat Removal System to supply water to the reactor pressure vessel.

The Residual Heat Removal System (emergency core cooling system) takes suction from the torus through strainers. The emergency core cooling system discharge is through the system isolation valves, to the reactor vessel or spray spargers into the Primary Containment. The emergency core cooling system low pressure coolant injection flow path into the reactor vessel for each Residual Heat Removal System is suction through the strainer in the torus, through four residual heat removal pumps, continuing through the outboard motor isolation valve, through the inboard air-operated check valve, and into the reactor vessel for discharge onto the core through the associated reactor vessel nozzle. All motor-operated valves in the emergency core cooling system low pressure coolant injection flow path of each loop are normally open during system standby, with the exception of a downstream motor isolation valve in the discharge header located outside the drywell. The flow path for primary containment spray is essentially the same as the emergency core cooling system low pressure coolant injection flow path except flow is diverted to the drywell and torus spray hearers. The Residual Heat Removal System piping and components in the pressure boundary are considered an extension of the primary containment boundary. Upon receipt of the initiation signal, all residual heat removal pumps in each Residual Heat Removal System loop starts.

Initiation of the four emergency core cooling system loops of the Residual Heat Removal System occurs upon receipt of a high drywell pressure or low-low-low reactor vessel level signal. These signals also start the emergency diesel generators, in order to supply power to the RHR pumps in the event of loss of normal electric power supply. The Residual Heat Removal System (emergency core cooling system) low pressure coolant injection loop can also be initiated manually. Once the reactor pressure drops below a preset value and the Residual Heat Removal System actuation signal is present, the motor-operated isolation valves in the discharge headers receive a permissive signal to open. Opening of the motor-operated isolation valves in the discharge headers completes the flowpath, and injection water from the four loops enters the reactor vessel through four penetrations.

After Residual Heat Removal System flow has been established into the vessel, the torus provides an essentially unlimited supply of cooling water. Water discharged from a pipe break inside the drywell will overflow through the drywell vents into the torus. During Residual Heat Removal System operation, the heat being absorbed by the water that flows back to the torus is transferred to the ultimate heat sink through the safety auxiliaries cooling system by the heat exchangers in the Residual Heat Removal System.

In the residual heat removal torus cooling mode of operation the Residual Heat Removal System has the capability of providing cooling of the water in the torus by manual operation of a motor operated valve to direct water from the torus pool through the residual heat removal pumps and heat exchanger and return the water to the torus pool.

The equipment area cooling system, which is part of the Reactor Building Ventilation System, is a safety related ventilation system that provides standby supplementary cooling to each Residual Heat Removal System pump room, where normal ventilation requirements would be excessive, in order to relieve the equipment heat gain. Each Residual Heat Removal System pump room is provided with two coolers sized to extract the heat generated by pump operation. Cooling water is supplied to these coolers from the safety and turbine auxiliaries cooling system and is evaluated with the Closed Cycle Cooling Water System. Air flow path for these coolers is evaluated with the Reactor Building Ventilation System.

For more detailed information, see UFSAR sections 5.4.7 and 6.3.

System Boundary

The Residual Heat Removal System has several piping flow paths that are part of this system boundary. The Residual Heat Removal System boundary begins with the strainers in the torus and includes residual heat removal pumps that take suction through individual suction headers from each strainer, continuing through the suction isolation valves, through the pump to the discharge piping with one outboard motor operated isolation valves outside of containment, continues through the inboard air operated check valve inside containment, and terminates where each residual heat removal loop is attached to the reactor vessel nozzle. Included are the primary containment spray lines that are connected to the residual heat removal pump discharge lines. Also included in this boundary is the minimum flow line full flow test line on each loop, pressure relief valve line on each discharge line that goes back to the torus, the cross tie line, and the piping keep-fill pumps and lines. The keep-fill piping takes suction from the suction side of the residual heat removal pumps, through the keep-fill pump back into the to the residual heat removal pump discharge piping, continues to the discharge side of the residual heat removal pumps and the Core Spray System. The Residual Heat Removal System boundary also includes the suction piping from the Reactor Recirculation System, through the residual heat removal pumps to the residual heat removal heat exchangers and return to the reactor recirculation discharge piping. The boundary with the Fuel Pool Cooling and Cleanup and the Service Water Systems are at the normally closed isolation valve to the attachment point on these systems where the piping is attached to these systems. All associated piping, components, and instrumentation contained within the flowpath discussed above are included in the system boundary.

Also included in the license renewal scoping boundary of the Residual Heat Removal System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor Building. Included in this boundary are pressure retaining components relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the License Renewal Boundary Drawing for identification of this boundary, shown in red.

Not included in the scope of the license renewal are the reactor vessel nozzles, which are evaluated with the Reactor Pressure Vessel, and downstream piping located inside the reactor vessel, which is evaluated with the Reactor Internals scoping boundary.

Not included in the Residual Heat Removal license renewal scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Closed Cycle Cooling Water System
Compressed Air System
Condensate Storage and Transfer System
Core Spray System
Fuel Pool Cooling and Cleanup System
Primary Containment
Primary Containment Instrument Gas System
Reactor Internals
Reactor Pressure Vessel
Reactor Recirculation System
Service Water System

Reason for Scope Determination

The Residual Heat Removal System meets the scoping requirements of 10 CFR 54.4(a)(1) because it is a safety-related system which is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It does meet 10 CFR 54.4(a)(3) because it is relied upon in the 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), and Station Blackout (10 CFR 50.63). The Residual Heat Removal System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide reactor coolant pressure boundary. The Residual Heat Removal System provides isolation from the reactor coolant pressure boundary. 10 CFR 54.4(a)(1)

2. Sense process conditions and generate signals for reactor trip or engineered safety features actuation. The Residual Heat Removal System includes the associated actuation logic. 10 CFR 54.4(a)(1)

3. Remove residual heat from the reactor coolant system. The Residual Heat Removal System has torus water heat removal capabilities following a LOCA that transfers the energy to the ultimate heat sink via the safety and auxiliary cooling system by the heat exchangers in the Residual Heat Removal System. 10 CFR 54.4 (a)(1)

4. Provide emergency core cooling where the equipment provides coolant directly to the core. The Residual Heat Removal System provides the emergency core cooling system function to limit peak clad temperatures below 2200° F, maintain local oxidization of clad to a thickness not exceeding seventeen percent of unoxidized clad, limit hydrogen generation from the metal-water reaction to not greater than one percent of the calculated value for the total metal-water reaction hydrogen generation, maintain a coolable geometry, and provide long term cooling. Minimum flow capability provides pump protection to assure capability of emergency core cooling system function. 10 CFR 54.4 (a)(1)

5. Provide primary containment boundary. The Residual Heat Removal System piping contains valves, which are considered containment isolation devices. 10 CFR 54.4 (a)(1)

6. Provide emergency heat removal from primary containment and provide containment pressure control. Residual Heat Removal System has the capability to remove heat energy and maintain the Primary Containment pressure and temperature within acceptable limits following a LOCA. 10 CFR 54.4 (a)(1)

7. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Residual Heat Removal system includes nonsafety-related water filled lines in the Reactor Building that have the potential for spatial interactions (spray or leakage) with safety-related SSCs. 10 CFR 54.4(a)(2)

8. 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). Residual Heat Removal System is part of Appendix R shut down method. 10 CFR 54.4(a)(3)

9. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). Residual Heat Removal System has components that are in the Environmental Qualification program. 10 CFR 54.4(a)(3)

10. 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). Residual Heat Removal System lines provide a containment isolation function. 10 CFR 54.4(a)(3)

UFSAR References

5.4.7
6.3
6.3.2.2.4

License Renewal Boundary Drawings

LR-M-10-1, Sheet 2
LR-M-23-1, Sheet 2
LR-M-38-0, Sheet 1
LR-M-41-1, Sheet 1
LR-M-43-1, Sheet 1
LR-M-51-1, Sheet 1
LR-M-51-1, Sheet 2
LR-M-52-1, Sheet 1
LR-M-58-1, Sheet 1
LR-M-87-1, Sheet 2

Table 2.3.2-8 **Residual Heat Removal (RHR) System**
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Bolting (Class 1)	Mechanical Closure
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary
Cyclone Separator (on RHR Pump)	Pressure Boundary
Flow Element	Pressure Boundary
Heat Exchanger Components (RHR)	Evaluated with the Closed Cycle Cooling Water System
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings (Class 1)	Pressure Boundary
Pump Casing (Jockey)	Pressure Boundary
Pump Casing (RHR)	Pressure Boundary
Restricting Orifices	Pressure Boundary
Restricting Orifices	Throttle
Restricting Orifices (Class 1)	Pressure Boundary
Restricting Orifices (Class 1)	Throttle
Sight Glasses	Leakage Boundary
Spray Nozzles	Spray
Strainer	Filter
Strainer	Pressure Boundary
Thermowell	Pressure Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary
Valve Body (Class 1)	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.2.2-7 Residual Heat Removal (RHR) System
Summary of Aging Management Evaluation

2.3.2.9 Vacuum Relief Valve System

System Purpose

The license renewal Vacuum Relief Valve System is part of the containment atmosphere control plant system. The Vacuum Relief Valve System consists of two independent subsystems, the torus to drywell pressure relief subsystem and the reactor building to torus pressure relief subsystem.

The torus to drywell pressure relief subsystem is designed to prevent torus water from backing up into the drywell during various reactor leakage and suppression condensation modes. The purpose of the torus to the drywell pressure relief subsystem is to prevent the drywell pressure from dropping significantly below the pressure in the torus airspace, and to prevent exceeding design external pressures of the drywell. The torus to drywell pressure relief subsystem is comprised of vacuum breakers that accomplish their purpose by automatically venting non-condensable gas (carryover to the torus during an accident) back to the drywell from the torus.

The reactor building to torus pressure relief subsystem limits the torus negative pressure relative to the Reactor Building pressure. This subsystem limits drywell negative pressures relative to the Reactor Building pressure and permits gas flow only inward from the Reactor Building to the Primary Containment. The reactor building to torus pressure relief subsystem is comprised of vacuum breakers that accomplish their purpose by opening automatically at a predetermined differential pressure.

System Operation

The Primary Containment is provided with a Vacuum Relief Valve System to equalize the pressure between the drywell and the torus, and between the torus and the Reactor Building. The Vacuum Relief Valve System assures that the external design pressure limits of the two chambers are not exceeded. The design bases accident is the complete instantaneous circumferential break of one of the recirculation suction lines while the reactor is at rated power. The air-steam mixture is vented to the torus. Within the first few seconds, drywell air is swept into the torus water space. Because of the high velocity steam within the vents, the air cannot diffuse back into the drywell and it is effectively forced into the torus water space. After blowdown is complete, steam is present in the drywell. As the steam condenses on various surfaces and the drywell spray is activated, the drywell pressure drops. This allows the torus to drywell vacuum breakers to open admitting the gas from the torus air space into the drywell, thus equalizing the pressures.

The torus to drywell pressure relief subsystem is comprised of eight self-actuating vacuum breaker assemblies, each connected between the torus and a drywell vent line. These valves permit flow from the torus air space into the drywell to torus vent line air space, when pressure differential between the torus and drywell is sufficient to open the check valve. The check valve prevents air from flowing in the opposite direction. The Vacuum Relief Valve System prevents the external design pressure limits of the two chambers from being exceeded.

The reactor building to torus relief subsystem is comprised of two sets of vacuum breaker assemblies located 180 degrees apart on top of the torus. Each set consists of a self-actuated swing check valve and a pneumatic operated butterfly valve. The check valve permits air to flow from the Reactor Building into the torus, when pressure differential between the Reactor

Building and torus air pressure is sufficient to open the valve. Cooling of the torus can cause negative pressure to develop. The check valve prevents air from flowing in the opposite direction. A butterfly valve on each path provides positive isolation of the Primary Containment. A differential pressure switch between the Reactor Building and torus opens the air-operated valve automatically.

For more detailed information, see UFSAR Section 7.3.1.1.6.

System Boundary

The torus to drywell pressure relief subsystem boundary begins at the eight connections to the drywell vent header, and continues through the swing check valves and terminates at the inlet to the check valve, which is open to the torus air space.

The reactor building to torus vacuum relief breaker subsystem starts at a vent opening in the Reactor Building and terminates at a point downstream of the containment isolation valves on the containment prepurge cleanup system supply lines to the torus. Not included in the boundary is the portion of piping downstream of this connection point all the way to the torus, which is evaluated separately in the Containment Inerting and Purging System license renewal system boundary. Also, not included in the vacuum relief valve system boundary are the gas supplies to the host pneumatic components or users. The host pneumatic components or users are the torus to drywell vacuum breakers and the reactor building to torus vacuum relief breakers. The gas supplies to the Vacuum Relief Valve System are evaluated in the Primary Containment Instrument Gas System package.

All associated piping, components, and instrumentation contained within the flowpath described above are included in the Vacuum Relief Valve System.

Not included in the Vacuum Relief Valve System scoping boundaries are the following interfacing systems, which are separately evaluated as license renewal systems:

Compressed Air System
Containment Inerting and Purging System
Primary Containment Instrument Gas System
Reactor Building Ventilation System (containment prepurge cleanup subsystem)

Reason for Scope Determination

The Vacuum Relief Valve System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. The Vacuum Relief Valve System is not in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system would not prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The Vacuum Relief Valve System meets 10 CFR 54.4(a)(3) because it is relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Vacuum Relief Valve System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48), Anticipated Transient Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide primary containment boundary. The Vacuum Relief Valve System includes primary containment isolation valves that close to prevent the release of radioactive contamination through system lines. 10 CFR 54.4(a)(1)

2. Provide emergency heat removal from primary containment and provide containment pressure control. The torus to drywell pressure relief subsystem of the Vacuum Relief Valve system prevents exceeding design external pressures of drywell, and the reactor building to torus vacuum breaker subsystem of the Vacuum Relief Valve System prevents exceeding the design external pressure of the torus. 10 CFR 54.4(a)(1)

3. Control combustible gas mixtures in the primary containment atmosphere. The Vacuum Relief Valve System is used for post accident combustible gas control of the primary containment atmosphere. 10 CFR 54.4 (a)(1)

4. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The limit switches associated with the torus to drywell vacuum breakers and the reactor building to torus vacuum breakers are Environmentally Qualified. 10 CFR 54.4(a)(3)

UFSAR References

7.3.1.1.6

License Renewal Boundary Drawings

LR-M-57-1, Sheet 1

Table 2.3.2-9 Vacuum Relief Valve System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Piping and Fittings	Pressure Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.2.2-8 Vacuum Relief Valve System
Summary of Aging Management Evaluation

2.3.3 AUXILIARY SYSTEMS

The following systems are addressed in this section:

2.3.3.1 Chilled Water System

System Purpose

The Chilled Water System is a closed-loop system designed to provide demineralized cooling water to plant air handling and cooling units during normal operation in the Reactor, Auxiliary, and Turbine Buildings. Included in the Chilled Water System is chemical treatment equipment designed to minimize corrosion by maintaining demineralized water quality. Large portions of the Chilled Water System are not required to perform intended functions and are not in scope.

The purpose of the Chilled Water System is to remove heat from the following loads during various modes of reactor operation: Auxiliary Building Service and Radwaste HVAC System (auxiliary building service area air supply cooling coils, auxiliary building solid radwaste area air supply cooling coils, radwaste area coolers, radwaste supply cooling coils), Drywell Air Cooling System (drywell unit coolers), Main Condenser Air Extraction System (mechanical vacuum pump seal water coolers), Miscellaneous Ventilation Systems (feedwater heater room coolers, primary and secondary condensate pump room unit coolers, turbine building supply unit cooling coils), Process and Post-Accident Sampling System (iso-thermal bath, turbine building cooling water mixing skid), Equipment and Floor Drainage System (drywell equipment drain sump cooler), Reactor Building Ventilation System (control rod drive facility unit coolers, steam tunnel unit coolers, reactor building ventilation system supply unit coolers), Reactor Recirculation System (reactor recirculation pump motor air coolers). The Chilled Water System accomplishes this purpose by transferring heat from these loads to the chiller units, which reject the heat from the chilled water to the turbine auxiliary cooling system portion of the Closed Cycle Cooling Water System. Flow and temperature control is achieved through both local and remote manual manipulation of the chilled water system valves.

System Operation

The Chilled Water System is comprised of three one-half capacity pumps, and four one-third capacity skid mounted chillers. Each chiller consists of one condenser unit, one compressor motor, one evaporator, one pump-out unit and one storage tank. Additional components in the Chilled Water System include the chemical treatment system, a head tank, various air cooling coils, and necessary controls and support equipment.

The chilled water system circulation pumps discharge to a common header, which branches into the chiller supply header. From this header, the water enters the chiller unit evaporators where heat is rejected from the water to the chiller unit refrigerant. The chilled water is returned to the common supply header for parallel redistribution to various systems and components throughout the plant. Chilled water from various cooled systems and components flows into a common return header and is routed to the suction of the chilled water circulation pumps. Heat absorbed by the chiller unit refrigerant is rejected to the turbine auxiliary cooling system portion of the Closed Cycle Cooling Water System. One circulation pump and one chiller are normally in standby.

The chemical treatment system is comprised of a chemical feed tank, a mechanical duplex side stream filter, an activated carbon side stream filter, and a side stream mixed bed demineralizer. The chemical feed tank provides a means of adding corrosion inhibiting chemicals to the system. Water is drawn from the discharge header of the chilled water circulation pumps and the solution is injected upstream of the pumps in the common pump suction header. The chemical addition tank is not currently used.

A head tank is provided at the high point of the system to provide net positive suction head for the chilled water circulation pumps and is sized to hold the expected maximum expansion of the Chilled Water System. Makeup to the head tank from the Makeup Demineralizer System can be added manually or by an automatic level control valve. Makeup flowrate is monitored and recorded to provide an indication of chilled water system leakage.

The chilled water pumps, the chilled water chiller units, and the chemical treatment system are located within the Turbine Building. The Chilled Water System supply penetrates the Primary Containment at two safety-related penetrations to provide two independent loops of the chilled water cooling to the Drywell Air Cooling System (drywell unit coolers), Equipment and Floor Drainage System (drywell sump cooler), and Reactor Recirculation System (reactor recirculation pump motor air cooler). The return from the Primary Containment loads exits the Primary Containment through two other safety-related penetrations. Each of the chilled water system supply and return flow lines, into and out of the Primary Containment, is equipped with inboard and outboard motor operated valves in series. These safety-related valves automatically close upon either low-low-low reactor level, high drywell pressure, or core spray initiation. Deliberate operator action is required to reopen these isolation valves.

The loss-of-coolant-accident signal results in loss of the Chilled Water System due to loss of the turbine auxiliary cooling system. The reactor auxiliary cooling system portion of the Closed Cycle Cooling Water System provides backup for the Chilled Water System loads within the Primary Containment (drywell coolers, drywell equipment sump cooler, recirculation pumps motor air coolers) upon a loss-of- offsite-power event. The chilled water circulation pumps and chillers trip in response to loss-of-offsite-power.

The Chilled Water System starts manually, but once started its operation is automatic. The standby chilled water circulation pump starts automatically on low flow conditions through either one of the operating pumps. The standby chiller requires operator action. The motive force for the chilled water circulation pumps, chiller compressors and motor operated valves is nonsafety-related AC power.

For more detailed information, see UFSAR Section 9.2.7.

System Boundary

The Chilled Water System boundary begins at the chilled water system circulation pumps and continues through the water chillers and through all the cooled loads (auxiliary building service area air supply cooling coils, auxiliary building solid radwaste area air supply cooling coils, control rod drive facility unit coolers, drywell equipment drain sump cooler, drywell unit coolers, feedwater heater room coolers, iso-thermal bath, mechanical vacuum pump seal water coolers, primary and secondary condensate pump room unit coolers, radwaste area coolers, radwaste supply cooling coils, reactor building ventilation system supply unit coolers, reactor recirculation pump motor air coolers, steam tunnel coolers, turbine building cooling water mixing skid, and turbine building supply unit cooling coil). The boundary continues from the cooled loads back to the suction of the chilled water system circulation pumps. Included in the boundary are the chilled water system chemical treatment equipment, the chilled water system head tank, and the chilled water system primary containment isolation valves. All associated piping, components, and instrumentation contained within the flow path described above are also included in the chilled water system boundary.

Included in the license renewal boundary of the Chilled Water System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related and nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within Auxiliary Building, Primary Containment, and the Reactor Building. Also included in the boundary are the pressure retaining components located in the Auxiliary Building, Primary Containment and the Reactor Building relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the scope of license renewal for leakage boundary is the drywell equipment drain sump cooling coil. This cooler is internal to component or enclosed panel and do not create the potential for spatial interaction (leakage or spray) with safety related equipment. Also not included in the scope of license renewal for leakage boundary is the reactor building ventilation supply unit coolers. These coolers are located in the Auxiliary Building Radwaste Area, and do not create the potential for spatial interaction (leakage or spray) with safety related equipment.

Not included in the Chilled Water System license renewal scoping boundaries are the following interfacing systems, which are separately evaluated as license renewal systems:

Auxiliary Building Service and Radwaste HVAC Systems
Closed Cycle Cooling Water System
Compressed Air System (Instrument (Control) Air System)
Drywell Air Cooling System
Equipment and Floor Drainage System
Leak Detection and Radiation Monitoring System (Plant Leak Detection System)
Main Condenser Air Extraction System
Makeup Demineralizer System
Miscellaneous Ventilation System
Process and Post-Accident Sampling System
Radwaste System
Reactor Building Ventilation System
Reactor Recirculation System

Not included in the scope of license renewal is the portion of the Chilled Water System located in the Turbine Building and Auxiliary Building Radwaste Area, as these portions of the system are not located within an area in proximity of components performing a safety-related function. Components that are not required to support the system's leakage boundary intended functions are not included in the scope of license renewal.

The Chilled Water System supports the primary containment boundary intended function. This portion of the system includes the chilled water supply and return penetrations, inboard and outboard containment isolation valves and interconnecting piping. The motor operated containment isolation valves are environmentally qualified and support the environmental qualification intended function.

Reason for Scope Determination

The Chilled Water System meets 10 CFR 54.4(a)(1) because portions of the system are safety-related that are relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Chilled Water System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection (10 CFR 50.48), Anticipated Transient Without Scram (10 CFR 50.62) or Station Blackout (10 CFR 50.63).

System Intended Functions

1) Provide primary containment boundary. The Chilled Water System includes primary containment isolation valves that close on high drywell pressure, reactor low-low-low level or core spray initiation. 10 CFR 54.4(a)(1)

2) Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Chilled Water System has piping and other components within the Auxiliary Building, Primary Containment, and Reactor Building that have the potential for spatial interaction (spray or leakage) with safety-related components. 10 CFR 54.4(a)(2)

3) Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The system has components that are environmentally qualified. 10 CFR 54.4(a)(3)

UFSAR References

9.2.7

License Renewal Boundary Drawings

LR-M-23-1, Sheet 2
LR-M-43-1, Sheet 1
LR-M-61-1, Sheet 2
LR-M-83-1, Sheet 1
LR-M-84-1, Sheet 1
LR-M-87-1, Sheet 2
LR-M-87-1, Sheet 5

Table 2.3.3-1 **Chilled Water System**
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Flexible Connection	Leakage Boundary
Flow Device	Leakage Boundary
Flow Element	Leakage Boundary
Heat Exchanger Components (CRD Facility Unit Coolers)	Leakage Boundary
Heat Exchanger Components (DW Cooler)	Leakage Boundary
Heat Exchanger Components (Recirc Pump Motor Air Cooler)	Leakage Boundary
Heat Exchanger Components (Steam Tunnel Coolers)	Leakage Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Pump Casing (CRD Facility Chilled Water Pump)	Leakage Boundary
Restricting Orifices	Leakage Boundary
Thermowell	Leakage Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-1 Chilled Water System
Summary of Aging Management Evaluation

2.3.3.2 Closed Cycle Cooling Water System

System Purpose

The Closed Cycle Cooling Water System is a normally operating closed-loop mechanical system designed to provide demineralized cooling water to various safety-related and nonsafety-related equipment within the plant. Included in the Closed Cycle Cooling Water System is chemical treatment equipment designed to minimize corrosion by maintaining demineralized water quality.

The Closed Cycle Cooling Water System is in scope for license renewal. However, portions of the Closed Cycle Cooling Water System are not required to perform intended functions and are not in scope. The Closed Cycle Cooling Water System has several interfaces with other systems that are not in the license renewal boundary of the Closed Cycle Cooling Water System.

The Closed Cycle Cooling Water System consists of the following two independent plant systems: safety and turbine auxiliary cooling plant system and reactor auxiliary cooling plant system.

Safety and Turbine Auxiliary Cooling System

The safety and turbine auxiliary cooling plant system is designed to provide a heat sink for engineered safety features equipment and turbine generator auxiliary equipment by circulating cooling water in a closed loop system. The safety and turbine auxiliary cooling plant system consists of two subsystems, the safety-related safety auxiliary cooling plant system and the nonsafety-related turbine auxiliary cooling plant system. Heat is rejected to the Service Water system through the safety auxiliary cooling system heat exchangers. The safety auxiliary cooling plant system heat exchangers are evaluated with the Service Water System. These heat exchangers, along with the chemical addition tanks, expansion tanks, demineralizers and circulating pumps, are part of the safety auxiliary cooling system. These components also service the turbine auxiliary cooling system, which is an independent loop designed to be isolated from the safety auxiliary cooling system during emergency conditions.

The purpose of the safety auxiliary cooling plant system is to remove heat from the following safety-related loads, located within the Reactor Building and Auxiliary Building, during various modes of reactor operation: Residual Heat Removal System (pumps, room unit coolers and heat exchangers), Standby Diesel Generators and Auxiliary Systems (emergency diesel generators and their room coolers), Fuel Pool Cooling and Cleanup System (heat exchangers), High Pressure Coolant Injection System (pump room unit coolers), Reactor Core Isolation Cooling System (pump room unit coolers), Core Spray System (pump room unit coolers), Reactor Building Ventilation System (filtration, recirculation, and ventilation system cooling coils and recirculation trains), Control Room and Control Area HVAC System (control room chillers, safety-related panel room chillers), Primary Containment Instrument Gas System (compressor coolers), and Process and Post-Accident Sampling System (coolers). Large portions of the safety auxiliary cooling plant system are required to perform intended functions and are in the scope of license renewal.

The purpose of the turbine auxiliary cooling plant system is to remove heat from the following nonsafety-related loads within the Turbine Building to meet the turbine generator auxiliary cooling requirements during normal operation and normal shutdown conditions: service air compressors, secondary condensate pump motor bearing coolers, condenser compartment unit coolers, reactor feed pump turbine lube oil coolers, mezzanine pipe chase unit coolers, turbine building sample station coolers, turbine building chiller condensers and pump out unit coolers, recirculation motor generator set fluid coupler and lube oil coolers, main turbine lube oil coolers, electro-hydraulic control hydraulic fluid coolers, isophase bus duct coolers, generator stator coolers, alterrex air cooler, generator hydrogen coolers, and plant heating steam condensate coolers. The turbine auxiliary cooling plant system is located within the Turbine Building. The turbine auxiliary cooling plant system is not required to perform intended functions and is not in the scope of license renewal.

The safety and turbine auxiliary cooling plant system accomplishes its purposes by transferring heat from these loads to the Service Water System, through the safety auxiliary cooling plant system heat exchangers. Flow and temperature control is achieved through manual/remote manipulation of system valves.

Reactor Auxiliary Cooling Plant System

The purpose of the reactor auxiliary cooling plant system is to remove heat from the following non-essential (non-engineered safety feature) loads located in the Reactor Building, Auxiliary Building, Radwaste Building, and Turbine Building, that can carry radioactive fluids: Control Rod Drive System (pumps), Radwaste System (Reactor Building equipment drain coolers), Main Condenser Extraction System (feed gas cooler condensers), Chilled Water System (backup to drywell unit coolers, the reactor recirculation pump motor coolers, drywell equipment drain sump cooler, steam tunnel cooler), Process and Post-Accident Sampling System (coolers), and Compressed Air System (backup to the emergency instrument air after-cooler and moisture separator). The reactor auxiliary cooling plant system accomplishes its purpose by transferring heat from these loads to the Service Water System, through the reactor auxiliary cooling plant system heat exchangers. Flow and temperature control is achieved through both local and remote manipulation of system valves. A portion of the reactor auxiliary cooling plant system containing the primary containment isolation valves is safety-related and supports the primary containment boundary intended function.

System Operation

Safety and Turbine Auxiliary Cooling Plant System

The safety auxiliary cooling plant system is comprised of two full capacity redundant closed loops with a potential to cross-connect the two loops. Each safety auxiliary cooling plant system loop is comprised of two one-half capacity pumps, two one-half capacity heat exchangers, chemical addition tank, expansion tank, demineralizer, accumulator, and associated controls and support equipment. The pumps in each safety auxiliary cooling plant system loop discharge into a common supply header. Coolant from this supply header is distributed to the components cooled by each safety auxiliary cooling plant system loop. After passing through the equipment being cooled, the water flows back through the return header and through the shell side of the safety auxiliary cooling plant heat exchangers to the suction of the circulating pumps. The safety auxiliary cooling plant system heat exchangers are cooled by the Service Water System.

Each loop is equipped with an expansion tank located at the high point of the system and is sized to accommodate expansion and contraction of system water volume due to temperature variations. Makeup to the expansion tank from the Makeup Demineralizer System can be added manually or by an automatic level control valve. Makeup flow rate is monitored and recorded to provide an indication of system leakage. The Service Water System can provide emergency makeup to the safety auxiliary cooling plant system through the discharge line of the expansion tank.

The chemical treatment equipment includes a chemical addition tank installed on each loop of the safety auxiliary cooling plant system. Each tank has an inlet to allow the addition of required chemicals, which can then be injected into the system. However, the chemical addition tanks currently are not being used to inject chemicals into the system. The safety and turbine auxiliary cooling plant system includes two filter demineralizers in the safety auxiliary cooling system and two filter demineralizers in the turbine auxiliary cooling system.

Each safety auxiliary cooling plant system loop is provided with a hydro-pneumatic accumulator in the supply and return headers from the safety auxiliary cooling plant system to the turbine auxiliary cooling plant system, to protect the safety auxiliary cooling plant system piping from being over-pressurized due to a pressure transient resulting from a pipe break in the turbine auxiliary cooling plant system loop.

The turbine auxiliary cooling plant system will automatically isolate from the safety auxiliary cooling plant system whenever there is indication of a pipe break in either system, as determined by decreasing water level in the two expansion tanks. On low level in only one expansion tank, the turbine auxiliary cooling plant system will remain in service but the safety auxiliary cooling plant system will automatically swap over to the loop that is not affected.

During normal plant conditions one safety auxiliary cooling plant system loop, with both pumps in service, is operating while the other loop is in automatic standby. Under loss-of-coolant-accident conditions or loss-of-offsite-power conditions the safety auxiliary cooling plant system heat removal capability is increased by starting the standby pumps and opening the associated heat exchanger inlet valves. The non-essential loads will be isolated. Start of any safety auxiliary coolant plant system pump will result in opening of its associated heat exchanger inlet valves. Also, any safety auxiliary cooling plant system pump stop will result in closure of the respective safety auxiliary cooling/turbine auxiliary cooling loop supply and return isolation valves.

The turbine auxiliary cooling plant system performs a nonsafety-related function. The turbine auxiliary cooling plant system loads are supplied by the safety auxiliary cooling plant system loop flow through a single supply header, after going through a hydro-pneumatic accumulator. The turbine auxiliary cooling system includes two demineralizers which provide an alternate method of corrosion prevention within the safety and turbine auxiliary cooling system. The turbine auxiliary cooling plant system isolation valves close and the system isolates upon initiation of any of the following conditions: loss-of-offsite power, loss-of-coolant-accident, or low level in both of the safety auxiliary cooling plant system expansion tanks. Additionally, the safety auxiliary cooling plant system/turbine auxiliary cooling plant system supply isolation valves will automatically close upon either a trip of the respective safety auxiliary cooling plant system pump or a low level in their associated expansion tank on the safety auxiliary cooling plant system loop. This signal can be overridden to allow continuation of turbine auxiliary cooling plant system operation.

Reactor Auxiliary Cooling Plant System

The reactor auxiliary cooling plant system is a closed cooling water system comprised of three parallel one-half capacity cooling water pumps, two parallel one-half capacity heat exchangers, a heat exchanger bypass flow control valve, one expansion tank, one chemical addition tank, two demineralizers, and associated valves, piping, controls and support equipment.

Discharge from the reactor auxiliary cooling plant system pumps merge into a common header. Coolant from this common header is then distributed to the components cooled by the reactor auxiliary cooling plant system. After passing through the equipment being cooled, the water flows back through the return header and through the shell side of the reactor auxiliary cooling plant heat exchangers to the suction of the circulating pumps. The reactor auxiliary cooling plant system heat exchangers are cooled by the Service Water System.

The reactor auxiliary cooling plant system head tank (or expansion tank) taps into the system on the common pump suction header. The head tank is located at a high point of the system and is sized to accommodate expansion and contraction of system water volume due to temperature variations. Makeup to the expansion tank from the Makeup Demineralizer System can be added manually or by an automatic level control valve.

The reactor auxiliary cooling plant system chemical treatment tank has an inlet to allow the addition of required chemicals, which can then be injected into the system. The reactor auxiliary cooling plant system chemical addition tank is not being used to inject chemicals in to the system. A preferred alternate method of reactor auxiliary cooling plant system water treatment has been established to eliminate the need for removing chemicals from the system prior to maintenance activities. This alternate water treatment system is comprised of two demineralizers tied into the reactor auxiliary cooling plant system lines supplying the emergency instrument air compressors. The demineralizers and one skid rack with instrumentation and controls, located in the Turbine Building, maintain low conductivity water in the reactor auxiliary cooling plant system, providing an acceptable means of corrosion control.

The system is normally operated with two of the three circulating pumps and both heat exchangers in service. A bypass line around the heat exchangers is equipped with a thermostatically controlled valve, which is used to control the reactor auxiliary cooling plant system supply temperature. A tap off the common pump discharge header directs a stream of reactor auxiliary cooling plant system water to the radiation monitoring system to detect inleakage of any contaminates which could foul the station Service Water System.

The reactor auxiliary cooling plant system has no safety-related function (other than for containment isolation) and is not required to operate following a loss-of-coolant-accident. Upon a loss-of-coolant-accident signal, the reactor auxiliary cooling plant system heat exchangers are automatically isolated from the balance of the Service Water System and two of the reactor auxiliary cooling plant system pumps (A and B), which are connected to safety-related buses, are tripped. An operating reactor auxiliary cooling plant system pump (C), which is not connected to a safety-related bus, will continue to operate. Upon a loss-of-offsite-power event all reactor auxiliary cooling plant system pumps trip, but the two reactor auxiliary cooling plant system pumps that are powered from the safety-related buses restart automatically. Also, upon initiation of either loss-of-offsite-power or loss-of-coolant-accident, the reactor building isolation valves located within the reactor auxiliary cooling plant system will automatically isolate. Upon initiation of a loss-of-coolant-accident, all reactor auxiliary cooling plant system isolation valves will automatically close. The systems that require reactor auxiliary cooling during a loss-of-offsite-power event are: reactor recirculation pump seal coolers, reactor recirculation pump motor oil cooler, control rod drive pump thrust bearing and gear box oil coolers, emergency instrument air compressor heat exchangers and reactor water cleanup pump coolers. The reactor auxiliary cooling plant system has connections to supply cooling water to the drywell coolers as a backup to the Chilled Water System. This backup is automatic following a loss-of-offsite-power without a loss-of-coolant-accident.

For additional information, see UFSAR Section 9.2.2 and 9.2.8.

<u>System Boundary</u>

Safety and Turbine Auxiliary Cooling Plant System

The safety auxiliary cooling plant system boundary begins at the discharge of the safety auxiliary cooling plant system circulating pumps and continues through all the cooled loads (residual heat removal pump seal coolers, residual heat removal pump bearing coolers, residual heat removal heat exchangers, supply side accumulator, residual heat removal pump room coolers, filtration, recirculation and ventilation system cooling coils, containment instrument gas compressor coolers, fuel pool heat exchangers, core spray pump room unit coolers, high pressure coolant injection pump room unit coolers, reactor core isolation cooling pump room unit coolers, emergency diesel generator room coolers, emergency diesel generator intercoolers, emergency diesel generator jacket water heat exchangers, emergency diesel generator lube oil heat exchangers, control room chillers, 1E panel room chillers, radiological monitoring sample loops, and the turbine auxiliary cooling plant system loads through the supply and return side accumulators). The boundary continues through the return header from the cooled loads, through the shell side of the safety auxiliary cooling plant system heat exchangers and terminates at the suction of the circulating pumps. Also included in the boundary of the safety auxiliary cooling plant system is the expansion tank, the accumulators, the demineralizers and associated piping, valves and instrumentation. Additionally, included in the system boundary is the portion of safety auxiliary cooling plant system piping that provides input to the Leak Detection and Radiation Monitoring System.

The turbine auxiliary cooling plant system boundary begins at the safety auxiliary cooling plant system pumps combined discharge header at the entrance to the Turbine Building and continues through all the cooled loads within the Turbine Building (station air compressors, main turbine lube oil coolers, EHC hydraulic fluid coolers, generator stator coolers, generator hydrogen coolers, reactor recirculation pump M-G set coolers, reactor feed pump turbine lube oil coolers, iso-phase bus coolers, alterrex air cooler, process sampling coolers, mezzanine pipe chase coolers, condenser compartment coolers, turbine building chillers, secondary condensate pump motor bearing coolers, and plant heating system condenser coolers). The boundary continues from the cooled loads through the return header and terminates at the entrance to the Auxiliary Building.

All associated piping, components, and instrumentation contained within the flowpath described above are also included in the safety and turbine auxiliary cooling plant system boundary.

Reactor Auxiliary Cooling Plant System

The reactor auxiliary cooling plant system boundary begins at the reactor auxiliary cooling plant system circulating pumps discharge and continues through all the cooled loads (reactor water cleanup system pumps seal coolers, reactor water cleanup non-regenerative heat exchangers, reactor recirculation pump seal coolers, reactor recirculation pump motor oil coolers, control rod drive pump seal coolers, reactor building equipment drain sump coolers, off-gas recombiner feed gas cooler condensers, reactor building sampling station cooler, emergency instrument air compressor, breathing air compressor, and off-gas system refrigeration machine, off-gas system charcoal compartment refrigeration). The boundary continues through the return header from the cooled loads, through the shell side of the reactor auxiliary cooling plant system heat exchangers and terminates at the suction of the circulating pumps. Included in the boundary of the reactor auxiliary cooling plant system is the heat exchanger bypass line, the expansion tank, the chemical addition tank and the demineralizers. Also included in the reactor auxiliary cooling plant system boundary is the piping, components, and instrumentation contained within the flowpath described above. Additionally, included in the system boundary is the portion of reactor auxiliary cooling plant system piping that provides input to the Leak Detection and Radiation Monitoring System.

Included in the license renewal boundary of the Closed Cycle Cooling Water System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor Building and Auxiliary Building. Included in this boundary are the pressure retaining components relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the scope of license renewal is the portion of the Closed Cycle Cooling Water System located within the Turbine Building, as these portions of the system are not located within an area in proximity to components performing a safety-related function. Also, not included in the scope of license renewal are the reactor building equipment drain sump coolers and the reactor recirculation pump motor oil coolers and seal coolers, as these components are physically enclosed and do not have the potential for spatial interaction with components performing a safety related function.

Not included in the Closed Cycle Cooling Water System license renewal scoping boundaries are the following interfacing systems, which are separately evaluated as license renewal system:

Auxiliary Steam System
Chilled Water System
Compressed Air System
Condensate System
Control Rod Drive System
Control Room and Control Area HVAC System
Core Spray System
Equipment and Floor Drainage System
Feedwater System
Filtration, Recirculation and Ventilation System

Fuel Pool Cooling and Cleanup System
High Pressure Coolant Injection System
Leak Detection and Radiation Monitoring System
Main Condenser Extraction System
Makeup Demineralizer System
Primary Containment Instrument Gas System
Process and Post-Accident Sampling System
Radwaste System
Reactor Building Ventilation System
Reactor Core Isolation Cooling System
Residual Heat Removal System
Reactor Recirculation System
Reactor Water Cleanup System
Service Water System
Standby Diesel Generators and Auxiliary System

Reason for Scope Determination

The Closed Cycle Cooling Water System meets 10 CFR 54.4(a)(1) because portions of the system are safety-related that are relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49), Fire Protection (10 CFR 50.48), and Station Blackout (10 CFR 50.63). The Closed Cycle Cooling Water System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide heat removal from safety related heat exchangers. The safety auxiliary cooling plant system portion of the Closed Cycle Cooling Water System removes heat from safety related systems and heat exchangers, such as fuel pool heat exchangers, and residual heat removal heat exchangers. 10 CFR 54.4(a)(1)

2. Provide primary containment boundary. The reactor auxiliary cooling plant system portion of the Closed Cycle Cooling Water System includes primary containment isolation valves that close on high drywell pressure, or reactor low-low-low level. 10 CFR 54.4(a)(1)

3. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Closed Cycle Cooling Water System includes nonsafety-related piping and components within the Reactor Building, Auxiliary Building, and Primary Containment that have the potential for spatial interaction (spray or leakage) with safety-related components. 10 CFR 54.4(a)(2)

4. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The system has components that are Environmentally Qualified. 10 CFR 54.4(a)(3)

5. 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). The system has components that are relied upon to meet the fire protection requirements. 10 CFR 54.4(a)(3)

6. 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). The system has components that support systems needed for recovery after the station blackout is cleared. 10 CFR 54.4(a)(3)

UFSAR References

9.2.2
9.2.8

License Renewal Boundary Drawings

LR-M-10-1, Sheet 2
LR-M-11-1, Sheet 1
LR-M-11-1, Sheet 2
LR-M-11-1, Sheet 3
LR-M-11-1, Sheet 4
LR-M-12-1, Sheet 1
LR-M-12-1, Sheet 2
LR-M-13-1, Sheet 1
LR-M-23-1, Sheet 2
LR-M-30-1, Sheet 1
LR-M-30-1, Sheet 2
LR-M-30-1, Sheet 3
LR-M-38-0, Sheet 1
LR-M-43-1, Sheet 1
LR-M-44-1, Sheet 1
LR-M-46-1, Sheet 1
LR-M-53-1, Sheet 1
LR-M-59-1, Sheet 1
LR-M-61-1, Sheet 2
LR-M-83-1, Sheet 1
LR-M-87-1, Sheet 2
LR-M-88-1, Sheet 1
LR-M-90-1, Sheet 1
LR-M-90-1, Sheet 2
LR-M-90-1, Sheet 3

Table 2.3.3-2 Closed Cycle Cooling Water System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Filter Housing	Leakage Boundary
Flow Device	Leakage Boundary
Flow Element	Leakage Boundary
Flow Element	Pressure Boundary
Heat Exchanger Components (1E Panel Room Chillers - Condensers)	Heat Transfer
Heat Exchanger Components (1E Panel Room Chillers - Condensers)	Pressure Boundary
Heat Exchanger Components (CRD Pump Cooler)	Leakage Boundary
Heat Exchanger Components (CS Pump Room Coolers)	Heat Transfer
Heat Exchanger Components (CS Pump Room Coolers)	Pressure Boundary
Heat Exchanger Components (Control Room Chillers - Condenser)	Heat Transfer
Heat Exchanger Components (Control Room Chillers - Condenser)	Pressure Boundary
Heat Exchanger Components (DG Intercoolers and Injectors)	Heat Transfer
Heat Exchanger Components (DG Intercoolers and Injectors)	Pressure Boundary
Heat Exchanger Components (DG Jacket Water)	Heat Transfer
Heat Exchanger Components (DG Jacket Water)	Pressure Boundary
Heat Exchanger Components (DG Lube Oil)	Heat Transfer
Heat Exchanger Components (DG Lube Oil)	Pressure Boundary
Heat Exchanger Components (DG Room Coolers)	Heat Transfer
Heat Exchanger Components (DG Room Coolers)	Pressure Boundary
Heat Exchanger Components (FRVS Cooling Coils)	Heat Transfer
Heat Exchanger Components (FRVS Cooling Coils)	Pressure Boundary

Component Type	Intended Function
Heat Exchanger Components (Fuel Pool Cooling)	Heat Transfer
Heat Exchanger Components (Fuel Pool Cooling)	Pressure Boundary
Heat Exchanger Components (Fuel Pool Cooling)	Structural Support
Heat Exchanger Components (HPCI Pump Room Cooler)	Heat Transfer
Heat Exchanger Components (HPCI Pump Room Cooler)	Pressure Boundary
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Heat Transfer
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Pressure Boundary
Heat Exchanger Components (RACS)	Leakage Boundary
Heat Exchanger Components (RCIC Pump Room Coolers)	Heat Transfer
Heat Exchanger Components (RCIC Pump Room Coolers)	Pressure Boundary
Heat Exchanger Components (RHR Pump Motor Bearing Cooler)	Heat Transfer
Heat Exchanger Components (RHR Pump Motor Bearing Cooler)	Pressure Boundary
Heat Exchanger Components (RHR Pump Room Coolers)	Heat Transfer
Heat Exchanger Components (RHR Pump Room Coolers)	Pressure Boundary
Heat Exchanger Components (RHR Pump Seal Cooler)	Heat Transfer
Heat Exchanger Components (RHR Pump Seal Cooler)	Pressure Boundary
Heat Exchanger Components (RHR)	Heat Transfer
Heat Exchanger Components (RHR)	Pressure Boundary
Heat Exchanger Components (RWCU Non-Regen)	Leakage Boundary
Heat Exchanger Components (RWCU Pedestal)	Leakage Boundary
Heat Exchanger Components (RWCU Pump HX)	Leakage Boundary
Heat Exchanger Components (SACS)	Evaluated with the Service Water System

Component Type	Intended Function
Heat Exchanger Components (Thermo-siphon)	Heat Transfer
Heat Exchanger Components (Thermo-siphon)	Pressure Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Pump Casing (RACS)	Leakage Boundary
Pump Casing (SACS)	Pressure Boundary
Restricting Orifices	Pressure Boundary
Restricting Orifices	Throttle
Sensor Element	Leakage Boundary
Sensor Element	Pressure Boundary
Strainer Body	Leakage Boundary
Tanks (RACS Chemical Addition)	Leakage Boundary
Tanks (RACS Head Tank)	Leakage Boundary
Tanks (SACS Chemical Addition)	Leakage Boundary
Tanks (SACS Demineralizers)	Leakage Boundary
Tanks (SACS Expansion)	Pressure Boundary
Tanks (Supply/Return Side Accumulator, Integral Attachments)	Pressure Boundary
Thermowell	Leakage Boundary
Thermowell	Pressure Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-2 Closed Cycle Cooling Water System
Summary of Aging Management Evaluation

2.3.3.3 Compressed Air System

System Purpose

The Compressed Air System is a normally operating system designed to provide clean and dry compressed air in support of plant operation.

The Compressed Air System is in scope for license renewal. However, major portions of the system are not required to perform license renewal intended functions and are not in scope. The Compressed Air System has several interfaces with other systems that are not in the license renewal boundary of the Compressed Air System.

The Compressed Air System consists of the following plant systems: the service/instrument air plant system and the breathing air plant system. The breathing air plant system is no longer in use but is described and evaluated because portions of the system still exists in the plant.

The purpose of the service/instrument air plant system is to provide clean and dry compressed air to pneumatically operated instruments and valves. To accomplish this purpose, this system takes air from outside of the Turbine Building, and processes the air through air compressors, intercooler/aftercoolers/moisture separator, air receivers, and air dryers for distribution to components in support of plant operation. The purpose of the breathing air plant system was to provide compressed air for plant personnel during maintenance for respiratory supply and pneumatic tools, however this system was abandoned in place and is no longer used.

System Operation

Service/Instrument Air Plant System

The service/instrument air plant system is comprised primarily of piping, valves, compressors, intercoolers/ aftercoolers/moisture separator, air receivers, accumulators, regulators, tubing, air dryers and filters. It begins at the air intake filter/silencer to the compressors and terminates at the attachment points to the host pneumatic components which are the supplied pneumatic instruments, air operated valves and other air operator components. There are two air compressors and one emergency instrument air compressor that process the air for both the service and instrument air loads.

Compressed air from the service air plant system is supplied through a single header with one service air receiver common to both service air compressors, all located in the Turbine Building. Each of the two full capacity service air compressors has an air intake filter/silencer, an intercooler and an aftercooler. The service air compressors provide compressed air to the service air system receiver. Compressed air from the service air plant system receiver charges the instrument air supply line and is sent to the instrument air plant system dryers and filters. In addition, an emergency instrument air compressor unit also provides compressed air to the instrument air plant system dryers and filters prior to distribution as processed compressed air.

The compressed air passes through three full capacity instrument air dryer packages that are provided in the instrument air system before distribution as processed compressed air. Each dryer package consists of a prefilter, heatless desiccant type dryer, and an afterfilter. The dryers and filters are located in the Turbine Building. Two air receivers for the instrument air are also provided downstream of the dryers. The dryer and filter charge lines then charge the two instrument air supply headers. Manual shutoff valves are provided in the headers and at the connections of smaller headers/taps from which instrument air is supplied to the plant pneumatic components. Two headers supply the Reactor Building instrument air. One supplies the outboard Main Steam Isolation Valves (MSIVs) in the outboard MSIV room. The other supplies the Reactor Building loads and provides a connection to the drywell. The Auxiliary Building, Turbine Building, Auxiliary Boiler and other miscellaneous areas are also provided with compressed air.

During normal plant operation, the service air compressors operate continuously to supply service and instrument air needed to support plant operations. The service air compressors keep all the service and instrument air receivers charged with compressed air. The instrument and service air receivers supply the individual pneumatic components throughout the plant. Instrument air is required for normal plant operation that includes certain important functions such as maintaining the control rod scram valves closed. Upon loss of air, the scram valves will open, causing the control rods to insert and shut down the reactor. Where required, pneumatically operated components are designed to fail safe upon loss of air or are provided with safety-related accumulators to provide a stored volume of compressed air when the compressors or other nonsafety-related sections of the instrument air system are unavailable. Accumulators are isolated by safety-related check valves to ensure backup air for components credited to function during or following design basis events.

Instrument air is required for normal control room chiller operation by maintaining the control valve to the chiller open. Upon loss of air due to the failure of nonsafety-related sections of the instrument air system, the required air can be provided with safety-related nitrogen/air cylinders and associated safety-related piping and valves which are evaluated with the Compressed Air System.

Service air is required to support the fuel pool cooling intended function by inflating the gate seals to provide a watertight seal. These gate seals are located at the interfaces of the reactor well to fuel pool, the cask pit to fuel pool, and the reactor well to dryer-separator pool. A rack of compressed air cylinders is installed in the Reactor Building to provide back-up air supply to these seals. The compressed air cylinders tie into the service air piping upstream of each of the seal supply regulator valves. All associating piping, components and instrumentation contained within the flow path as described are evaluated with the Compressed Air System.

Other important design features in the service/instrument air plant systems include the service air penetration (P27) for the drywell and the instrument air supply to the equipment hatch (C2) at the drywell boundary. The service air drywell penetration, although not in use during power operation, has piping that penetrates the drywell and performs the primary containment boundary intended function. This penetration is isolated during normal operation by two safety-related manual isolation valves. One locked closed valve is inside the drywell and the other locked closed valve is outside the drywell. Similarly, the instrument air supply piping to the equipment hatch also performs a primary containment boundary intended function. This supply piping to the equipment hatch located at the drywell boundary (C2) is provided by the instrument air plant system and is isolated during normal operation by a locked closed manual isolation valve. Drywell penetration P27 and equipment hatch C2 will be evaluated as part of the Primary Containment license renewal structure. The piping and isolation valves associated with penetration P27 and equipment hatch C2 will be evaluated as part of the Compressed Air license renewal system.

The following components of the service/instrument plant system are not required to function for safe shutdown of the plant and do not have any license renewal intended function: the air intake filter/silencer, service air compressors, intercoolers/aftercoolers/moisture separator, air receivers, dryers, filters, headers, valves and piping up to the attachment points to the safety related valves for the Main Steam System and drywell penetration/equipment hatch. These components do not perform any intended functions and are not included in the scope of license renewal. These components are not safety-related, do not have the ability to affect safety related SSCs and provide no function for safe shutdown of the plant.

Breathing Air Plant System

The breathing air plant system was designed to provide compressed air to plant personnel, however, this system was abandoned in place and is no longer used. The breathing air system, however, includes a line that penetrates the drywell. This line is isolated during reactor operation by two manual normally closed gate valves, one inside and one outside primary containment. In addition to these two isolation valves, this line is blocked off by spectacle flanges during plant operation.

The breathing air plant system is not required to operate to support a license renewal intended function, but is included within the scope of license renewal because this plant system includes piping that penetrates the drywell at penetration 31 and performs a primary containment boundary intended function. Penetration 31 will be assessed as part of the Primary Containment license renewal structure. The manual valve inside and outside of primary containment, the spectacle flange and line that penetrates containment will be evaluated as part of this Compressed Air license renewal system.

For more detailed information, see UFSAR Section 9.3.1.

System Boundary

The license renewal scoping boundary of the Compressed Air System consists of the service/instrument and breathing air plant systems, as follows:

Service/Instrument Air Plant System

This plant system begins at the air intake filter/silencer for the service air compressors and continues through the instrument air dryers and filters that discharge into the Turbine Building air headers. The system boundary also includes piping downstream of the instrument air dryers, main instrument air header, instrument air receivers, connections of smaller headers, manual shutoff valves, pressure reducing valves, check valves, accumulators and all associated piping components and instrumentation. The system boundary terminates at the attachment points to the host pneumatic components.

Not included in the Compressed Air System scoping boundary are the host pneumatic components which are pneumatic instrumentation, air operated valves and other components supplied by the Compressed Air System in systems such as: Main Steam, Containment Inerting and Purging, Reactor Building Ventilation, Condensate Storage and Transfer Systems and Closed Cycle Cooling Water System. The host pneumatic components are separately evaluated in their associated license renewal systems.

Not included in the scope of license renewal is the portion of the service/instrument air plant system from the air intake filter/silencer, air compressors, intercoolers/ aftercoolers/moisture separator, air receiver, dryers, filters, headers, valves and branch piping up to the attachment points to the safety-related check valves of the Main Steam System or to the locked closed manual isolation valves associated with the drywell penetration and equipment hatch. This portion is not required to support license renewal intended functions and is not included within the scope of license renewal. The loss of this portion will not compromise the ability of any safety-related system or component to mitigate the consequences of an accident or event as defined in 10 CFR 54.4(a).

Not included in the scope of license renewal is the portion of the service/instrument air plant system that provides compressed air to various nonsafety-related users, including local nonsafety-related nitrogen storage cylinders installed to allow operation of nonsafety-related pneumatic component when the Compressed Air system is not available.

The service/instrument air plant system supports the intended function of providing motive power to safety-related components requiring air for operation by providing compressed air from safety-related accumulators or safety-related nitrogen/air cylinders. Thus, those portions of the system that are in the scope of license renewal start at the safety-related isolation check valves upstream of the individual safety-related accumulator that supplies the in-line solenoid valves and ends at the attachment point to the safety-related valve actuators in the Main Steam System.

Similarly, a portion of the Compressed Air System boundary includes the piping that supports the Closed Cycle Cooling Water System. The portion that is in the scope of license renewal starts at the safety-related check valve, which is upstream of the safety-related nitrogen/air cylinders that supply the pressure regulator valves, and ends at the safety-related isolation valves of the control room chillers. Additionally the drywell penetration P27, equipment hatch C2 and associated safety-related supply line piping and safety-related isolation valves are in the scope of license renewal for their containment boundary intended function.

Service air is required to support the fuel pool cooling intended function by inflating the gate seals to provide a watertight seal. These gate seals are located at the interfaces of the reactor well to fuel pool, the cask pit to fuel pool, and the reactor well to dryer-separator pool. This portion of the system boundary begins at the service air supply line and continues through the branch connection point for the back-up compressed air cylinders, service air supply station, check valves, gate seal regulator valve, pressure relief valve, and then ends at the gate seals. All associating piping, components and instrumentation contained within the flow path as described are in the scope of the Compressed Air license renewal system. The boundary excludes the gate seals, which are evaluated with the Reactor Building Structure for license renewal.

Breathing Air Plant System

The breathing air plant system begins at the air intake to the breathing air compressor. The system boundary includes the air dryer, air receiver and filters that discharge into the Turbine Building air header. The system boundary terminates at the plant connections for the compressed air in Reactor Building, Turbine Building and Auxiliary Building. This plant system is abandoned in place and no longer used.

Not included in the scope of license renewal is the major portion of the system, which is abandoned in place and no longer used to provide compressed air to the plant. This portion of the system does not perform any license renewal intended function and is therefore not in the scope of license renewal.

The breathing air plant system does, however, support the intended function of primary containment boundary. The only portion of the breathing air plant system that supports an intended function and is in the scope of license renewal is the line that penetrates the drywell at drywell penetration P31. This portion of the plant system includes the manual valves, spectacle flange and piping line that penetrate the containment.

For the Compressed Air System, also included in the license renewal scoping boundary are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor. Included in this boundary are components relied upon to preserve the structural support intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the scoping boundary of the Compressed Air System are items such as drywell penetration and equipment hatch which are separately evaluated with the Primary Containment structure for license renewal.

Not included in the Compressed Air System license renewal scoping boundary is the following interfacing system, which is separately evaluated as a license renewal system:

Closed Cycle Cooling Water System

Reason for Scope Determination

The Compressed Air System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Environmental Qualification (10 CFR 50.49). The Compressed Air System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48), Anticipated Transient Without Scram (10 CFR 50.62) or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide primary containment boundary. Supply lines penetrating primary containment are provided with isolation valves. 10 CFR 54.4(a)(1)

2. Provide motive power to safety-related components. Safety-related accumulators are connected to air operated pneumatic components. 10 CFR 54.4(a)(1)

3. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. This includes nonsafety-related piping and components credited to provide compressed air to the Fuel Pool and Reactor Well gate seals. This also includes

components relied upon to preserve the structural support intended function associated with safety-related/nonsafety-related interfaces. 10 CFR 54.4(a)(2)

4. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Compressed Air System includes components that are in the Environmental Qualification Program. 10 CFR 54.4(a)(3)

UFSAR References

9.3.1

License Renewal Boundary Drawings

LR-M-11-1, Sheet 4
LR-M-12-1, Sheet 2
LR-M-15-0, Sheet 4
LR-M-15-1, Sheet 1
LR-M-41-1, Sheet 1
LR-M-53-1, Sheet 2

Table 2.3.3-3 Compressed Air System
Components Subject to Aging Management Review

Component Type	Intended Function
Accumulator	Pressure Boundary
Bolting	Mechanical Closure
Hoses	Pressure Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Valve Body	Pressure Boundary
Valve Body	Structural Support

The aging management review results for these components are provided in:

Table 3.3.2-3 Compressed Air System
Summary of Aging Management Evaluation

2.3.3.4 Containment Inerting and Purging System

System Purpose

The Containment Inerting and Purging System is a license renewal system that is part of the containment atmosphere plant system. The Containment Inerting and Purging System is a pressurized gas system designed to maintain an inert atmosphere within the primary containment during plant operations to preclude energy releases from a possible hydrogen-oxygen reaction following a postulated loss-of-coolant-accident. The inert environment also precludes the possibility of an exposure fire within the primary containment. The Containment Inerting and Purging System is only credited during normal operation to inert the drywell. This system is not credited to provide makeup during a design basis event.

The purpose of the Containment Inerting and Purging System is to provide a means of reducing the oxygen concentration in the containment for normal power operations and a means of reestablishing oxygen concentration to normal life supporting levels to allow access to the primary containment. To ready the primary containment for power operation, the Containment Inerting and Purging System accomplishes the purpose of inerting by introducing nitrogen from the liquid nitrogen vaporizer to displace the oxygen from the free volume in the primary containment. The Containment Inerting and Purging System depends on the Drywell Air Cooling System to provide effective containment atmosphere mixing, since the Containment Inerting and Purging System does not have any fans. Also, the Containment Inerting and Purging System depends on the torus to drywell portion of the Vacuum Relief Valve System for effective mixing of the torus atmosphere. Liquid nitrogen is provided to the nitrogen vaporizer from the liquid nitrogen storage tank in the Main Condenser Air Extraction System.

To ready the primary containment for shutdown, the Containment Inerting and Purging System accomplishes the purpose of purging or de-inerting through interfacing with the containment prepurge cleanup system portion of the Reactor Building Ventilation System. The valves on the containment prepurge cleanup system supply and return lines to and from the drywell and torus are opened and the containment prepurge fan is started to initiate purging.

The Containment Inerting and Purging System is started manually.

System Operation

The Containment Inerting and Purging System is comprised of a liquid nitrogen vaporizer system located in the Auxiliary Building that consists of a nitrogen vaporizer, a flow control valve, and system flow, pressure and temperature instruments, and a nitrogen supply header that provides nitrogen to the rest of the system through two headers located in the Reactor Building. The liquid nitrogen vaporizer system portion of the Containment Inerting and Purging System receives liquid nitrogen from the nitrogen storage portion of the Main Condenser Air Extraction System located outside the building. The portion of the Containment Inerting and Purging System located in the Auxiliary Building is not in scope, as this portion does not serve any intended function.

Within the Reactor Building the Containment Inerting and Purging System is comprised of a one inch header and a six inch header, arranged in parallel, both originating downstream of a nitrogen supply header isolation valve in the Reactor Building. The six inch header, or the nitrogen supply header, is used for primary containment inerting during plant startup. The one-inch header, or the makeup header, is used for nitrogen makeup to the primary containment during plant operation.

Additionally, within the Reactor Building the Containment Inerting and Purging System includes a containment prepurge cleanup system supply and return header to and from both torus and drywell. Each containment prepurge cleanup system supply and return header is comprised of an air operated primary containment inboard and outboard isolation valve. However, the containment prepurge cleanup system return header from the drywell includes an additional air operated containment isolation bypass valve on the primary containment vent path to the containment prepurge cleanup system.

The nitrogen supply header is comprised of a nitrogen flow control valve, a nitrogen supply header isolation valve, and system flow, pressure, and temperature instruments. The nitrogen makeup header is comprised of a nitrogen makeup supply isolation valve, and system flow, pressure, and temperature instruments. The nitrogen supply header provides nitrogen to the drywell and torus through a connection point in between the inboard and outboard containment isolation valves on containment prepurge cleanup supply lines to the drywell and torus, respectively. The nitrogen makeup to the drywell and torus takes place through a connection point between the inboard and outboard containment isolation valves on the Hydrogen and Oxygen Analyzer System supply line to the drywell and torus, respectively.

The Containment Inerting and Purging System provides inerting, makeup, purging and venting flow paths.

During the inerting process, nitrogen is introduced to the drywell and torus through the nitrogen supply header and the containment prepurge cleanup supply lines. The torus to drywell vacuum breakers are cycled to promote torus atmosphere mixing since there are no fans to provide this function. Additionally, the Drywell Cooling System is used to promote atmosphere mixing within the primary containment. While nitrogen is being admitted to the torus and drywell, air will be drawn through the containment prepurge cleanup return line from the drywell until the desired oxygen level in the primary containment is obtained.

During the makeup process, nitrogen will be admitted to the torus or drywell through the "B" train of the hydrogen and oxygen analyzer inboard containment sample valves to maintain the required oxygen level and pressure in the primary containment.

During the purging process, fresh air is supplied through the appropriate containment prepurge cleanup system inboard and outboard supply isolation valves, and the drywell and torus atmosphere is purged to the Reactor Building Ventilation System through the containment prepurge cleanup system return inboard and outboard isolation valves, and the drywell ventilation exhaust damper. The purging process takes place during periods of reactor shutdown to maintain a suitable environment for personnel occupancy of the primary containment.

During the venting process, the normal flow path is from the drywell or torus, depending on which is being vented, through inboard isolation valve located on the containment prepurge cleanup system return lines from the primary containment. After passing through the isolation valve, flow passes through a bypass valve. The bypass valve bypasses the outboard containment prepurge cleanup system isolation valve from the drywell or torus to the Reactor Building Ventilation System.

All remotely operated containment isolation valves in the Containment Inerting and Purging System are automatically closed by the Primary Containment Isolation System upon indications of high drywell pressure, low-low reactor water level or Reactor Building exhaust high radiation. These isolation signals can be overridden to enable inerting and purging.

For more detailed information see UFSAR Section 6.2.5.

System Boundary

The Containment Inerting and Purging System boundary begins at the liquid nitrogen supply to the liquid nitrogen vaporizer system, and it continues through the nitrogen vaporizer. The vaporized nitrogen continues through a flow control station, consisting of a flow control valve and a bypass valve, and then continues through a header that enters the remaining portion of the Containment Inerting and Purging System located within the Reactor Building. Within the Reactor Building the vaporized nitrogen continues through a nitrogen supply header isolation valve until it splits into two headers, the six inch nitrogen supply header and the one inch nitrogen makeup header.

The nitrogen supply header inlet flowpath includes a flow element, followed by a flow control valve and supply header isolation valve before splitting into two separate paths, one for nitrogen supply to the drywell and one for nitrogen supply to the torus. The nitrogen supply line to the drywell terminates at a point between two containment isolation valves on the containment prepurge cleanup system supply line that enters the spherical section of the drywell. The nitrogen supply line to the torus terminates at a point between two containment isolation valves on the containment prepurge cleanup system supply line to the torus.

The nitrogen makeup header inlet flowpath includes a flow element, followed by an isolation valve before it splits into two separate paths, one for nitrogen makeup to the drywell and one for nitrogen makeup to the torus. Nitrogen makeup to the drywell is through one of the two containment hydrogen and oxygen analyzer sample lines, on the "B" train, from the drywell that is located closer to the spherical region of the drywell. The nitrogen makeup to the drywell terminates at the hydrogen and oxygen analyzer sample line from the drywell. Nitrogen makeup to the torus is through one of the two hydrogen and oxygen analyzer sample lines, on the "B" train, from the torus that is located closer to the mid section of the torus. The nitrogen makeup to the torus terminates at the hydrogen and oxygen analyzer sample line.

The Containment Inerting and Purging System boundary continues through the containment prepurge cleanup system return lines from the drywell and torus. The Containment Inerting and Purging System return flowpath from the drywell is through the containment prepurge cleanup system return line from the cylindrical region of the drywell, which is equipped with containment isolation valves downstream of the connection point to the Hydrogen Recombiner System. The Containment Inerting and Purging System return flowpath from the torus is through the containment prepurge cleanup system return line from the torus, which is equipped with containment isolation valves downstream of the connection point to the Hydrogen Recombiner System, and also downstream of the connection point to the reactor building to torus vacuum relief valves. Between the containment isolation valves is the connection to the hardened torus vent line, which passes through the Reactor Building and vents to the atmosphere. Also included in the system boundary are those portions of the containment prepurge cleanup system supply and return lines that lead to the drywell and torus, up to and including the second containment isolation valve.

All associated piping, components, and instrumentation contained within the flowpath described above are included in the Containment Inerting and Purging System.

Also included in the license renewal scoping boundary of the Containment Inerting and Purging System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related and nonsafety-related interface up to the location of the first seismic anchor. Included in this boundary are components relied upon to preserve the structural support intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the scope of license renewal is the liquid nitrogen vaporizor system portion of the Containment Inerting and Purging System, located within the Auxiliary Building, as this portion of the system does not support any intended functions.

Also, not included in the Containment Inerting and Purging System license renewal scoping boundaries are the following systems or structures, which are separately evaluated as license renewal systems:

Containment Hydrogen Recombiner System
Drywell Air Cooling System
Hardened Torus Vent System
Hydrogen and Oxygen Analyzer System
Main Condenser Air Extraction System
Primary Containment
Reactor Building Ventilation System (containment prepurge cleanup system)
Vacuum Relief Valve System (torus to drywell vacuum breakers)

Reason for Scope Determination

The Containment Inerting and Purging System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49), Station Blackout (10 CFR 50.63) and Fire Protection (10 CFR 50.48). The Containment Atmosphere Control System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide Primary Containment boundary. The Containment Inerting and Purging System includes primary containment isolation valves that close on high drywell pressure, low-low reactor water level, and Reactor Building exhaust high radiation. 10 CFR 54.4(a)(1)

2. Control combustible gas mixtures in the Primary Containment atmosphere. The Containment Inerting and Purging System is only credited during normal operation to establish an inert drywell environment to preclude any release from a possible hydrogen-oxygen

reaction following a postulated loss-of-coolant-accident. This system is not required to function during a design basis event. 10 CFR 54.4 (a)(1)

3. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. Some portions of nonsafety sections of the nitrogen supply header and the nitrogen makeup header are relied upon to preserve the structural support intended function of this portion of the system. 10 CFR 54.4(a)(2)

4. 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). The inerted conditions within the primary containment prevents start of fire in the primary containment. 10 CFR 54.4(a)(3)

5. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The limit switches associated with the primary containment isolation valves within the Containment Inerting and Purging System are environmentally qualified. 10 CFR 54.4(a)(3)

6. 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). Provides miscellaneous instrumentation used by plant station blackout procedure to monitor plant conditions during coping, shutdown and restoration. 10 CFR 54.4(a)(3)

UFSAR References

6.2.5.2.1

License Renewal Boundary Drawings

LR-M-57-1, Sheet 1
LR-M-76-1, Sheet 1

Table 2.3.3-4 Containment Inerting and Purging System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Expansion Joints	Structural Support
Flow Element	Structural Support
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Valve Body	Pressure Boundary
Valve Body	Structural Support

The aging management review results for these components are provided in:

Table 3.3.2-4 Containment Inerting and Purging System
Summary of Aging Management Evaluation

2.3.3.5 Control Area Chilled Water System

System Purpose

The Control Area Chilled Water System is a normally operating mechanical system designed to provide chilled water to plant ventilation cooling coils. The Control Area Chilled Water System consists of two plant systems: control room chilled water system and the safety-related panel room chilled water system. The purpose of the Control Area Chilled Water System is to provide cooling water to the safety-related and nonsafety-related ventilation systems for the Control Room and Control Area HVAC System and the Standby Diesel Generator Area Ventilation System. Chilled water is provided to the following ventilation system rooms: main control room, auxiliary equipment rooms, emergency switchgear rooms, safety auxiliary cooling pump rooms, class 1E panel rooms, technical support center and the remote shutdown panel room. The Control Area Chilled Water System accomplishes this purpose by providing a continuous supply of chilled water to the cooling coils for room cooling coils in the Control Room and Control Area Ventilations System and the Standby Diesel Area Ventilation System during normal and accident conditions. Each of the Control Area Chilled Water System plant systems consists of two independent 100 percent capacity chilled water loops to provide for complete mechanical redundancy. The redundant trains will start on the following conditions: low flow conditions indicated on in-service train, and on either high or low chilled water supply temperatures for the operating loop.

System Operation

The Control Area Chilled Water System consists of the following safety-related cooling and ventilation plant systems; control room chilled water plant system and the safety-related panel room chilled water plant system.

Control Room Chilled Water Plant System

The control room chilled water plant system consists of two independent 100 percent capacity chilled water loops, providing complete mechanical redundancy. One train is normally in operation and the other train is in standby. Each safety-related train consists of one water chiller, a full capacity recirculation pump, head tank, chemical addition tank, cooling coils, piping header, controls and instrumentation. The flow path begins at the pump, and continues to the water chiller evaporator, and is then distributed in parallel to the safety-related components cooled (control room a/c unit cooling coils, switchgear room cooling unit coils, control equipment room a/c unit cooling coils and safety auxiliary system room cooling unit cooling coils). The flowpath then leaves the equipment being cooled and flows through the return header and is routed back to the pump suction. The standby train automatically starts on failure of the in-service train, and on either high or low chilled water supply temperatures for the operating loop.

The control area water chiller is used to cool the closed loop water for the control room chilled water plant system. Each redundant train has a full capacity chiller and associated skid mounted equipment including the evaporator and condenser heat exchangers. The chilled water enters the tube side of the evaporator where it is cooled, and discharges to the common piping header to the cooled safety-related components. Refrigerant is used as the chiller cooling medium and heat is rejected to the chiller condenser. The cooling water supply to the chiller condenser is from the safety auxiliaries cooling plant system, which is evaluated with the Closed Cycle Cooling Water System. The chiller compressor is an integral part of the active chiller assembly and is therefore not subject to license renewal Aging Management Review. The pumpout unit and storage tanks associated with each chiller are used for refrigerant transfer, machine evacuation and machine pressurizing for refrigerant charge during machine service periods and extended shutdown, and do not have a license renewal intended function.

Safety-Related Panel Room Chilled Water Plant System

The safety-related panel room chilled water plant system consists of two independent 100 percent capacity chilled water loops, providing complete mechanical redundancy. One train is normally in operation and the other train is in standby. Each safety-related train consists of one water chiller, a full capacity recirculation pump, head tank, chemical addition tank, chiller, cooling coils, piping, controls and instrumentation. The flow path begins at the pump, and continues to the water chiller evaporator and is then distributed in parallel to the components cooled (class 1E panel room supply a/c cooling coils, remote shutdown panel room cooling coil and technical support center a/c unit cooling coil). The flowpath then leaves the equipment being cooled and flows into a common return header and is routed back to the full capacity recirculation pump suction. The safety-related panel room chilled water plant system provides cooling to both safety-related and nonsafety-related compartments. The standby train automatically starts on low flow conditions indicated on the in-service train, and on either high or low chilled water supply temperatures for the operating loop.

The tech support center and 1E panel room water chiller is used to cool the closed loop water for the safety-related panel room chilled water plant system. Each redundant train has a full capacity chiller and associated skid mounted equipment including the evaporator and condenser heat exchangers. The chilled water enters the tube side of the evaporator where it is cooled and discharges to the common piping header and to the cooled components. Refrigerant is used as the cooling medium and heat is rejected to the chiller condenser. The cooling water supply to the chiller condenser is from the safety auxiliaries cooling plant system, which is evaluated with the Closed Cycle Cooling Water System. The chiller compressor is an integral part of the active chiller assembly and is therefore not subject to license renewal Aging Management Review.

For additional information see, UFSAR section: 9.2.7.2

<u>System Boundary</u>

Control Room Chilled Water Plant System

The control room chilled water plant system boundary begins at the inlet to the chilled water circulation pump, and continues through the tube side of the water chiller evaporator and through all the cooled loads (control room cooling coil, control equipment room coil, switchgear cooling coils and the safety auxiliary room cooling coils). The system boundary continues from the cooled loads back to the suction of the chilled water circulating pump. Also included in the system boundary are the head tank and chemical addition tank.

Safety-Related Panel Room Chilled Water Plant System

The safety-related panel room chilled water system boundary begins at the inlet to the chilled water circulation pump and continues through the tube side of the water chiller evaporator and through all the cooled loads (remote shutdown panel cooling coil, technical support center cooling coil and the class 1E panel cooling coils). The system boundary continues from the cooled loads back to the suction of the chilled water circulating pump. Also included in the system boundary are the head tank and chemical addition tank.

The housings that provide structural support for the various ventilation system cooling coils supplied by the Control Area Chilled Water System, and which are required to support the ventilation system intended functions, are normally evaluated with the associated ventilation license renewal system. The technical support center supply unit ventilation system is part of the Auxiliary Building Service and Radwaste Area Ventilation license renewal system, which does not have any intended functions and is not in the scope of license renewal. The housing that provides structural support for the cooling coils associated with this ventilation unit in the Auxiliary Building Service and Radwaste Area Ventilation license renewal system will be evaluated with the Control Area Chilled Water System.

Not included in the scope of license renewal are the pumpout unit and storage tanks associated with each chiller which are used for refrigerant transfer, machine evacuation and machine pressurizing for refrigerant charge during machine service periods and extended shutdown. These components do not perform an intended function and are therefore not included in the scope of license renewal.

Not included in the Control Area Chilled Water System boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Closed Cycle Cooling Water System
Control Room and Control Area HVAC System
Makeup Demineralized System
Reactor Building Ventilation System
Standby Diesel Generator Area Ventilation System

Reason for Scope Determination

The Control Area Chilled Water System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of functions(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48). The Control Area Chilled Water System is not relied upon in any safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49), Anticipated Transient Without Scram (10 CFR 50.62) or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Maintain emergency temperature limits within areas containing safety-related components. The Control Area Chilled Water System and Standby Diesel Generator Area Ventilation System maintain the operating conditions for safety related equipment and components in the ventilation boundary. 10 CFR 54.4 (a)(1)

2. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The demineralized water make-up piping to the head tanks are nonsafety-related but located in the vicinity of safety-related components. 10 CFR 54.4 (a)(2).

3. Relied upon in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection. (10 CFR 50.48) The Control Area Chilled Water System provides chilled water for safety related equipment compartments required during safe shutdown. 10 CFR 54.4(a)(3)

UFSAR References

9.2.7.2

License Renewal Boundary Drawings

LR-M-83-1, Sheet 1
LR-M-88-1, Sheet 1
LR-M-88-1, Sheet 2
LR-M-89-1, Sheet 1
LR-M-90-1, Sheet 1
LR-M-90-1, Sheet 2
LR-M-90-1, Sheet 3
LR-M-93-0, Sheet 2

Table 2.3.3-5 Control Area Chilled Water System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Fan Housing (TSC)	Structural Support
Flow Device	Leakage Boundary
Flow Element	Pressure Boundary
Heat Exchanger Components (1E Panel Room Cooling Coils)	Heat Transfer
Heat Exchanger Components (1E Panel Room Cooling Coils)	Pressure Boundary
Heat Exchanger Components (Condenser)	Evaluated with the Closed Cycle Cooling Water System
Heat Exchanger Components (Conrol Equipment Room Cooling Coil)	Heat Transfer
Heat Exchanger Components (Conrol Equipment Room Cooling Coil)	Pressure Boundary
Heat Exchanger Components (Contol Room Supply Cooling Coils)	Heat Transfer
Heat Exchanger Components (Contol Room Supply Cooling Coils)	Pressure Boundary
Heat Exchanger Components (Evaporator AK 400, BK 400, AK 403, BK 403)	Heat Transfer
Heat Exchanger Components (Evaporator AK 400, BK 400, AK 403, BK 403)	Pressure Boundary
Heat Exchanger Components (RSP Room Cooling Coils)	Heat Transfer
Heat Exchanger Components (RSP Room Cooling Coils)	Pressure Boundary
Heat Exchanger Components (SACS Room Cooling Coils)	Heat Transfer
Heat Exchanger Components (SACS Room Cooling Coils)	Pressure Boundary
Heat Exchanger Components (Switchgear Room Cooling Coils)	Heat Transfer
Heat Exchanger Components (Switchgear Room Cooling Coils)	Pressure Boundary
Heat Exchanger Components (TSC Coils)	Pressure Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support

Component Type	Intended Function
Pump Casing (Chilled Water Pump AP 400, BP 400, AP 414, BP 414)	Pressure Boundary
Rupture Disks	Pressure Boundary
Rupture Disks	Structural Support
Sight Glasses	Leakage Boundary
Sight Glasses	Pressure Boundary
Strainer	Filter
Strainer Body	Pressure Boundary
Tanks (Chem Feed AT 401, BT 401, AT 414, BT 414))	Leakage Boundary
Tanks (Head Tank AT 410, BT 410, AT413, BT 413)	Pressure Boundary
Thermowell	Pressure Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary
Valve Body	Structural Support

The aging management review results for these components are provided in:

Table 3.3.2-5 Control Area Chilled Water System
Summary of Aging Management Evaluation

2.3.3.6 Control Rod Drive System

System Purpose

The Control Rod Drive System is a high pressure, low flow system designed to rapidly insert all control rods into the core in response to manual action or an automatic signal from the Reactor Protection System, or the Redundant Reactivity Control System. Also, it incrementally positions control rods in response to signals from the Reactor Manual Control System. The Control Rod Drive System is in scope for license renewal. However, portions of the system are not required to perform intended functions and are not in scope.

The Control Rod Drive System consists of the following plant systems: control rod drive hydraulic system, and control rod drive removal and cleaning system. The primary purpose of the control rod drive hydraulic system is to rapidly insert negative reactivity to shut down the reactor under accident or transient conditions and to manage reactivity in the reactor core by inserting or withdrawing control rods at a limited rate, one rod at a time for power level control and flux shaping during normal reactor operation. The control rod drive hydraulic system accomplishes this by providing water at the required operating pressures to the control rod drives for cooling and for all types of control rod motion in response to inputs from the Reactor Manual Control System, Redundant Reactivity Control System and Reactor Protection System.

The secondary purpose of the Control Rod Drive System is to provide a water source for pump seal operation and makeup. This includes reactor recirculation pump seal purge and makeup water to the reactor water level reference leg condensing chambers.

System Operation

The Control Rod Drive System is comprised of control rod drive mechanisms and the control rod drive hydraulic system.

Each of the control rod drive mechanisms is a double acting, mechanically latched, hydraulic cylinder using reactor grade water as the operating fluid. Each control rod drive mechanism is capable of inserting or withdrawing the attached control rod at a slow, controlled rate, as well as providing rapid insertion in an emergency. A locking mechanism allows a drive to be positioned during stroking and will hold the control rod in a fixed position. Each control rod drive mechanism is an integral unit mounted vertically inside a drive housing, welded to a stub tube, which is welded into a reactor bottom head penetration (evaluated with the Reactor Vessel). The lower end of each drive housing terminates in a flange containing ports for attaching the hydraulic lines from the hydraulic control units, and a machined face which mates with a corresponding flange at the lower end of the control rod drive mechanism drive housing.

The control rod drive hydraulic system is comprised of AC powered drive water pumps, filters, control valves, piping and associated instrumentation and controllers. In normal operation, the Control Rod Drive System takes suction from the Condensate System or condensate storage tank through the control rod drive pump suction filters. One of the two control rod drive water pumps pressurizes condensate water, which is then passed through parallel drive water filters. The discharge from the filters supplies the hydraulic control units via the charging header, the drive water header, and the cooling water header, each at a different pressure. The charging header supplies pressurized water to maintain the accumulators charged and ready for service in the event of a scram. Stored energy available from the nitrogen charged accumulators and from reactor pressure provides hydraulic power for rapid simultaneous insertion, or scram, of all control rods. The drive water header provides the control rod drive mechanisms with motive force for moving the control rods to manage reactivity in the reactor core. The cooling water header provides a constant flow of water to the control rod drive mechanisms to maximize the life of the internal seals. Minimum flow protection to the drive water pumps is provided by a line from the discharge of each pump to the condensate storage tank.

The control rod drive hydraulic system is arranged so that the equipment supporting each control rod drive mechanism is packaged into modular hydraulic control units, one hydraulic control unit module to each drive. The hydraulic control units receive signals from the Reactor Manual Control System, Redundant Reactivity Control System, or Reactor Protection System and direct water to and from the control rod drive mechanisms to move the control rods accordingly. Water exhausted from the control rod drive mechanisms is returned through the hydraulic control units to the exhaust water header and discharged into the control rod drive return header. Each control rod drive mechanism has its own separate control and scram devices. Solenoid operated valves on each hydraulic control unit direct air pressure from the instrument air system scram valve pilot air headers to the inlet and outlet scram valves on each hydraulic control unit to maintain them in a closed position during normal operation, or to vent them to atmosphere on a scram signal or loss of power.

The hydraulic control units are arranged into a north and a south bank, each of which discharges into its own scram discharge volume. Each scram discharge volume also includes an instrument volume with level instrumentation. The scram discharge volume receives reactor water exhausted from all the control rod drives during a scram. During a scram, the scram discharge volumes are isolated from equipment drains. During normal plant operation and following a scram, the scram discharge volumes are drained to the reactor building equipment drain sump.

The Control Rod Drive System also provides a flow path to provide high pressure water to the reactor recirculation pump seal purge and to provide makeup water to the Nuclear Boiler Instrumentation System reactor water level condensing chambers. It also includes a flow path from the Nuclear Boiler Instrumentation System that provides a reference of vessel pressure above the core plate for use with Control Rod Drive System differential pressure measurement instrumentation.

The Control Rod Drive System has two friction test stations with associated instrumentation, valves and piping used to test the scram times of control rods. The hydraulic control units are isolated from the friction test stations by manual valves when the test stations are not in use. Opening of manual valves to the test stations allows hydraulic control unit hydraulic pressure to be measured by the friction test station to identify any significant lengthening of control rod scram times.

For more detailed information, see UFSAR Sections 4.6 and 3.9.4.

<u>System Boundary</u>

The Control Rod Drive System suction side boundary begins at the Control Rod Drive System attachment points to the Condensate and Condensate Storage and Transfer Systems. The boundary continues through the control rod drive pump suction filters, control rod drive drive water pumps, the drive water filters, to the hydraulic control units (including the inlet and outlet scram valves) and control rod drive mechanisms via the charging, drive water and cooling headers and back via the exhaust header. The boundary includes the suction piping, discharge piping, minimum flow line to the condensate storage tank connection, test bypass and stabilizing header lines, hydraulic control units, control rod drive mechanisms and control rod drive insert and withdraw lines up to the control rod drive housing flange. Included within the system boundary are the scram discharge volume and instrument volume, their associated piping, instruments, valves, vents and drains. Also included within the system boundary is the piping and valves associated with the reactor recirculation pump seal purge water supply up to and including the outboard containment isolation valves. The piping and valves, including the control rod drive backfill station associated with supplying control rod drive makeup water to the reactor water level instrumentation are also included in the system boundary up to the first safety related check valve. This check valve and associated downstream piping, valves and instruments are evaluated with the Nuclear Boiler Instrumentation System. Additional portions of the system included in the Control Rod Drive System boundary include the piping and valves associated with the friction test station, and the piping and valves associated with the sensing line for reactor pressure above core plate, beginning after the safety related manual isolation valve. This valve as well as the piping back to the reactor vessel are evaluated with the Nuclear Boiler Instrumentation System. All associated piping, components and instrumentation contained within the flow paths described above are included in the Control Rod Drive System boundary

Included in the license renewal scoping boundary of the Control Rod Drive System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related to nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor Building and the Auxiliary Building. Included in this boundary are pressure retaining components relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the Control Rod Drive System boundary are the control rod drive housings, which are evaluated with Reactor Internals, and stub tubes, which are evaluated with the Reactor Pressure Vessel. Also not included in the Control Rod Drive System license renewal scoping boundary are the following interfacing systems, which are evaluated as separate license renewal systems:

Control Rods
Compressed Air System
Equipment and Floor Drainage System
Condensate Storage and Transfer System
Closed Cooling Water System
Reactor Pressure Vessel
Reactor Recirculation System
Nuclear Boiler Instrumentation

Reason for Scope Determination

The Control Rod Drive System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the 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), Anticipated Transient Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide reactor coolant pressure boundary. The control rod drive mechanisms (CRDMs) are considered part of the reactor pressure boundary. 10 CFR 54.4(a)(1)

2. Introduce negative reactivity to make the reactor subcritical. The system inserts control rods from Reactor Protection System signals. 10 CFR 54.4(a)(1)

3. Provide primary containment boundary. The system provides containment isolation at each rod insert and withdraw line and at the reactor recirculation pump purge seal penetrations. 10 CFR 54.4(a)(1)

4. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The system includes nonsafety-related piping within the Reactor and Auxilliary Buildings. 10 CFR 54.4(a)(2)

5. 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). The system is credited for reactor shutdown. 10 CFR 54.4(a)(3)

6. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The system includes containment isolation valves, which are part of the Environmental Qualification program. 10 CFR 54.4(a)(3)

7. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Anticipated Transient Without Scram (10 CFR 50.62). The system is required to insert control rods using signals from the Redundant Reactivity Control System. 10 CFR 54.4(a)(3)

8. 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). The system is credited for reactor shutdown. 10 CFR 54.4(a)(3)

UFSAR References

3.9.4
4.6

License Renewal Boundary Drawings

LR-M-08-0, Sheet 2
LR-M-23-1, Sheet 2
LR-M-42-1, Sheet 1
LR-M-43-1, Sheet 1
LR-M-46-1, Sheet 1
LR-M-46-1, Sheet 2
LR-M-47-1, Sheet 1

Table 2.3.3-6 Control Rod Drive System
Components Subject to Aging Management Review

Component Type	Intended Function
Accumulator	Pressure Boundary
Bolting	Mechanical Closure
Filter Housing	Leakage Boundary
Flow Device	Leakage Boundary
Flow Element	Leakage Boundary
Gearbox	Leakage Boundary
Heat Exchanger Components (CRD Pump Gear Oil Cooler)	Leakage Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Pump Casing (CRD)	Leakage Boundary
Restricting Orifices	Leakage Boundary
Rupture Disks	Pressure Boundary
Sensor Element	Leakage Boundary
Strainer Body	Leakage Boundary
Thermowell	Leakage Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-6 Control Rod Drive System
Summary of Aging Management Evaluation

2.3.3.7 Control Room and Control Area HVAC Systems

System Purpose

The Control Room and Control Area HVAC Systems is a mechanical system designed to provide normal and emergency ventilation to the control room and associated areas in the Auxiliary Building. The Control Room and Control Area HVAC System consists of the following plant systems: the control room supply, the control area exhaust, the control room emergency filter, the control equipment room supply, the control area battery exhaust, the control area smoke exhaust, the wing area supply, the wing area exhaust, elevator machine room wall exhaust fan and the compartment electric unit heaters.

The purpose of the Control Room and Control Area HVAC Systems is to maintain habitability conditions within the control room envelope (senior shift supervisors office, computer room, instructional viewing room, ready room, storage room and toilet rooms), maintain area temperatures within acceptable limits, maintain hydrogen concentrations for all battery rooms below 2%, and remove smoke and noxious gases in the event of a fire. The Control Area Ventilation System accomplishes this purpose by regulating temperature, humidity, and pressure during normal and accident conditions, and by providing adequate ventilation flow capacity.

The system monitors radiation levels at the outside air intakes, and automatically diverts the outside air supply through charcoal filter trains to provide a habitable environment for control room operators following a radiological release event. The filter trains can be operated by filtering a mixture of recirculation air and outside air or by filtering 100% recirculation air with no outside air (full recirculation mode). The Control Room and Control Area Ventilation System maintains room pressure above that of the adjacent areas to prevent in leakage into the main control room, except when the system is operating in the full recirculation mode.

System Operation

The control room supply and control area exhaust plant systems consists of redundant supply, exhaust and return air systems and air handling units used to maintain habitable conditions in the main control room and associated adjacent areas. Each redundant loop consists of a control room return air fan, supply fan, exhaust fan, electric heating coil, humidifier, cooling coil, filters, controls, detectors, instrumentation and distribution ductwork. The Control Area Chilled Water System supplies the chilled water for the cooling coils. The cooling coils are evaluated in the Control Area Chilled Water System. One of the redundant loops is normally operating with the other loop maintained in standby. During accident conditions, the control room emergency filter plant system is automatically placed into service.

The control room emergency filter plant system is safety-related and consists of two 100% filter trains. Each filter train consists of an electric heating coil, pre-filter, upstream and downstream HEPA filters and a charcoal absorber. Each control room emergency filter train operates in series with one control room supply fan unit and return unit. The control room emergency filter system is automatically initiated in the event of a LOCA or when a high radiation level is detected at the outside air intake. The system can be manually placed either into the full or partial recirculation mode. The control room emergency filter unit is completely redundant and is normally in a standby mode.

The control equipment room supply plant system provides ventilation, cooling and heating to diesel area HVAC equipment room and all elevations within the control area of the Auxiliary Building, except the main control room. The control equipment room supply system is safety-related and consists of two 100% capacity air handling units, each consisting of a fan, low efficiency pre-filter, cooling coils, an electric heater, high efficiency filter, controls, instrumentation and distribution ductwork. The Control Area Chilled Water System supplies the chilled water for the cooling coils. The cooling coils are evaluated in the Control Area Chilled Water System. The system filters and heats or cools a mixture of recirculated air and outside air. One of the redundant loops is normally operating with the other loop maintained in standby. Failure of the operating fan will automatically start the standby system.

The control area battery exhaust plant system consists of two 100% capacity exhaust fans, a control damper and tornado damper. This safety-related plant system is designed to maintain environmental conditions and exhaust potential hydrogen gasses generated in the battery compartments during normal and emergency conditions. One of the fans is normally in operation with the other fan in standby. Upon a low flow condition or an operating fan failure, the standby unit will automatically start.

The control area smoke exhaust plant system is a nonsafety-related system and consists of a single 100% capacity fan and associated ductwork. The system is normally maintained in standby. The system is available to exhaust smoke and fumes in the event of a fire in the control area of the Auxiliary Building. Smoke from an effected area is purged by manually opening the appropriate dampers and starting the fan. The control area smoke exhaust fan will only be placed into service on post fire conditions to remove smoke once a fire has been extinguished, however this exhaust fan is not required to perform an intended function for the Fire Protection Program.

The wing area supply and exhaust plant systems are not safety-related, and are designed to maintain the wing area within the auxiliary building at specified temperatures. The systems consist of two 50% supply and exhaust fans that are designed to run continuously during normal plant operation. The supply units provide a source of clean outside air, which flows through the filter unit consisting of an intake roughing and high capacity filters, steam heating coil, and supply ductwork.

Included in the Control Room and Control Area Ventilation System is the elevator machine room wall exhauster fan. The nonsafety-related elevator machine room wall exhauster flow path is from the machine room compartment directly to the outdoors when placed into operation. This nonsafety-related fan is a full capacity wall mounted fan and is manually started and stopped if ventilation of the compartment is required. Also included are the compartment electric unit heaters. These self contained heaters will automatically operate using local thermostats.

For more detailed information, see UFSAR sections 6.4 and 9.4.1.

<u>System Boundary</u>

The control room supply plant system boundary begins at the inlet louver, and continues to the inlet plenums containing the radiation and smoke detectors. The system boundary continues through tornado and inlet dampers and the supply ductwork, to the inlet to the control room return air fans, where the supply ductwork connects to the return air ductwork from the various areas of the control room. The system boundary continues through the control room return air fans and leads to the supply ductwork of the control room supply unit. The control room supply unit includes the low and high efficiency filters, supply fans, chilled water cooling and electric heating coils and humidifier. The chilled water cooling coil is evaluated as part of the Control Area Chilled Water System. After exiting the control room supply unit, the system boundary connects to common discharge ductwork that distributes air to the various control room areas. The boundary ends at the discharge registers, located in the following rooms: computer room, control room, watch engineer room, storage room, ready room, instructional viewing room and console pit room. The 24" diameter reinforced concrete missile shield tube is evaluated as part of the Auxiliary Building/Diesel Generator Area structure for license renewal aging management review.

The control room exhaust plant system boundary begins at the control room area exhaust registers and continues to a common exhaust duct, through two isolation dampers, and continuing to the exhaust fans inlet. The system boundary continues through the fans and discharge ductwork and through the fan discharge damper and tornado damper and the boundary ends at the exhaust outside the building. The control room exhaust plant system is not safety-related, except for the isolation dampers, tornado damper and associated ductwork. The isolation dampers are required to close to isolate the control room envelope during accident conditions. The tornado damper closes in the event of severe weather, to provide tornado protection to the structure and enclosed safety-related systems. The isolation dampers, tornado damper and associated ductwork are included in the scope of license renewal. The remainder of the control room exhaust plant system, including the exhaust fans and fan inlet and discharge dampers, are not required to perform an intended function and are not in scope for license renewal.

The control room emergency filter plant system is safety-related. The boundary begins at the outdoor inlet isolation dampers, and includes the connecting ductwork to the inlet of the control room return air fan. The boundary continues to the inlet of the control room emergency filter supply fan and through the control room emergency filter unit, which include an electric heating coil, roughing filter, charcoal absorber and up stream and down stream HEPA filters and connecting ductwork, instruments and controls. The plant system boundary ends at the inlet connection to the control room supply unit.

The control equipment room supply plant system boundary begins at the outside air inlet louvers and continues to the inlet to the control equipment room supply units. The system boundary continues through the control equipment room supply units that include low and high efficiency filters, a fan, an electric heater, a cooling coil, and associated instruments and controls. The chilled water cooling coil will be evaluated as part of the Control Area Chilled Water System. After exiting the control equipment room supply unit, the system boundary continues through a common discharge duct and distributes air to various control room areas within the Auxiliary Building. Also included in the system boundary is the return air registers and ductwork that provide return air flow from the various control room areas to a connection with the control equipment room supply unit inlet ductwork.

The control area battery exhaust plant system boundary begins at the air inlet registers located in the battery rooms and continues through the exhaust ductwork to the inlet to the control area battery exhaust fans. The system boundary continues through the discharge ductwork from the fans and through the tornado dampers, and the system boundary ends at the outlet from the Auxiliary Building.

Not included in the scope of license renewal is the control area smoke exhaust plant system, wing area supply plant system, wing area exhaust plant system, elevator machine room exhaust fan and the compartment electric unit heaters of the Control Room and Control Area Ventilation System. These plant systems are not safety-related and do not perform or support license renewal intended functions, and are not included in the scope of license renewal.

Not included in the Control Room and Control Area Ventilation System license renewal scoping boundary are the following interfacing systems, which are evaluated as a separate license renewal systems:

Leak Detection and Radiation Monitoring System
Control Area Chilled Water System
Fire Protection System
Makeup Demineralizer System

Reason for Scope Determination

The Control Room and Control Area HVAC Systems meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. The Control Room and Control Area HVAC System is not in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system would not prevent satisfactory accomplishment of functions(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is 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). The Control Room and Control Area Ventilation System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49), or Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Maintain emergency temperature limits within areas containing safety-related components. The Control Room and Control Area Ventilation System maintains operating conditions for safety related equipment within required limits. 10 CFR 54.4(a)(1)

2. Provide centralized area for control and monitoring of nuclear safety-related equipment. The Control Room and Control Area Ventilation System supports the control room envelope, which is designed to provide habitability of the control room under all design conditions. 10 CFR 54.4(a)(1)

3. Relied upon in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection. (10 CFR 50.48) The Control Room and Control Area Ventilation System provides ventilation for equipment required during safe shutdown. 10 CFR 54.4(a)(3)

4. 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) The Control Room and Control Area Ventilation System maintains control room habitability during coping and restoration. 10 CFR 54.4(a)(3)

UFSAR References

9.4.1
6.4

License Renewal Boundary Drawings

LR-M-89-1, Sheet 1

Table 2.3.3-7 Control Room and Control Area HVAC Systems
Components Subject to Aging Management Review

Component Type	Intended Function
Bird Screen	Filter
Bolting	Mechanical Closure
Damper Housing	Pressure Boundary
Door Seal	Pressure Boundary
Drain Traps	Pressure Boundary
Ducting and Components	Pressure Boundary
Electric Heaters (Housing)	Pressure Boundary
Fan Housing	Pressure Boundary
Filter Housing	Pressure Boundary
Flexible Connection	Pressure Boundary
Flow Element	Pressure Boundary
Heat Exchanger Components (Control Room Supply)	Evaluated with the Control Area Chilled Water System
Louver	Pressure Boundary
Nozzle	Spray
Piping and Fittings	Pressure Boundary
Sensor Element (In-Duct Radiation Detector)	Pressure Boundary
Thermowell	Pressure Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-7 Control Room and Control Area HVAC Systems
Summary of Aging Management Evaluation

2.3.3.8 Cranes & Hoists

System Purpose

Cranes and Hoists consists of load handling bridge cranes, jib cranes, lifting devices, and hoists provided throughout the facility to support operation and maintenance activities. Cranes and Hoists include the cranes and hoists required to comply with the requirements of NUREG-0612, Control of Heavy Loads, and hoists for handling light loads. Major cranes include the reactor building polar crane and the turbine building crane.

The reactor building polar crane services the operating floor and is used to lift heavy loads such as the reactor closure head. The crane is also used to handle new fuel and transport the spent fuel cask. The reactor building polar crane main hoist and auxiliary hoist are designed to be single failure proof in conformance with NUREG-0554 and NUREG-0612. The crane is designed to include seismic loading for the OBE and SSE seismic events and is classified as seismic Category I.

The turbine building crane services the operating floor and is used to lift loads to support turbine repairs or maintenance. The crane is designed as seismic Category II.

The purpose of Cranes and Hoists is to safely move material and equipment as required to support operations and maintenance activities. The Cranes and Hoists accomplish this by compliance with NUREG-0612 and use of written procedures so damage resulting from a heavy load drop will not prevent safe shutdown of the reactor.

Included in the evaluation boundary of Cranes and Hoists are load handling systems in various areas of the facility. Cranes and hoists that are in the scope of NUREG-0612 are in scope for license renewal. Other cranes and hoists that are not in the scope of NUREG-0612 but travel in the vicinity of safety-related systems, structures, and components (SSCs) are also in scope for license renewal, if it is determined that their failure could impact a safety-related function. As a result, the following cranes and hoists are in scope for license renewal:

- reactor building polar crane
- personnel air lock hoist
- recirculation pump motor hoist
- high pressure coolant injection pump and turbine hoist
- reactor core isolation cooling pump and turbine hoist
- vacuum breaker valve removal hoist
- main steam line relief valve removal hoist
- inboard main steam isolation valve hoist
- main steam tunnel underhung crane
- diesel generator underhung crane
- intake structure gantry crane
- personnel lock shield removal hoist
- control rod drive service hoist
- safety auxiliary cooling system pumps hoist
- safety auxiliary cooling system heat exchanger hoists
- control rod drive transfer cask jib crane
- service water strainers trolley beam hoists
- service water crane

The boundary for Cranes and Hoists is limited to load bearing structural components such as, the bridge, the trolley, rail system (rails, rail clips, and rail fasteners), structural bolts, lifting devices, monorail beams, and jib crane structural members.

Cranes and hoists that were determined not in scope for license renewal are:

- reactor water clean-up filter/demineralizer hoist
- turbine building bridge crane
- feedwater heater removal hoist
- heating and ventilation equipment removal hoist
- motor-generator set hoist (recirculation pump motors)
- secondary condensate pump hoist
- reactor feed pump hoist
- water box removal hoist
- steam packing exhauster hoist
- turbine generator auxiliary crane
- chiller tube removal hoist
- emergency air compressor hoist
- main air compressor hoist
- vacuum pump water cooler hoist
- heat and cooling coil removal hoist
- solid radwaste monorail
- solid radwaste bridge crane
- demineralizer removal hoist
- demineralizer evaporator hoist
- equipment decontamination room hoist
- machine shop underhung crane
- waste evaporator recirculation pump hoist
- waste evaporator hoist
- recombiner system hoist
- feedwater flow straightener hoists
- steam jet air ejector hoist
- low level radwaste storage facility crane
- hydrogen bottles storage hoist
- demineralizer strainer basket hoist
- lock shield removal hoist
- 2 ton monorail in Torus

Failure of these cranes and hoists will not impact a safety-related intended function. Personnel lifts, pump up hydraulic lifts, two-man and one-man lifts are portable equipment and are not in scope for license renewal.

Not included in the evaluation boundary of Cranes and Hoists are the refueling platform, overhead crane structural support steel, and crane runway girders. The refueling platform is separately evaluated with the Fuel Handling and Storage System. The structural support concrete, steel and runway girders are included with the structure serviced by the crane.

For more detailed information, refer to UFSAR Section 9.1.4 and Section 9.1.5.

System Operation

Not Required

System Boundary

Not Required

Reason for Scope Determination

Cranes and Hoists meet 10 CFR 54.4(a)(1) because they are a safety-related system that is relied upon to remain functional during and following design basis events. They meet 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). They do not meet 10 CFR 54.4(a)(3) because Cranes and Hoists are not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48), Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provides physical support, shelter and protection for safety-related systems, structures, and components (SSCs). The reactor building polar crane is classified as safety-related (seismic category I) and is used to transport heavy loads over the irradiated fuel and above and near safety-related components. 10 CFR 54.4(a)(1)

2. Provides a safe means for handling safety-related components and loads above or near safety-related components. The other in scope cranes and hoists handle loads above or near safety-related components. 10 CFR 54.4(a)(2)

UFSAR References

9.1.4
9.1.5
Table 9.1-10

License Renewal Boundary Drawings

Not Required

Table 2.3.3-8 **Cranes & Hoists**
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Structural Support
Crane/Hoist (Bridge / Trolley / Girders)	Structural Support
Crane/Hoist (Jib Crane Columns / Beams / Plates / Anchorage)	Structural Support
Crane/Hoist (Monorail Beams / Lifting Devices / Plates)	Structural Support
Crane/Hoist (Rail System)	Structural Support

The aging management review results for these components are provided in:

Table 3.3.2-8 Cranes & Hoists
Summary of Aging Management Evaluation

2.3.3.9 Equipment and Floor Drainage System

System Purpose

The Equipment and Floor Drainage System is a normally operating mechanical system designed to collect and transfer radioactive and nonradioactive liquid waste for processing or discharge to the cooling tower basin or Delaware River. The Equipment and Floor Drainage System consists of the following plant systems: building and equipment drains, decontamination facilities, building sewage, storm drainage, chemical waste, oily waste, normal drains, floor drain collection, and control rod drive removal and cleaning. The Equipment and Floor Drainage System is in scope for License Renewal. However, major portions of the Equipment and Floor Drainage System are not required to perform intended functions and are not in scope. The Equipment and Floor Drainage System has several interfaces with other systems that are not in the license renewal boundary of the Equipment and Floor Drainage System.

The plant systems that make up the Equipment and Floor Drainage System can be divided into three general groups: Radioactive Waste Drainage Systems, Nonradioactive Waste Drainage Systems, and Sewage and Storm Drainage Systems.

The radioactive waste drainage plant system consists of building and equipment drains, and control rod drive removal and cleaning, with the building and equipment drains consisting of the following subsystems: clean radwaste, dirty radwaste, decontamination radwaste, high conductivity radwaste, and oily radwaste. The radioactive drains transfer the collected water to the Radwaste System (evaluated separately as a license renewal system) for processing.

The nonradioactive waste drainage plant systems consist of chemical waste, oily waste, normal drains and floor drain collection. The nonradioactive drains transfer the collected water to the low volume and oily waste water treatment system, which is part of the Oily Waste system, for processing to meet New Jersey Pollution Discharge Elimination Systems permit limitations prior to discharge to the Delaware River.

The sewage and storm drainage plant systems consist of building sewage and storm drainage. Storm drainage is directed to the Delaware River. Building sewage is transferred to the sewage treatment plant, which is part of the building sewage system, for processing to meet New Jersey Pollution Discharge Elimination Systems permit limitations prior to discharge to the Delaware River.

The purpose of the Equipment and Floor Drainage System is to collect plant effluents and transfer them for the appropriate processing or discharge them to the cooling tower basin or Delaware River. The Equipment and Floor Drainage System accomplishes this purpose through the use of gravity drain lines, sumps, and pumps used to separate waste drainage based on the source point of the drainage. The Equipment and Floor Drainage System is designed to accommodate the volumes of fluids resulting from maintenance activities, system flushing, rinsing operations, and other plant work and is sized to minimize the potential for plant flooding.

No portions of the Equipment and Floor Drainage System are safety related. Portions of the oily waste system, normal drains system, and dirty radwaste subsystem are relied upon to perform a function that demonstrates compliance with the Commission's regulations for Fire

Protection. Portions of the remaining Equipment and Floor Drainage System piping and valves are in the scope of license renewal for spatial interaction only.

System Operation

The Equipment and Floor Drainage System is comprised of collection piping, equipment drains, floor drains, vents, traps, cleanouts, collection sumps, sump pumps, waste treatment components, and associated valves and instrumentation. Each sump, excluding the emergency sump in the Turbine Building, has a duplex pump arrangement. The backup pump starts after the water level rises above the first pump start level. The lead pump is alternated with each pump down cycle.

The plant systems that provide for collection and processing of various liquid wastes operate as listed below:

Radioactive Waste Drainage Systems:

The clean radwaste system collects liquid wastes of high chemical purity from the drywell, Reactor Building, Auxiliary Building, and Turbine Building. The drainage has hard piped connections to equipment drain funnels that convey the wastes by gravity to a sump in the respective enclosure. The sump pumps transfer the collected water to the Radwaste System (evaluated separately as a license renewal system). The drywell and reactor building equipment drain sumps, both portions of the clean radwaste subsystem, have pump out rate and level alarms (evaluated with Leak Detection and Radiation Monitoring System) used to detect reactor coolant pressure boundary leakage.

The dirty radwaste system collects liquid wastes of lower chemical purity from the drywell and the Reactor Building, Auxiliary Building, and Turbine Building. The drainage is collected by floor drains and equipment drain funnels and is conveyed by gravity to a sump in the respective enclosure. In the circulating water area of the turbine building, the floor drain sump is crosstied with the emergency sump to collect a flow rate input higher than the floor drain sump pump discharge capacity. The sump pumps transfer the collected water to the Radwaste System. The drywell and reactor building floor drain sumps, both portions of the dirty radwaste system, have pump out rate and level alarms (evaluated with Leak Detection and Radiation Monitoring System) used to detect reactor coolant pressure boundary leakage. The emergency core cooling system room drains are fitted with check valves in the drain lines that operate to prevent emergency core cooling system room flooding due to backflow through the drain system.

The high conductivity radwaste system collects liquid wastes of high conductivity from the Auxiliary and Turbine Buildings. The drainage is collected by floor drains and equipment drain funnels and is conveyed by gravity to a sump in the respective enclosure. The sump pumps transfer the collected water to the Radwaste System.

The decontamination radwaste system collects corrosive, potentially radioactive liquid wastes from the washdown and decontamination areas in the Reactor Building, Auxiliary Building, and Turbine Buildings and from floor and equipment drain filters, condensate and fuel pool filter demineralizers, and chemistry laboratory drains. The wastes are collected by floor drains and by hard piped connections to equipment drain funnels and are conveyed to the Radwaste System chemical waste tank located in the Auxiliary Building.

The oily radwaste system collects potentially radioactive, oil water mixtures from the reactor feed pump rooms, motor generator set rooms, lube oil reservoir area, lube oil storage tank areas, mezzanine/air equipment area, and lube oil reservoir rooms for the reactor feed pump turbine. The drainage is collected by floor drains and equipment drain funnels and is conveyed to the oil water separator located in the Turbine Building. The separated oil is discharged to 55-gallon drums, and the clarified effluent water is conveyed to the dirty radwaste drainage system in the Turbine Building.

The turbine building circulating water dewatering sump collects drainage that is potentially contaminated with tritium. Following sampling to confirm appropriately low contamination levels this water can be discharged to the cooling tower basin.

Nonradioactive Waste Drainage Systems:

The oily waste drainage system collects liquid wastes from the nonradioactive equipment areas in which oil is expected to be present. These areas include the circulating water pumphouse, Diesel Generator Building, transformer areas, oil circuit breaker areas, and Auxiliary Buildings.

The chemical waste drainage system collects liquid wastes containing nonradioactive chemicals and corrosive substances from equipment and floor drains in the sodium hypochlorite and sulphuric acid/caustic storage tank areas, diesel building HVAC units and chillers, and corridors outside diesel building battery rooms on elevation 163'.

The normal drains and floor drain collection systems collect liquid wastes from the nonradioactive equipment and floor drains. Condensate drainage from four radwaste area supply units may also be collected by the normal waste system.

Oily, chemical, normal drains, and floor drain collection systems drain to the low volume and oily waste treatment system in the yard.

Sewage and Storm Drainage Systems:

The Building Sewage system collects liquid wastes from all plant plumbing fixtures, with the exception of the lavatory basins and showers in the personnel decontamination area. Building Sewage drains to the Sewage Treatment system for treatment and discharge.

Storm drainage systems collect water from precipitation on enclosure roofs, areaways, the ground, and paved and unpaved surfaces outside the buildings. Storm water drains to the Delaware River.

For more detailed information, see UFSAR section 9.3

System Boundary

The Equipment and Floor Drainage System boundary begins with the input to the individual floor, equipment, or storm drains and continues through the collection system piping to the respective sump pump discharge or Radwaste System (radioactive wastes), or to the cooling tower basin or Delaware River (nonradioactive wastes). The boundary also includes the sewage treatment and oily waste processing equipment associated with these waste streams prior to their release.

The Equipment and Floor Drainage System supports the Fire Protection intended function. This portion of the system begins with the individual floor drain in the rooms containing safety-related equipment and continues through gravity drain to a sump in the Reactor Building, Auxiliary Building Control/Diesel Generator Area, or Intake Structure. This portion of the system ends at the respective sump inlet.

Also included in the license renewal scoping boundary of the Equipment and Floor Drainage System are those water filled portions of nonsafety-related piping and equipment located in proximity to equipment performing a safety-related function. This includes the nonsafety-related portions of the system located in the Primary Containment, Reactor Building, Auxiliary Building Control/Diesel Generator Area, and Intake Structure. Included in this boundary are pressure-retaining components relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the license renewal boundary drawings for identification of this boundary, shown in red.

With the exception of a section of drain piping located in the Auxiliary Building Radwaste Area that is included in scope due to potential spatial interaction with the Remote Shutdown Panel, the remainder of the Equipment and Floor Drainage System piping and components associated with the Turbine Building, Auxiliary Building Service/Radwaste Area, Circulating Water pumphouse, Sewage Treatment system, low volume and oily waste treatment system, and piping not in the vicinity of safety-related equipment are not required to support intended functions. This portion of the Equipment and Floor Drainage System is not included in the scope of license renewal.

Not included in the Equipment and Floor Drainage System license renewal scoping boundary are the following interfacing systems which are separately evaluated as license renewal systems:

Chilled Water System
Circulating Water System
Leak Detection and Radiation Monitoring System
Closed Cycle Cooling Water System
Radwaste System

Reason for Scope Determination

The Equipment and Floor Drainage System does not meet 10 CFR 54.4(a)(1) because no portion of the system is safety-related and relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in safety analyses and plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection (10 CFR 50.48). The Equipment and Floor Drainage System is not relied upon in any safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Station Blackout (10 CFR 50.63), Environmental Qualification (10 CFR 50.49), or Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Resist nonsafety related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Equipment and Floor Drainage System includes nonsafety-related water filled lines in the Primary Containment, Reactor Building and Auxiliary Building Control/Diesel Generator Area that have the potential for spatial interaction (spray or leakage) with safety-related SSCs. 10 CFR 54.4(a)(2)

2. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection. (10 CFR 50.48) The Equipment and Floor Drainage System is relied upon in the Fire Protection analysis to drain safety-related equipment rooms. 10 CFR 54.4(a)(3)

UFSAR References

1.2
1.8
3.4
5.2
6.2
9.1
9.3.3

License Renewal Boundary Drawings

LR-M-10-1, Sheet 1
LR-M-23-1, Sheet 2
LR-M-25-1, Sheet 1
LR-M-44-1, Sheet 1
LR-M-47-1, Sheet 1
LR-M-61-1, Sheet 1
LR-M-61-1, Sheet 2
LR-M-83-1, Sheet 1
LR-M-84-1, Sheet 1
LR-M-87-1, Sheet 5
LR-M-89-1, Sheet 1
LR-M-94-0, Sheet 1
LR-M-97-0, Sheet 5

Table 2.3.3-9 Equipment and Floor Drainage System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Drum Traps	Leakage Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Tanks (Neutralizers and Oil Interceptor)	Leakage Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-9 Equipment and Floor Drainage System
Summary of Aging Management Evaluation

2.3.3.10 Fire Protection System

System Purpose

The Fire Protection System is a normally operating mechanical system, designed for the rapid detection and suppression of a fire at the plant. The Fire Protection System is in scope for License Renewal. However, portions of the Fire Protection System are not required to perform intended functions and are not in scope.

The Fire Protection System consists of the fire protection water systems, carbon dioxide systems, halon system, foam system, portable fire extinguishers, and fire detection and signaling systems. These systems work in conjunction with the design of the physical plant design features to provide for overall protection for Hope Creek. The physical plant features consist of fire barriers, fire doors and fire rated enclosures.

The purpose of the Fire Protection System is to prevent fires from starting, promptly detect and suppress fires to limit damage, and in the event of a fire allow for safe shutdown to occur. The Fire Protection System accomplishes this purpose by providing fire protection equipment in the form of detectors, alarms, fire barriers and suppression for selected areas of the plant.

The Fire Protection System includes subsystems that can be actuated automatically and/or manually upon detection of a fire. The Hope Creek fire protection water system is physically connected to the Salem fire water protection system by the use of sectionalizing valves. The two systems are normally isolated from each other.

System Operation

The Fire Protection System is comprised of water, carbon dioxide, Halon and foam suppression systems described as follows:

The fire protection water system is supplied by one electric and one diesel driven fire pump, each are full 100% capacity pumps. Both pumps are housed in a building outside of the power block. Within this housing, both pumps are separated by a 3-hour firewall. These pumps are automatically started on low header pressure, and can be manually started remotely from the main control room or locally at the pumps. The diesel driven fire pump has its own fuel supply located next to the pump house. The portion of the fuel supply line from the outdoor tank to the diesel engine is provided with electrical heat tracing. Loss of the electric heat trace on the diesel fire pump fuel supply line does not change the operator response to a fire. The fuel supply is a blended mixture, which is appropriate for this climate to prevent gelling. Therefore, the electric heat trace is not required to support the intended functions of the Fire Protection System and is not included within the scope of license renewal. Both pumps take suction from two fire water storage tanks. Each fire pump has a discharge that connects to the main fire header loop. The pumps, tanks, discharge piping from the pumps, and controls are completely separate and redundant.

A fire jockey pump normally maintains fire water system pressure in the main fire header loop, with the electric and diesel fire pumps maintained in standby. The electric and diesel fire pump discharge lines connect with the underground main fire header loop. The fire header loop encircles the plant and provides fire protection water to the yard fire hydrants, fixed pipe water suppression systems and fire hose stations. The fire water enters the power block at several locations from branch headers off the main fire header loop. The main fire header loop also supplies remote facilities away from the power block. Some of these locations are not in scope. Sectionalizing valves of the post indicator type are provided on the loop to allow isolation of the various sections for maintenance.

The fire water suppression systems include wet pipe sprinkler and deluge systems, pre-action water spray systems and manual pre-action water spray systems. Hose stations have been provided within the plant buildings and are located such that for safety-related areas of the plant, no single primary piping failure can impair the fire protection water system's ability to provide coverage for a single area. Adjacent area backup hose stations and available pumping capability provide added assurance that areas within the power block can be reached with an effective hose stream after any single piping failure.

A total carbon dioxide flooding system protects the Emergency Diesel Generator Rooms, Emergency Diesel Generator fuel oil storage tank rooms and the control equipment mezzanine. The turbine generator exciter bearings are protected by a separate high-pressure carbon dioxide system. Local temperature sensors actuate all carbon dioxide systems automatically. The carbon dioxide Fire Protection System is in scope for license renewal. However, the carbon dioxide hose reel portions of the carbon dioxide Fire Protection System are permanently valved out of service and are not required to perform intended functions and therefore, are not in scope.

A manually actuated total flooding Halon system provides fire protection for the main control room console and associated pit. Halon storage bottles are not permanently connected to the system discharge piping but stored in a room near the main control room. In the event there is a fire in either the console or pit, which cannot be extinguished by portable fire extinguishers, the Halon storage containers are hooked up to the discharge piping and the system is manually actuated.

A manually actuated mechanical foam system provides fire protection for the fuel oil storage tank located in the yard. A hose connection on the foam header is provided to supply the foam solution from a fire truck to the foam maker mounted onto the fuel oil storage tank.

Portable fire extinguishers are provided at strategic locations throughout Hope Creek and also in the vicinity of all safety-related pumps in accordance with NFPA guidelines. In general, dry chemical type fire extinguishers and carbon dioxide type fire extinguishers are provided at these locations. Pressurized water fire extinguishers are provided in the reactor building and service water intake structure to supplement the normally "dry" standpipe and hose station system in these areas. These extinguishers provide backup fire fighting capability only. Large wheeled dry type fire extinguishers are also available for use on large flammable liquid fires. These wheeled extinguishers are located near pumps that contain a substantial quantity of lubricating oils. These units also provide a supplement to the standpipe and hose station systems in these areas.

Early warning fire and smoke detection and signaling systems provide a means of detecting the presence of a fire and initiating an alarm in the main control room. In addition, some of these fire detection systems will automatically initiate the appropriate fire protection system. There are four types of detectors used at Hope Creek: ionization, flame, photoelectric and thermal detectors. Ionization detectors or incipient fire detectors (IFD) sound an alarm at the presence of invisible combustion products during the incipient stage of fire. Flame detectors respond directly to the infrared radiation emanating from a flame in areas where fire develops rapidly. Photoelectric smoke detectors, which will respond to visible smoke, are used in areas where fire potential might exist and areas that are exposed to a radiation dose rate greater than that recommended for ionization detectors. Rate compensating thermal detection responds to area high temperature conditions. All of the detectors go to the fire protection status panel located in the main control room. The fire status panel provides an alarm to the main control room.

For more detailed information, see UFSAR Section 9.5 and Appendix 9A.

System Boundary

The boundary of the Fire Protection System begins at the two fire tanks, which supply water to the two 100% capacity pumps and the jockey pump. The discharge from each of the main fire pumps ties into the main fire header loop, which terminates at the suppression systems, hydrants and hose stations. Included in this boundary is a Salem cross connect from the Hope Creek fire protection main fire header loop that is physically connected and isolated from the Salem fire protection yard loop. The main fire header loop continues around the perimeter of the power block, and includes numerous branch lines that supply various sprinkler systems, hose stations and fire hydrants. One branch line connects to the fire protection hose stations and sprinkler systems to the Intake Structure. Sectionalizing post indicator type valves are provided on the main fire header loop to allow isolation of various sections for maintenance.

There are two separate carbon dioxide systems at Hope Creek Generating Station. The first system is for the total flooding carbon dioxide suppression system protecting three fire zones: the emergency diesel generators, emergency diesel generator fuel oil storage tank rooms and control equipment mezzanine areas. This system begins at the 17-ton carbon dioxide storage tank, and continues through the normally closed master control valve to a common distribution header. Each of the three fire zones has a feed distribution header to a normally closed discharge control valve to each room's spray nozzles. The second carbon dioxide system is for the local application of carbon dioxide for the oil piping located inside the main turbine generator exciter housing. The boundary starts at the 4-ton carbon dioxide storage tank and continues through a normally closed master control valve. Upon actuation, the carbon dioxide discharges through the header and into the spray nozzles discharging into the main generator housing.

The boundary for the halon suppression system that protects the main control room console and pit begins with the halon discharge piping including the flexible hose connections and continues through the normally closed discharge control valve. In case of fire, the halon storage cylinders are connected by the use of quick-connect hoses onto the console and pit piping and then to the spray nozzles.

The boundary of the mechanical foam fire protection system begins with the connector that joins the permanent piping to the fire truck and continues to the foam maker located at the fuel oil storage tank. The foam maker discharges directly into the top of the fuel oil storage tank.

Portable fire extinguishers are included in the boundary of this license renewal system scoping evaluation, however a flow path description is not applicable for this self-contained portable equipment. Portable fire extinguishers are provided in accordance with NML, NFPA 10, and OSHA regulations and recommendations. These extinguishers are routinely inspected and replaced by station procedures and are therefore not subject to aging management review.

All associated piping, components and instrumentation contained within the flow path described above are included in the system boundary. Also included in the system boundary are the physical plant design features that consist of fire barrier walls and slabs, fire barriers, fire doors and fire rated enclosures located in the Reactor Building, Auxiliary Building, Turbine Building, and Auxiliary Building Diesel Area and Service Radwaste Building. In addition, dikes around the unit substation transformers and the Fire Pump Diesel Fuel Oil Day Tank are included in the system boundary of the Fire Protection System.

The fire detection and signaling and associated circuitry are evaluated separately as electrical commodities.

Not included in the scope of the license renewal are the piping and components associated with the abandoned construction pumps in the Fire Water Pump House. The construction diesel driven fire pump, construction motor driven and construction service water pumps are isolated from the Fire Protection System by locked closed manual isolation valves and do not support the Fire Protection System's leakage boundary intended function. This portion of the system is nonsafety-related and is not required to function to support any Fire Protection System intended function. Therefore this portion of the Fire Protection System is not required to perform an intended function and is not in the scope of license renewal. Also not included in the scope of the license renewal are the fire protection equipment located in the following area: Circulating Water Pump Structure, Auxiliary Boiler Building, Guardhouse, some portions located in the Administrative Building, Nuclear Annex, and some remote area fire hydrants. These areas do not contain safety related components and are not required to support any Fire Protection System intended functions. Therefore, these portions of the Fire Protection System are not included in the scope of license renewal.

Not included in the Fire Protection System license renewal scoping boundary is the following interfacing systems, which are separately evaluated as a license renewal system:

Compressed Air System
Fresh Water Supply System

Reason for Scope Determination

The Fire Protection System is not in scope under 10 CFR 54.4(a)(1) because no portions of the system are safety-related or relied upon to remain functional during and following design basis events. The Fire Protection System is in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection (10 CFR 50.48). The Fire Protection System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Environmental Qualification (10 CFR 50.49), Anticipated Transient Without Scram (10 CFR 50.62) or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. Fire protection piping is located throughout the entire power block (Reactor Building, Auxiliary Building) and located at the Service Water Intake Structure. 10 CFR 54.4(a)(2)

2. Relied upon in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection (10 CFR 50.48). The Fire Protection System works in conjunction with fire barriers and other plant design features, and established safe shutdown systems and procedures to demonstrate compliance with fire protection regulations. The Fire Protection System provides fire detection, alarms and suppression for vital areas in the plant, to prevent significant release of radioactive material in the event of fire. 10 CFR 54.4(a)(3)

UFSAR References

9.5.1
Appendix 9A

License Renewal Boundary Drawings

LR-M-22-0, Sheet 1
LR-M-22-0, Sheet 2
LR-M-22-0, Sheet 3
LR-M-22-0, Sheet 4
LR-M-22-0, Sheet 5
LR-M-22-0, Sheet 6
LR-M-83-1, Sheet 1
LR-M-84-1, Sheet 1
LR-M-89-1, Sheet 1
LR-M-93-0, Sheet 2

Table 2.3.3-10 <u>Fire Protection System</u>
Components Subject to Aging Management Review

Component Type	Intended Function
Bird Screen (Fire Water Tank Vents)	Filter
Bolting	Mechanical Closure
Concrete Curbs	Direct Flow (Contains Oil Spills)
Damper Housing	Fire Barrier
Damper Housing	Pressure Boundary
Doors	Fire Barrier
Electric Heaters (Fire Water Storage Tank Heaters)	Pressure Boundary
Filter Housing	Pressure Boundary
Fire Barriers (Masonry Walls: Interior)	Fire Barrier
Fire Barriers (Penetration Seals)	Fire Barrier
Fire Barriers (Walls, Ceilings and Floors)	Fire Barrier
Fire Barriers (Wraps)	Fire Barrier
Fire Hydrant	Pressure Boundary
Flame Arrestor	Pressure Boundary
Flow Element	Pressure Boundary
Gas Bottles (Halon)	Pressure Boundary
Hose Manifold	Pressure Boundary
Hoses	Pressure Boundary
Odorizer	Pressure Boundary
Piping and Fittings	Pressure Boundary
Pump Casing (Jockey Pump)	Pressure Boundary
Pump Casing (Motor and Diesel Driven Fire Pumps)	Pressure Boundary
Restricting Orifices	Pressure Boundary
Restricting Orifices	Throttle
Spray Nozzles (Carbon Dioxide)	Spray
Spray Nozzles (Foam)	Spray
Spray Nozzles (Halon)	Spray
Sprinkler Heads	Pressure Boundary
Sprinkler Heads	Spray
Strainer	Filter
Strainer (Fire Pump Suction Strainers)	Filter
Strainer (Fire Water Tank Silt Stop)	Filter
Strainer Body	Pressure Boundary

Component Type	Intended Function
Tanks (CO2- 17 Ton)	Pressure Boundary
Tanks (CO2- 4 Ton)	Pressure Boundary
Tanks (Fire Diesel Fuel Oil)	Pressure Boundary
Tanks (Fire Water)	Pressure Boundary
Tanks (Retarding Chambers)	Pressure Boundary
Thermowell	Pressure Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-10 Fire Protection System
Summary of Aging Management Evaluation

2.3.3.11 Fire Pump House Ventilation System

System Purpose

The Fire Water Pump House Ventilation System is an automatic air ventilation system designed to supply sufficient combustion air for the diesel driven fire pump engine. It is also designed to maintain the fire water pump house room air flows and temperatures in the building compartments within acceptable range by the use of louvers, heaters and roof exhaust fans.

The purpose of the Fire Water Pump House Ventilation System is to supply sufficient combustion air for the diesel fire pump. In addition, it maintains building room air temperature above freezing and will limit rise of room temperatures during the summer and maintain the equipment environment within the design temperature limits. The system accomplishes this purpose by utilizing ventilation louvers, electric unit heaters, exhaust fans and associated controls. The diesel driven fire pump compartment louver will open on a diesel driven fire pump engine start. Temperatures are maintained within the fire water pump house through heating using the compartment heaters and cooling using the compartment exhaust fans. The Fire Water Pump House Ventilation System is in scope for license renewal, however a portion of the system is not required to perform an intended function and is not in scope. This portion is the portion of the Fire Water Pump House Ventilation System that services the compartment that contains the abandoned construction diesel driven fire pump. The Fire Water Pump House Ventilation System is a stand-alone system located at the Fire Water Pump House.

System Operation

The Fire Water Pump House Ventilation System is located in the Fire Water Pump House. The Fire Water Pump House has three separate compartments. One compartment contains the Diesel Driven Fire Pump including the batteries required to start the diesel engine. The second compartment contains the full capacity Motor Driven Fire Pump and Jockey Pump. This compartment also contains the abandoned construction motor driven fire pump and construction service water pumps. The third compartment houses the abandoned construction diesel driven fire pump. There are a total of five roof exhaust fans above the three compartments. Two of the roof fans are located above the diesel driven fire pump compartment. Two additional fans are located above the motor driven fire pump and jockey pump compartment. The remaining fan, which is located above the abandoned construction diesel driven fire pump, is not in the scope of license renewal because it does not perform an intended function. Each of the three compartments has individual thermostats that automatically will start and stop the fans on increasing or decreasing compartment temperatures. There are four heaters located in the firewater pump house. One heater is located in the diesel driven fire pump compartment and one located in the abandoned construction diesel driven fire pump compartment. The remaining two heaters are located in the motor driven fire pump and jockey pump compartment. The heater in the compartment where the abandoned Construction diesel driven fire pump is housed is not in the scope of license renewal and does not perform an intended function.

The Fire Water Pump House Ventilation System maintains proper environmental temperature by the use of five exhaust fans that are normally maintained in the "auto" mode. The exhaust fans will ventilate the pump house upon increasing room temperatures as detected by indoor thermal detectors. These fans are mounted flush on the roof and are freestanding ventilators with installed gravity shutters. Upon decreasing room temperatures the electric unit heaters will energize to prevent freezing. There is no pressure boundary associated with the electric unit heaters. Since there is no pressure boundary or housing associated with the electric unit heaters, this component type is not subject to an aging management review. Separate compartment thermostats within the pump house control the four electric heaters. There are a total of five louvers located on the exterior walls of the Fire Water Pump House. These louvers allow fresh air into the building and supply sufficient combustion air supply to the diesel driven fire pump. Upon a diesel driven fire pump engine start, the diesel driven fire pump engine compartment louver will automatically open, providing the engine with sufficient air for combustion. The one louver that is located on the exterior wall of the compartment that houses the abandoned construction diesel driven fire pump is not in the scope of license renewal and does not perform an intended function.

For more detailed information, see UFSAR Section 9.5.1.

<u>System Boundary</u>

The Fire Water Pump House Ventilation System begins with outside air entering into the building through the installed compartment louvers. The air continues into the room and can flow through the compartment heaters when necessary to prevent freezing. The air then flows through the compartment and up to the ceiling where the air finally exhausts outdoors through the roof exhaust fans.

Not included in the scope of license renewal is the portion of the Fire Water Pump House Ventilation System located in the compartment that contains the abandoned construction diesel driven fire pump. The construction diesel driven fire pump is abandoned equipment that does not perform an intended function and is not in the scope of license renewal. In addition, this compartment does not contain any other component types that are in the scope of license renewal. Therefore, the portion of the Fire Water Pump House Ventilation System that is located in the compartment that contains the abandoned construction diesel driven fire pump does not perform an intended function and is not in the scope of license renewal. This portion of the ventilation system includes one louver, an electric heater and an exhaust fan.

Not included in the scoping boundary of the Fire Water Pump House Ventilation System are the Fire Pump House Structure and Fire Protection System which are separately evaluated as license renewal structure/system:

Fire Water Pump House
Fire Protection System

<u>Reason for Scope Determination</u>

The Fire Water Pump House Ventilation System is not in scope under 10 CFR 54.4(a)(1) because no portions of the system are safety-related or relied on to remain functional during and following design basis events. The Fire Water Pump House Ventilation System is not in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system would not prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection (10 CFR 50.48). The Fire Water Pump House Ventilation System is not relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49), Anticipated Transient Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Relied upon in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection (10 CFR 50.48). Adequate combustion air supply will be provided in the pump house for diesel engine combustion requirements. Proper temperatures will be maintained in the Fire Water Pump House compartments. This system accomplishes its purpose by use of ventilation exhaust fans, louvers and electric unit heaters. 10 CFR 54.4 (a)(3)

UFSAR References

9.5.1

License Renewal Boundary Drawings

LR-M-81-0, Sheet 1

Table 2.3.3-11 Fire Pump House Ventilation System
Components Subject to Aging Management Review

Component Type	Intended Function
Fan Housing	Pressure Boundary
Louver	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-11 Fire Pump House Ventilation System
Summary of Aging Management Evaluation

2.3.3.12 Fresh Water Supply System

System Purpose

The intended function of the Fresh Water Supply System for license renewal is to maintain leakage boundary integrity to preclude system interactions. For this reason, this system's pressure retaining components located in proximity to other components performing safety-related functions have been included in the scope of license renewal. This system is not required to operate to support license renewal intended functions, and is in scope for potential spatial interaction.

The Fresh Water Supply System is a normally operating mechanical system. The purpose of the system is to supply water in sufficient quantities to satisfy the demand for station potable and makeup water, safety showers, eye washes and sanitary water. The license renewal Fresh Water Supply System consists of the fresh water and domestic (potable and sanitary) water plant systems. The portions of the Fresh Water Supply System that are evaluated for license renewal scope are the components in the Auxiliary Building Control/Diesel Generator Area and Reactor Building. The Fresh Water Supply System components that are not in scope are the components located in the Auxiliary Building Service/Radwaste area, Turbine Building or yard areas where there are no safety-related components. The Fresh Water Supply System has no safety-related function.

The Fresh Water Supply System accomplishes it's purpose using wells, pumps, piping, piping components, plumbing fixtures, tanks and valves.

System Operation

The Fresh Water Supply System flow path begins where the fresh water supply system pumps water from the wells to two firewater storage tanks, a fresh water storage tank and two 10,000 gallon domestic water storage tanks in the domestic (potable and sanitary) water systems that are located in the water treatment building. Hookup for portable chlorination is also available at the wellhead. Three pumps draw water from the domestic water storage tanks and discharge it to the domestic water hydropneumatic pressure tank. Under automatic control, the first, second, and third pumps are actuated according to preset levels in the hydropneumatic pressure tank to satisfy the water demand. An air compressor replaces the air in the hydropneumatic tank if the pressure in the tank is less than a predetermined value. The air compressor operates only after the pumps stop at the maximum high water level in the tank. From the hydropneumatic pressure tank, the distribution system supplies the water to plumbing fixtures, laundry rooms, safety showers, eye washes and washing stations where the Fresh Water Supply System flow path ends. The distribution system is routed throughout the Reactor Building, Turbine Building, Auxiliary Building Service/Radwaste Area, and the Auxiliary Building Control/Diesel Area.

The Fresh Water Supply System is not required to operate to support any license renewal intended functions, but is included in the scope of license renewal as the system is liquid filled and portions of the system are located within an area in proximity of components performing a safety-related function. The areas containing safety-related components are the Auxiliary Building Control/Diesel Area and the Reactor Building.

The Fresh Water Supply System components that are not in the scope of license renewal are the components located in the Auxiliary Building Service/Radwaste Area or Turbine Building, where there are no safety-related components, or located in the yard areas.

For more detailed information, see UFSAR Section 9.2.4.

System Boundary

The license renewal scoping boundary of the Fresh Water Supply System encompasses the liquid filled portion of the system that is located in proximity to equipment performing a safety-related function. This includes the liquid filled portions of the Fresh Water Supply System located within the Auxiliary Building Control/Diesel Area and Reactor Building that are in proximity of components performing a safety-related function. Included in this boundary are pressure retaining components relied upon to preserve the leakage boundary intended function of this system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the scope of license renewal is the portion of the Fresh Water Supply System located in the Turbine Building and Auxiliary Building Service/Radwaste Area, as these portions of the system are not located within an area in proximity of components performing a safety-related function. Not included in this boundary are Fresh Water Supply System components located in bathroom and kitchen areas and storage rooms in the Auxiliary Building Control/Diesel Area because there are no safety-related components in these rooms. Components that are not required to support the system's leakage boundary intended functions are not included in the scope of license renewal.

Not included in the Fresh Water Supply System scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Auxiliary Steam System
Condensate System
Equipment and Floor Drainage System (Sanitary Waste Disposal System)
Fire Protection System
Makeup Demineralizer System
Radwaste System

Reason for Scope Determination

The Fresh Water Supply System is not in scope under 10 CFR 54.4(a)(1) because no portions of the system are safety-related or relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The system is not in scope under 10 CFR 54.4(a)(3) because it is not 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), Environmental Qualification (10 CFR 50.49), Anticipated Transient Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Fresh Water Supply System has potential for spatial interaction with safety related equipment within the Reactor Building and Auxiliary Building. 10 CFR 54.4(a)(2)

UFSAR References

9.2.4

License Renewal Boundary Drawings

LR-M-98-0, Sheet 1

Table 2.3.3-12 Fresh Water Supply System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Piping and Fittings	Leakage Boundary
Valve Body	Leakage Boundary

The aging management review results for these components are provided in:

Table 3.3.2-12 Fresh Water Supply System
Summary of Aging Management Evaluation

2.3.3.13 Fuel Handling and Storage System

System Purpose

The Fuel Handling and Storage System consists of the spent fuel storage pool and racks, new fuel storage vault and racks, cask loading pit and spent fuel cask, and fuel handling equipment.

The spent fuel storage pool and cask loading pit are enclosed and an integral part of the Reactor Building. The spent fuel storage pool and cask loading pit are reinforced concrete structures, completely lined with seam welded stainless steel liner plate that serves as a watertight barrier. The pool contains high-density stainless steel racks for storage of spent fuel, equipped with Boral poison. The pool is filled with demineralized water, with about twenty-five feet of water covering the spent fuel storage racks for radiation shielding. This provides adequate shielding for normal building occupancy by operating personnel. The Fuel Pool Cooling and Cleanup System maintains water temperature within acceptable limits. That system is evaluated with the license renewal Fuel Pool Cooling and Cleanup System. The spent fuel storage pool communicates with the reactor well through the fuel transfer canal. Removable concrete plugs and gates are inserted in the canal opening to provide a watertight boundary; except during refueling when the reactor well is also flooded for underwater transfer of nuclear fuel. The spent fuel storage pool and the racks are classified as seismic category I structures.

The new fuel storage vault is located within the reactor building adjacent to the spent fuel storage pool. The reinforced concrete vault contains aluminum racks for dry storage of new fuel bundles. The new fuel storage vault and the racks are classified as seismic Category I structures.

Fuel handling equipment consists of the reactor building overhead bridge crane, fuel pool jib cranes, the refueling platform, fuel preparation machines, new fuel inspection stand, and special purpose tools for fuel and reactor servicing.

The reactor building overhead bridge crane is separately evaluated with the license renewal Cranes and Hoists System and is not described herein.

The refueling platform is a motor driven bridge and trolley which traverses the space between the reactor well and the spent fuel storage pool. The bridge travels on rails extending on both sides of the fuel storage pool and the reactor well. The trolley runs on rails located on top of the bridge. The fuel grapple is mounted on the trolley. Two auxiliary hoists are provided on the platform. The hoists are used with an assortment of refueling and component handling tools. Together with the fuel grapple, they perform necessary tasks with irradiated fuel and core components.

Two fuel preparation machines are mounted on the walls of the fuel storage pool. Each fuel preparation machine consists of a work platform, a frame, and a movable carriage. The frame and movable carriage are located below the normal water level in the spent fuel storage pool, thus providing a water shield for the fuel assemblies being handled.

Special purpose tools include control rod grapple tool, control rod latch tool, fuel support installation tool, instrument handling tool, channel bolt wrench, fuel bundle sampler, and other tools specifically designed for handling nuclear fuel and for servicing reactor vessel internals during an outage.

The purpose of the Fuel Handling and Storage System is to support, transfer, and provide for storage of nuclear fuel in a manner that precludes inadvertent criticality and maintain shielding and cooling of spent fuel. The Fuel Handling and Storage System accomplishes this by spent fuel storage racks designed to maintain fuel in a subcritical configuration having a k(eff) less than or equal to 0.95. To preclude the possibility of raising spent fuel assemblies out of the water, the hoist incorporates redundant electrical limit switches and interlocks that prevent hoisting above the preset limit. In addition, the cables on the auxiliary hoists incorporate adjustable mechanical stops that jam the hoist cable against the hoist structure, which prevents further hoisting, if the limit switch interlock system fails. The special purpose tools facilitate handling and transfer of nuclear fuel, and assembly and disassembly of reactor vessel internals.

Included in the evaluation boundary of the Fuel Handling and Storage System are new and spent fuel storage racks, the refueling platform, fuel preparation machines, fuel pool jib cranes, new fuel inspection stand, and the special purpose tools. New and spent fuel storage racks are in scope of license renewal since they perform a safety-related function. The refueling platform is classified as a seismic category I structure, thus is in scope. The fuel preparation machines, fuel pool jib cranes and new fuel inspection stand are also in scope for license renewal because they are required to maintain structural integrity during a design basis seismic event (seismic II/I) to preclude interaction with nuclear fuel. Special purpose tools are used to support refueling activities, to facilitate transfer of nuclear fuel and to service the reactor vessel internals. They do not perform a license renewal intended function and are not in scope.

Not included in the evaluation boundary of the Fuel Handling and Storage System are the new fuel vault, the spent fuel storage pool and liner plate, cask storage pit and liner plate, gates and plugs, the reactor building overhead bridge crane, and supports for components and tools. The new fuel vault, the spent fuel storage pool and liner plate, cask storage pit and liner plate, and gates and plugs are separately evaluated with the license renewal Reactor Building structure. The reactor building overhead bridge crane is separately evaluated with the license renewal Cranes and Hoists. Supports for components are separately evaluated with the license renewal Component Supports Commodity Group.

For more detailed information, refer to UFSAR Sections 9.1.1, 9.1.2 and 9.1.4.

<u>System Operation</u>

Not Required

<u>System Boundary</u>

Not Required

<u>Reason for Scope Determination</u>

The Fuel Handling and Storage System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The Fuel Handling and Storage System is not relied upon in any 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), Anticipated Transients Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Prevents criticality of fuel assemblies stored in the spent fuel pool. The spent fuel storage racks maintain fuel in a subcritical configuration, with a k(eff) less than or equal to 0.95. 10 CFR 54.4(a)(1)

2. Provides protection for safe storage of new and spent fuel. The spent fuel and the new fuel storage racks provide physical support, shelter and protection for the nuclear fuel. 10 CFR 54.4(a)(1)

3. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The fuel preparation machines, fuel pool jib cranes, new fuel inspection stand and refueling platform are in scope for license renewal because they are required to maintain structural integrity during a design basis seismic event (Seismic II/I) to preclude interaction with nuclear fuel. 10 CFR 54.4 (a)(2)

UFSAR References

1.1
1.2
9.1

License Renewal Boundary Drawings

Not Required

Table 2.3.3-13 Fuel Handling and Storage System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Structural Support
Crane/hoist (Fuel Preparation Machine and New Fuel Inspection Stand)	Structural Support
Crane/hoist (Grapple/Mast for all bridges)	Structural Support
Crane/hoist (Rail System)	Structural Support
Crane/hoist (Refueling Platform and Jib Crane Columns / Beams / Plates / Anchorage)	Structural Support
Fuel Storage Racks (irradiated fuel)	Absorb Neutrons
Fuel Storage Racks (irradiated fuel)	Structural Support
Fuel Storage Racks (new fuel racks)	Structural Support

The aging management review results for these components are provided in:

Table 3.3.2-13 Fuel Handling and Storage System
Summary of Aging Management Evaluation

2.3.3.14 Fuel Pool Cooling and Cleanup System

System Purpose

The Fuel Pool Cooling and Cleanup System is a normally operating closed loop system designed to remove heat from the fuel storage pool and maintain fuel storage pool water clarity. This scoping evaluation does not include structures such as the fuel storage pool, reactor well, fuel cask storage pit, skimmer surge tanks and dryer-separator storage pool (evaluated with the Reactor Building Structure).

The purpose of the Fuel Pool Cooling and Cleanup System is to remove decay heat from spent fuel assemblies that are stored within the fuel storage pool during all modes of operation, to remove decay heat from the water inventory contained within the reactor well and dryer-separator storage pool during refuel outages, to minimize thermal stresses within the floor and walls of the fuel storage pool and maintain the chemistry of the fuel storage pool water inventory within acceptable EPRI guidelines. It accomplishes this by delivering recirculated water from the fuel pool during normal operation as well as from the reactor well, fuel cask storage pit and dryer-separator storage pool during refueling outage, which is pumped through the Fuel Pool Cooling and Cleanup System heat exchangers and filter-demineralizer system. The Fuel Pool Cooling and Cleanup System heat exchangers then remove the heat from the pools and transfer it to the Closed Cycle Cooling Water System. The heat exchangers are evaluated with the Closed Cycle Cooling Water System. The filter-demineralizer system maintains pool water purity and clarity by a combination of filtration and ion exchange.

The Fuel Pool Cooling and Cleanup System operation is a manually initiated system for spent fuel cooling and cleanup functions.

System Operation

The Fuel Pool Cooling and Cleanup System is comprised of two surge tanks, two half capacity fuel pool cooling water pumps, two half capacity fuel pool heat exchangers, two full capacity fuel pool filter-demineralizers, and a common discharge flow path back to the fuel storage pool diffusers. It also includes associated piping, valves, and instrumentation.

The main flow path of the Fuel Pool Cooling and Cleanup System starts where water from the fuel storage pool overflows via an adjustable weir into two cross-tied skimmer surge tanks (evaluated with the Reactor Building Structure). The skimmer surge tanks drain into a common suction header for the fuel pool cooling pumps. Two parallel flow paths exist from the header, each with a fuel pool cooling pump that takes suction from the header and discharges through heat exchangers. The fuel pool cooling heat exchangers are plate type heat exchangers with a hot and cold side. The hot side of the heat exchanger is the fuel pool cooling process side and the cold side of the heat exchanger is the closed cycle cooling water heat sink side. The heat exchangers are evaluated with the Closed Cycle Cooling Water System. A crosstie line exists on the pump discharge piping in order to operate either pump with either heat exchanger. The heat exchangers discharge into a common header, then through the fuel pool filter-demineralizer. The fuel pool filter-demineralizer discharges back into the fuel storage pool through two lines and diffusers at the bottom of the fuel pool. The filter-demineralizer can be bypassed when there is not an issue with water clarity. The return lines to the fuel storage pool that enter near the top have vacuum breaker vents to act as antisiphon devices, to preclude uncontrolled draining of the pool during a pipe break. The fuel pool liner drains are connected to the area under the fuel pool liner for leak detection.

During refueling outages, the reactor well is filled, and the gates are removed between the fuel storage pool and reactor well. The system circulates the fuel storage pool water inventory, as described above, and maintains the fuel storage pool water inventory at a predetermined temperature. Water flows, over two adjustable skimmer weirs located in the fuel storage pool and two skimmer weirs located in the reactor well, into the skimmer surge tanks. The Fuel Pool Cooling and Cleanup System removes decay heat from the spent fuel assemblies that are stored within the fuel storage pool, as well as, decay heat from the water inventory contained within the reactor well and dryer-separator storage pool during refueling operations. The Fuel Pool Cooling and Cleanup System may be aligned by manual valves to discharge into the reactor well and fuel cast storage pit (evaluated with the Reactor Building Structure). The water is pumped through the heat exchanger. Cooling water to the cold side of the heat exchangers is supplied from the Closed Cycle Cooling Water System (evaluated with the Closed Cycle Cooling Water System).

The following components operate only during outage periods; the piping and components downstream of the fuel pool filter-demineralizer outlet header valve because they are normally isolated from the Fuel Pool Cooling and Cleanup System by this normally closed valve, the piping and components associated with the reactor well drains and liner drains.

The Fuel Pool Cooling and Cleanup System can provide additional heat removal capabilities through an interface with the Residual Heat Removal System. In this mode, the Fuel Pool Cooling and Cleanup System may be aligned by manual valves to discharge into the Residual Heat Removal System and cooled water is returned from the Residual Heat Removal System to the Fuel Pool Cooling and Cleanup System into the two diffusers in the fuel storage pool.

In addition to reactor well and dryer-separator storage pools, there is also a fuel cask storage pit. It is used to discharge spent fuel into spent fuel shipping casks. Filling of the cask pool is normally done prior to spent fuel loading into the cask, and draining is normally accomplished after cask loading. The fuel cask storage pit is filled via the refueling fill line and drained through a condensate demineralizer or the fuel pool filter-demineralizers in the same manner as the refueling volume is filled and drained.

Normal makeup to the fuel storage pool is provided from the Condensate Storage Tank. Additional makeup can be provided from the service box for shipping cask washdown through the use of hoses. To prevent loss of Fuel Pool Cooling and Cleanup System cooling due to system water loss, and an unlikely condition where normal makeup is lost, a fuel pool water makeup line from Service Water System loop A or B ties into one of the fuel pool cooling and cleanup return lines immediately upstream of the point where it enters the fuel storage pool.

For more detailed information, see UFSAR Section 9.1.3.

System Boundary

During normal plant operations, the boundary of the Fuel Pool Cooling and Cleanup System begins at the attachment point of the suction piping to the skimmer surge tanks. It continues through the Fuel Pool Cooling and Cleanup System pumps, heat exchangers, filter-demineralizers and associated piping and valves, to the bottom of the fuel storage pool via diffusers. The water spills over the fuel storage pool weirs and continuous to the attachment point of the skimmer surge tanks.

During refueling operations, the boundary begins at the attachment point of the suction piping to the skimmer surge tanks through the fuel pool cooling pumps and fuel pool cooling heat exchanger and returns to the common discharge flow path downstream of the filter-demineralizers. Included in the boundary is the piping that discharges into reactor well, fuel cask storage pit and fuel storage pool. When the removable blocks and gates are removed, water can flow from the reactor well to the dryer-separator storage, fuel cast storage pit, and fuel storage pools. Water returns to the skimmer surge tanks over the weirs in the fuel storage pool and through skimmer drain headers located in the reactor well and dryer-separator storage pool.

All associated piping, components and instrumentation contained within the flow paths described above are included in the system evaluation boundary.

Also included in the license renewal scoping boundary of the Fuel Pool Cooling and Cleanup System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor Building. Also included in this boundary are pressure-retaining components located in the Reactor Building relied upon to preserve the leakage boundary intended function of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

The following items are not required for the cooling flow path for the Fuel Pool Cooling and Cleanup System but are included in the Fuel Pool Cooling and Cleanup System scoping boundary: skimmer drain header, storage pool drains and spent fuel pool liner drains.

Not included in the scoping boundary of the Fuel Pool Cooling and Cleanup System license renewal are items such as reactor well to dryer-separator pool gate, fuel cask storage pit to fuel storage pool gate, reactor well to fuel storage pool gate and associated gate seals, reactor well, skimmer surge tank, dryer-separator storage pool, fuel storage pool, fuel cast storage pit and their supporting structures, which are separately evaluated in the Reactor Building structure.

Not included in the Fuel Pool Cooling and Cleanup System license renewal scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Service Water System
Compressed Air System
Condensate Storage and Transfer System
Closed Cycle Cooling Water System
Residual Heat Removal System
Radwaste System
Reactor Building
Torus Water Cleanup System
Process and Post Accident Sampling System

The Fuel Pool Cooling and Cleanup System supports the spent fuel pool cooling intended functions. This portion of the system includes a flow path from the fuel storage pool cooling skimmer surge tank continuing through the fuel pool cooling pumps and heat exchangers but allows bypass of the filter-demineralizers so that flow can be returned to the fuel storage pool. This closed loop flow path through the Fuel Pool Cooling and Cleanup System heat exchangers, which is cooled by Closed Cycle Cooling Water System, ensures the Fuel Pool Cooling and Cleanup System will perform this systems intended function. The heat exchangers are evaluated with the Closed Cycle Cooling Water System.

Reason for Scope Determination

The Fuel Pool Cooling and Cleanup System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of non-safety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Environmental Qualification (10 CFR 50.49). The Fuel Pool Cooling and Cleanup System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48), Anticipated Transient Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Ensure adequate cooling in the spent fuel pool to maintain stored fuel within acceptable temperature limits. The Fuel Pool Cooling and Cleanup System operates continuously to circulate and cool the fuel pool water inventory and maintain the water inventory at a predetermined temperature. 10 CFR 54.4 (a)(1)

2. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety related function. The system contains nonsafety-related piping that has the potential to spatially and structurally interact with safety-related portions of this and other systems. 10 CFR 54.4(a)(2)

3. Relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Environmental Qualification (10 CFR 50.49). The Fuel Pool Cooling and Cleanup System includes components that are environmentally qualified. 10 CFR 54.4(a)(3)

UFSAR References

9.1.3

License Renewal Boundary Drawings

LR-M-08-0, Sheet 2
LR-M-10-1, Sheet 2
LR-M-44-1, Sheet 1
LR-M-51-1, Sheet 1
LR-M-51-1, Sheet 2
LR-M-53-1, Sheet 1
LR-M-53-1, Sheet 2

Table 2.3.3-14 Fuel Pool Cooling and Cleanup System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Diffuser	Direct Flow
Flow Element	Leakage Boundary
Flow Element	Pressure Boundary
Heat Exchanger Components (Fuel Pool Cooling and Cleanup)	Evaluated with the Closed Cycle Cooling Water System
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Pump Casing (Fuel Pool Cooling Pump)	Pressure Boundary
Restricting Orifices	Pressure Boundary
Restricting Orifices	Throttle
Spray Nozzles (Fuel Storage Pool)	Spray
Thermowell	Pressure Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary
Weir	Direct Flow

The aging management review results for these components are provided in:

Table 3.3.2-14 Fuel Pool Cooling and Cleanup System
Summary of Aging Management Evaluation

2.3.3.15 Hardened Torus Vent System

System Purpose

The Hardened Torus Vent System is a hard piped vent system designed for venting the Primary Containment during severe accident sequences.

The purpose of the Hardened Torus Vent System is to vent the Primary Containment from the torus during severe accident sequences that involve loss of normal decay heat removal capability. The Hardened Torus Vent System accomplishes this purpose by providing a vent path from the torus to the environment through the containment prepurge cleanup system return header from the torus. This portion of the containment prepurge cleanup system is part of the Containment Inerting and Purging System.

The Hardened Torus Vent System is only used for conditions beyond the design basis events.

System Operation

The Hardened Torus Vent System is comprised of a hard pipe installed off of the containment prepurge cleanup system return header from the torus. Primary containment venting from the Hardened Torus Vent System is through a bypass line off of the containment prepurge cleanup system return header from the torus, which is located in between two containment isolation valves, through the isolation valve located on the hardened vent line, through a rupture disk, and to the environment at an elevated release point along the Reactor Building exterior cylindrical wall. Operation of the system from either the main control room or locally is performed manually in accordance with station abnormal operating procedures. Operation of the system requires opening of both the upstream containment isolation valve located on the containment prepurge cleanup system return header and the isolation valve located on the hardened vent line. Opening of these valves from the main control room can be performed when compressed air and power are available. A manual jack station located locally, outside the Primary Containment, provides for opening of these valves when power or compressed air is not available.

The Hardened Torus Vent System is designed for the mitigation of severe accident sequences that are beyond the design basis accidents in which decay heat removal capability is unavailable.

The torus was chosen as the vent path because of the beneficial scrubbing effect of the torus water. A rupture disk on the hardened vent line ensures that inadvertent opening of the vent line isolation valve will not result in radiation release to the environment.

For more detailed information, see UFSAR Section 6.2.5.

System Boundary

The Hardened Torus Vent System boundary begins at an attachment point on the containment prepurge cleanup system return header, in between the two containment isolation valves within the torus room. The boundary continues through a twelve inch pipe and through an isolation valve, through a set of radiation detectors, followed by a rupture disk and the boundary terminates at an elevated release point in the environment along the Reactor Building exterior cylindrical wall.

Included in the license renewal scoping boundary of the Hardened Torus Vent System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related and nonsafety-related interface up to the location of the first seismic anchor. Included in this boundary are components relied upon to preserve the structural support intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red. Not included in the scope of license renewal is the portion of Hardened Torus Vent System located above the plant ground level, as this portion of the system is located beyond the seismic anchor point.

Not included in the Hardened Torus Vent System license renewal scoping boundaries are the following systems or structures, which are separately evaluated as license renewal systems or structures:

Containment Inerting and Purging System
Reactor Building Ventilation System (containment prepurge cleanup system)
Primary Containment
Reactor Building
Compressed Air System (plant instrument air system)

The Hardened Torus Vent System is designed for mitigation of severe accident sequences that are beyond the design basis accident. Beyond design basis accident events are not considered for license renewal scoping.

Reason for Scope Determination

The Hardened Torus Vent System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The Hardened Torus Vent System meets 10 CFR 54.4(a)(3) because it is relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Hardened Torus Vent System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48), Anticipated Transient Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide primary containment boundary. The Hardened Torus Vent System is equipped with a primary containment isolation valve. 10 CFR 54.4 (a)(1)

2. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. Portions of the Hardened Torus Vent System within the Reactor Building are nonsafety-related and provide structural support for attached safety-related piping. 10 CFR 54.4(a)(2)

3. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The limit switches associated with the primary containment isolation valves within the Hardened Torus Vent System are environmentally qualified. 10 CFR 54.4(a)(3)

UFSAR References

3.11
11.5.2.2.21
18.2.2
6.2.4.3.5

License Renewal Boundary Drawings

LR-M-57-1, Sheet 1

Table 2.3.3-15 <u>Hardened Torus Vent System</u>
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-15 Hardened Torus Vent System
Summary of Aging Management Evaluation

2.3.3.16 Hydrogen Water Chemistry System

System Purpose

The intended function of the Hydrogen Water Chemistry System for license renewal is to maintain leakage boundary integrity to preclude system interactions. This system's pressure retaining components located in proximity to other components performing safety-related functions have been included in the scope of license renewal. This system is not required to operate to support license renewal intended functions, and is in scope for potential spatial interaction. The portions of the Hydrogen Water Chemistry System in scope are the components in the Reactor Building.

The Hydrogen Water Chemistry System consists of the following subsystems: hydrogen injection, oxygen injection, reactor recirculation hydrogen and oxygen analyzer panel and crack monitoring. The only portion of the Hydrogen Water Chemistry System that is in the Reactor Building and is in scope for potential spatial interaction is the reactor recirculation hydrogen and oxygen analyzer panel and crack monitoring subsystems. The hydrogen injection and oxygen injection subsystems are not in scope for potential spatial interaction, since the components for these subsystems are located in the turbine building or yard areas.

The purpose of the Hydrogen Water Chemistry System is to reduce the potential for intergranular stress corrosion cracking and flow-assisted corrosion. It accomplishes this by injecting hydrogen to reduce the potential for intergranular stress corrosion cracking, injecting oxygen to reduce flow-assisted corrosion, and monitoring for the concentration of dissolved hydrogen and oxygen in the reactor recirculation system.

System Operation

Reactor Recirculation Hydrogen and Oxygen Analyzer Panel Subsystem

The Hydrogen Water Chemistry System includes a reactor recirculation hydrogen and oxygen analyzer panel subsystem for dissolved hydrogen and dissolved oxygen. The Hydrogen Water Chemistry System reactor recirculation hydrogen and oxygen analyzer panel normal flow path begins downstream of process sampling system needle valve at the process sampling station in the Reactor Building and goes through six way valves and hydrogen and oxygen sensors in the filtration recirculation ventilation system vent room before being pumped back to the building and equipment drain system in Reactor Building where the system ends. The components for this plant system are enclosed in NEMA Type 12 electrical enclosures except the inlet line with a water bath and outlet line to the building and equipment drain system. There are also branch lines for calibration gas inlet and vent to the hydrogen and oxygen analyzer absorption column. This subsystem consists of an absorption column, vessels, instruments, pipes, tubes and valves.

This subsystem is not required to operate to support license renewal intended functions, but is included in the scope of license renewal as this liquid filled subsystem is located within an area in proximity of components performing a safety related function. This subsystem is located in the Reactor Building. However, the portion of the Hydrogen Water Chemistry System hydrogen and oxygen analyzer panel components that is contained within a NEMA 12 enclosure are not in scope since this enclosure will prevent spatial interaction with safety related components. The branch lines for calibration gas inlet and vent are not in the scope of license renewal as they are gas filled and not liquid or steam filled.

Crack Monitoring Subsystem

The Hydrogen Water Chemistry System also includes a crack monitoring subsystem that is isolated and no longer in use. The Hydrogen Water Chemistry System crack monitoring system begins at the tee from the process sampling system in the Reactor Building sample station room and goes through the crack growth pressure vessel and a electrochemical potential pressure vessel in parallel with a bypass line around these vessels. The license renewal boundary for this system ends upstream of the flow element which provides an input signal to the reactor water cleanup differential flow detector. The flow element for reactor water cleanup differential flow leak detection system is evaluated with the license renewal Reactor Water Cleanup System.

This subsystem is not required to operate to support license renewal intended functions, but is included in the scope of license renewal as this liquid-filled subsystem is located within an area in proximity of components performing a safety-related function. This subsystem is located in the reactor building.

Hydrogen Injection Subsystem

The Hydrogen Water Chemistry hydrogen injection subsystem is provided for injecting gaseous hydrogen to provide intergranular stress corrosion cracking (IGSCC) protection of the recirculation piping.

This subsystem is not required to operate to support license renewal intended functions, and is not included in the scope of license renewal as this liquid filled subsystem is not located within an area in proximity of components performing a safety-related function. This subsystem is located in the Turbine Building or yard areas.

Oxygen Injection Subsystem

The Hydrogen Water Chemistry oxygen injection subsystem is provided to ensure that sufficient oxygen is present in the gaseous radwaste system to combine with the excess hydrogen. The oxygen injection subsystem injects oxygen upstream of the offgas recombiners to maintain the stoichiometric balance of oxygen and hydrogen. In order to maintain the desired dissolved oxygen level in the feedwater, a supplemental oxygen injection system (oxygen gas bottles) is also installed to reduce the potential for flow-assisted corrosion. This subsystem is not required to operate to support license renewal intended functions and is not in scope for potential spatial interaction, since the components for this subsystem are located in the Turbine Building or yard areas.

This subsystem is not required to operate to support license renewal intended functions, and is not included in the scope of license renewal as this liquid filled subsystem is not located within an area in proximity of components performing a safety-related function. This subsystem is located in the Turbine Building or yard areas.

For more detailed information, see UFSAR Sections 5.2.3.2, 9.5.1.1.11, 10.4.7.2.1 and 11.3.2.1.

System Boundary

The license renewal scoping boundary of the Hydrogen Water Chemistry System encompasses the liquid filled portion of the system that is located in proximity to equipment performing a safety-related function. This includes the liquid filled portions of the Hydrogen Water Chemistry System located within the Reactor Building. Included in this boundary are pressure retaining components relied upon to preserve the leakage boundary intended function of this system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red. Components that are not required to support the leakage boundary intended function are not included in the scope of license renewal.

Not included in the scope of license renewal is the portion of the Hydrogen Water Chemistry System hydrogen and oxygen analyzer panel components that are contained within a NEMA type 12 electrical enclosure, as this panel is nonsafety-related and physically shielded and does not have the potential for spatial interaction with components performing a safety-related function. Also not included in the scope of license renewal are the hydrogen injection and oxygen subsystems, as they are nonsafety-related and physically located in the Turbine Building and yard areas that do not have components performing a safety-related function.

Not included in the Hydrogen Water Chemistry System scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Compressed Air System
Condensate System
Equipment and Floor Drainage System
Main Condenser Air Extraction System
Process and Post-Accident Sampling System
Reactor Water Cleanup System

Reason for Scope Determination

The Hydrogen Water Chemistry System is not in scope under 10 CFR 54.4(a)(1) because no portions of the system are safety-related or relied on to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The system is not in scope under 10 CFR 54.4(a)(3) because it is not 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), Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Hydrogen Water Chemistry System has potential for spatial interaction with safety-related equipment within the Reactor Building. 10 CFR 54.4(a)(2)

UFSAR References

5.2.3
9.5.1
10.4.7
11.3.2

License Renewal Boundary Drawings

LR-M-23-1, Sheet 2
LR-M-101-0, Sheet 3
LR-M-101-0, Sheet 4

Table 2.3.3-16 Hydrogen Water Chemistry System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Flow Element	Leakage Boundary
Heat Exchanger Components (Sample Cooler 433)	Leakage Boundary
Piping and Fittings	Leakage Boundary
Tanks (CAV)	Leakage Boundary
Tanks (ECP)	Leakage Boundary
Valve Body	Leakage Boundary

The aging management review results for these components are provided in:

Table 3.3.2-16 Hydrogen Water Chemistry System
Summary of Aging Management Evaluation

2.3.3.17 Leak Detection and Radiation Monitoring System

System Purpose

The Leak Detection and Radiation Monitoring System is a normally operating instrumentation system that detects leaks from the reactor coolant pressure boundary and other plant systems as well as assesses overall plant radiological conditions at the facility. In addition, this system also detects the radiation level and the release of radioactivity in key locations throughout the plant.

The Leak Detection and Radiation Monitoring System is in the scope of license renewal. However, major portions of the system are not required to perform license renewal intended functions and are not in scope. The Leak Detection and Radiation Monitoring System has several interfacing systems that are not in the license renewal boundary of the Leak Detection and Radiation Monitoring System.

The Leak Detection and Radiation Monitoring System consists of the following two plant systems: leak detection plant system and radiation monitoring plant system.

The purpose of the leak detection plant system is to detect leaks and provide alarms at established leakage rate limits so that the affected system can be isolated if necessary. To accomplish this purpose, this system directly monitors the drywell for reactor coolant pressure boundary leakage as required by Regulatory Guide 1.45 and indirectly detects leakage from the reactor coolant pressure boundary and from other systems by monitoring the process variables.

The purpose of the radiation monitoring plant system is to detect the release of radioactivity, to monitor radiation levels and to provide alarms so that the general public and plant personnel can be protected from exposures in excess of those allowed by the applicable regulations. The system accomplishes this purpose by utilizing radiation detectors and associated instrumentation to monitor and indicate the radiation levels.

System Operation

Leak Detection Plant System

The leak detection plant system is comprised of instrumentation components including temperature sensors, flow elements, level elements, level transmitters, radiation monitors, acoustic sensors, pressure differential transmitters, flow transmitters, timers and associated tubing and valves. This system consists of two subsystems. The first subsystem, primary leak detection, monitors the drywell for reactor coolant pressure boundary leakage as required by Regulatory Guide 1.45. The second subsystem, secondary leak detection, indirectly detects leakage from the reactor coolant pressure boundary and from other systems by monitoring the process variables.

The primary leak detection subsystem includes the drywell leak detection radiation monitor, liquid leakage detection monitor and steam leakage detection monitor. The drywell leak detection radiation monitor is designed to measure the changes in the level of gaseous radioisotopes for the indication of leakage. This system operates by drawing samples of the drywell atmosphere continuously through a radioactive gas sampler that continuously monitors the beta radiation. It also detects noble gases, which would be outgased from the primary coolant in the event of a boundary leak, thus indicating the presence of reactor coolant pressure boundary leakage. The radioactive gas sampler is connected to a local processor that performs radioactivity calculations. The sample flow then proceeds through the flow control devices and vacuum pump, and is discharged back to the Primary Containment. A high level of radioactivity will activate an alarm in the Main Control Room.

The liquid leakage detection monitor measures the drywell sump level for the liquid inventories in the drywell equipment drain sump and the drywell floor drain sump. A level transmitter is located in the drywell floor drain sump and drywell equipment drain sump. A level change in the sumps is converted to a flow rate by a microprocessor. Any change in the flow rate that exceeds the pre-established limit will activate an alarm in the Main Control Room. High level in the sumps and excessive pump running time will also activate an alarm in the Main Control Room. The sump pumps start automatically when a preset high water level is reached. They stop at a preset low water level. The sump pumps are evaluated in the Equipment and Floor Drainage license renewal system. The steam leakage detection monitor measures the liquid runoff from drywell cooler units. Two flow transmitters are used in the drywell air coolers condensate flow monitoring system. Each transmitter sends signals to a local processor, which calculates and determines the flow rate in the system. If a predetermined flow rate is exceeded, an alarm in the Main Control room is activated.

The secondary leak detection subsystem monitors leakage from the reactor coolant pressure boundary and other systems. When plant system leakage occurs on a system, such as RCIC, HPCI, RHR, RWCU, Main Steam, or Core Spray, the leakage can be detected through monitoring the process variables (e.g., ambient temperature, pressure, pressure differential, flow rate) with instruments such as temperature sensors, temperature elements, pressure transmitters, flow transducers, flow sensors, water level transmitters and associated switches. Flooding in pump rooms for various systems such as RCIC, HPCI, RHR, RWCU, Core Spray and SACS is also detected and alarmed with the use of water level switches and associated instrumentation. Some monitors also initiate actions such as system isolation.

Radiation Monitoring Plant System

The radiation monitoring plant system is comprised of the process radiation monitoring subsystem and the area radiation monitoring subsystem.

The process radiation monitoring subsystem consists of safety-related and nonsafety-related monitors. These monitors include the radiation monitoring system (RMS) for the following plant systems and processes:

Main steam line RMS
Refueling floor exhaust RMS
Reactor building ventilation and exhaust RMS
Control room ventilation RMS
Drywell atmosphere post-accident RMS
North plant vent RMS
South plant vent RMS
Filtration, recirculation, and ventilation RMS
Cooling tower blowdown RMS
Liquid radwaste RMS
Off-gas and off-gas treatment RMS

Turbine building compartment and exhaust RMS
Radwaste and gaseous radwaste exhaust RMS
Technical support center ventilation RMS
Drywell leak detection RMS
Reactor auxiliaries cooling system RMS
Safety auxiliaries cooling system RMS
Heating steam condensate RMS
Turbine building circulating water RMS
Hardened torus vent RMS

The process radiation monitoring subsystem monitors either directly utilize radiation detectors located inside or adjacent to the process piping being monitored, or utilize a sample piping system to extract and transport a sample to a monitoring station. All monitors interface with annunciator systems and dedicated displays to present radiological information to plant personnel. When the radioactivity in certain monitored systems exceeds established operating limits, the related process radiation monitoring subsystems provide alarms to plant operators. Some monitors also provide actions such as automatic isolation and system trip.

The safety auxiliaries cooling system (SACS) radiation monitor includes a sample chamber that is part of the SACS system pressure boundary, and this monitor is evaluated with the Closed Cycle Cooling Water System for aging management review. All other radiation monitors utilize radiation detectors located inside or adjacent to the process or sample piping being monitored, and do not have a pressure boundary intended function and are therefore considered active and not subject to aging management review.

The process radiation monitoring subsystem monitors that utilize a mechanical piping sampling system to extract a sample from the process for transport to the monitoring stations are north plant vent RMS, south plant vent RMS, filtration recirculation and ventilation RMS, hardened torus vent RMS, off-gas RMS, drywell leak detection RMS, reactor auxiliaries cooling system RMS and safety auxiliaries cooling system RMS. All of these monitors except the drywell leak detection monitor and the safety auxiliaries cooling system monitor are nonsafety-related. These nonsafety-related monitors do not support a license renewal intended function, and are not included in the scope of license renewal. The drywell leak detection monitor and safety auxiliaries cooling system monitor support a license renewal intended function, and are included in the scope of license renewal. The sample piping to and from the drywell leak detection monitor is evaluated for license renewal scoping with the leak detection plant system previously discussed in this license renewal scoping evaluation. The sample piping to and from the safety auxiliaries cooling system monitor is not included in this scoping evaluation but is evaluated separately for license renewal with the Closed Cycle Cooling Water System.

The area radiation monitoring subsystem consists of various area radiation monitors that are located throughout the plant. Each monitor is comprised of one or two radiation detectors, an associated local radiation processor, and a local indicator unit. The detectors are wall mounted and are located so that the radiation flux measurement is as representative as possible of the area. The monitor interfaces with annunciator systems and dedicated displays to present information on the area to plant personnel, locally and at selected points in the plant. When the radiation level in any monitored area exceeds established limits, the area radiation monitoring system supplements the personnel and area radiation survey provisions of the plant radiation protection program to ensure compliance with the applicable regulatory guidelines on personnel exposure. These devices are nonsafety-related. The area radiation monitoring subsystem has no function related to the safe shutdown of the plant. The area radiation monitoring subsystem does not support a license renewal intended function and is not included in the scope of license renewal.

For more detailed information, see UFSAR Sections 11.5 and 12.3.4.

System Boundary

Leak Detection Plant System

The leak detection plant system consists of the primary leak detection and secondary leak detection subsystems. The primary leak detection subsystem directly monitors leakage through the drywell leak detection radiation monitor, liquid leakage detection monitor and steam leakage detection monitor. The secondary leak detection subsystem utilizes various instruments and associated circuitry to monitor process variables for leakage detection.

The boundary for the drywell leak detection radiation monitor begins at the sample supply attachment point to the drywell, and continues through the filter, radiation gas sampler, pump, radiation detector and then ends at the sample return attachment point to the drywell. The boundary includes all associated piping, components and instrumentation in the sampling flow path described above. Included in the scope for license renewal is the safety-related supply and return sample piping from the containment penetrations to the associated containment isolation valves. Not included in scope is the remainder of the boundry described above as that portion of the system provides a monitoring and alarm function only.

The boundary for the liquid leakage detection monitoring systems consists of instruments and associated circuitry, and a mechanical boundary description is not applicable. The piping and components for drywell equipment and floor drainage are evaluated separately for license renewal with the Equipment and Floor Drainage license renewal system.

The boundary for the steam leakage detection begins at the liquid runoff point from the drywell cooler units, continues through the flow element, and ends at the open pipe to the floor drain.

The secondary leak detection subsystem consists of instruments and associated circuitry, and a mechanical boundary description is not applicable. The various flow elements and other process sensing devices that are associated with the monitored system pressure boundary are evaluated with the respective system.

Radiation Monitoring Plant System

The majority of the radiation monitoring plant system consists of radiation detectors and associated circuitry, and a mechanical boundary description is not applicable. Some portions of the system utilize sample piping to transport samples to monitoring stations. These portions are not included in the scope of license renewal except for the sampling systems associated with the SACS RMS and the Drywell Leak Detection RMS. The SACS sample piping is not included in this scoping evaluation but is evaluated separately for license renewal with the Closed Cycle Cooling Water System. The Drywell Leak Detection sample piping is evaluated in this scoping evaluation with the leak detection plant system.

Included in the license renewal scoping boundary of the Leak Detection and Radiation Monitoring System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor. Included in this boundary are components relied upon to preserve the structural support intended function of this portion of the system. Also included in the license renewal scoping boundary are those portions of nonsafety-related piping and equipment located in proximity to equipment performing a safety-related function. This includes the nonsafety-related portions of the system located within the Primary Containment. Included in this boundary are pressure retaining components relied upon to preserve the leakage boundary intended function of these portions of this system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the Leak Detection and Radiation Monitoring System license renewal scoping boundary are the following interfacing systems, which are separately evaluated as a license renewal system:

Reactor Core Isolation Cooling System
High Pressure Coolant Injection System
Main Steam System
Reactor Water Cleanup System
Closed Cycle Cooling Water System
Nuclear Boiler Instrumentation System
Residual Heat Removal System
Core Spray System
Drywell Air Cooling System

Reason for Scope Determination

The Leak Detection and Radiation Monitoring System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is 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), Environmental Qualification (10 CFR 50.49) and Station Blackout (10 CFR 50.63). The Leak Detection and Radiation Monitoring System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide primary containment boundary. Supply and return lines penetrating primary containment are provided with isolation valves. 10 CFR 54.4(a)(1)

2. Sense process conditions and generate signals for reactor trip or engineered safety features actuation. The Leak Detection and Radiation Monitoring System contains electronic instrumentation that monitors parameters for line break, radiation level and radioactivity concentration and initiates trip signals to isolate the monitored systems. 10 CFR 54.4(a)(1)

3. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The safety-related/nonsafety-related interface has components relied upon to preserve the structural support intended function. 10 CFR 54.4(a)(2)

4. 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). The Leak Detection and Radiation Monitoring System is relied upon to support safe shutdown during fire conditions by preventing spurious isolation of the High Pressure Coolant Injection and Reactor Core Isolation Cooling systems. 10 CFR 54.4(a)(3)

5. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Leak Detection and Radiation Monitoring System has components that are in the Environmental Qualification Program. 10 CFR 54.4(a)(3)

6. 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). The Leak Detection and Radiation Monitoring System is relied upon to support shutdown, coping and recovery during a station blackout event by preventing spurious isolation of the High Pressure Coolant Injection and Reactor Core Isolation Cooling systems. 10 CFR 54.4(a)(3)

UFSAR References

11.5
12.3.4

License Renewal Boundary Drawings

LR-M-25-1, Sheet 1

Table 2.3.3-17 Leak Detection and Radiation Monitoring System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Flow Element	Leakage Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-17 Leak Detection and Radiation Monitoring System
Summary of Aging Management Evaluation

2.3.3.18 Makeup Demineralizer System

System Purpose

The intended function of the Makeup Demineralizer System for license renewal is to maintain leakage boundary integrity to preclude system interactions. For this reason, this system's pressure retaining components located in proximity to other components performing safety-related functions have been included in the scope of license renewal. This system is not required to operate to support license renewal intended functions, and is in scope for potential spatial interaction. The portions of the Makeup Demineralizer System in scope are the components in the reactor and auxiliary buildings. The remainder is not in scope.

The purpose of the Makeup Demineralizer System is to demineralize fresh water from the station wells, store the demineralized water, and deliver demineralized water to plant services, as required. The demineralized water system is designed to provide demineralized water intermittently to various plant components. The system is manually initiated. After initiation, the demineralizer sequence is controlled automatically.

System Operation

The Makeup Demineralizer System consists of one makeup demineralizer having two trains. Each train consists of a cation exchanger, an anion exchanger, and a mixed bed exchanger. The Makeup Demineralizer System includes one vacuum degasifier vessel complete with three degasifier booster pumps and three degasifier vacuum pumps, four demineralized water storage tanks, one demineralized water jockey pump, two demineralized water transfer pumps, demineralized regeneration system that includes a resin cleaning tank, acid and caustic positive displacement pumps, caustic dilution hot water heater and associated piping, valves, and controls. The system also includes one makeup demineralizer regenerant waste tank complete with two regenerant waste pumps, two makeup demineralizer feed tanks, complete with three makeup demineralizer feed pumps, acid and caustic storage tanks in the condensate demineralizer system for regeneration associated piping and controls for all demineralizer operations.

The Makeup Demineralizer System begins upstream of the demineralizer feed tanks where the Fresh Water Supply System provides water to the tanks. It continues through the demineralization equipment to demineralized water storage tanks and supplies the demineralized water jockey pump and transfer pumps demineralized water. These pumps feed a common header, which then branches off to the systems being supplied. The Makeup Demineralizer System ends at the inlet to the systems receiving the demineralized water.

The systems in the reactor and auxiliary building that receive demineralized water from the Makeup Demineralizer System include Process and Post Accident Sampling, Standby Liquid Control, Closed Cycle Cooling Water, Standby Diesel Generators and Auxiliary, Chilled Water, Reactor Building Ventilation, and Auxiliary Building Service and Radwaste Ventilation Systems. As previously mentioned, the portions of the Makeup Demineralizer System in the Reactor Building and Auxiliary Building Control/Diesel Generator Area are in scope for potential spatial interaction.

The demineralized water in the four demineralized water storage tanks is used to fill the condensate storage tank prior to unit operation. The demineralizer water is also used prior to unit operation for flushing and filling plant systems.

For more detailed information, see UFSAR Section 9.2.3.

System Boundary

The license renewal scoping boundary of the Makeup Demineralizer System encompasses the liquid filled portion of the system that is located in proximity to equipment performing a safety-related function. This includes the liquid filled portions of the Makeup Demineralizer System located within the Reactor and Auxiliary Buildings. Included in this boundary are pressure retaining components relied upon to preserve the leakage boundary intended function of this system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red. Components that are not required to support the system's leakage boundary intended function are not included in the scope of license renewal.

Not included in the Makeup Demineralizer System scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Auxiliary Building Service and Radwaste Ventilation System
Auxiliary Steam System
Chilled Water System
Circulating Water System
Closed Cycle Cooling Water System
Condensate Storage and Transfer System
Control Room and Control Area HVAC Systems
Feedwater System
Fresh Water Supply System
Main Generator and Auxiliary System
Main Turbine and Auxiliary System
Miscellaneous Ventilation Systems
Process Sampling and Post-Accident Sampling System
Reactor Building Ventilation System
Service Water System
Standby Liquid Control System
Standby Diesel Generators and Auxiliary System

Reason for Scope Determination

The Makeup Demineralizer System is not in scope under 10 CFR 54.4(a)(1) because no portions of the system are safety related or relied on to remain functional during and following design basis events. The Makeup Demineralizer System is in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The system is not in scope under 10 CFR 54.4(a)(3) because it is not 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), Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62) or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Makeup Demineralizer System has potential for spatial interaction with safety-related equipment within the Reactor and Auxiliary Buildings. 10 CFR 54.4(a)(2)

UFSAR References

9.2.3

License Renewal Boundary Drawings

LR-M-10-1, Sheet 2
LR-M-11-1, Sheet 1
LR-M-13-1, Sheet 1
LR-M-18-0, Sheet 3
LR-M-23-1, Sheet 2
LR-M-30-1, Sheet 2
LR-M-48-1, Sheet 1
LR-M-89-1, Sheet 1
LR-M-90-1, Sheet 1
LR-M-90-1, Sheet 2
LR-M-90-1, Sheet 3
LR-M-93-0, Sheet 2

Table 2.3.3-18 Makeup Demineralizer System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Piping and Fittings	Leakage Boundary
Valve Body	Leakage Boundary

The aging management review results for these components are provided in:

Table 3.3.2-18 Makeup Demineralizer System
Summary of Aging Management Evaluation

2.3.3.19 Primary Containment Instrument Gas System

System Purpose

The Primary Containment Instrument Gas System is a safety-related system designed to provide a continuous supply of dried, oil free, filtered compressed gas to pneumatic components inside primary containment during normal operations.

The Primary Containment Instrument Gas System is in scope for license renewal. A minor portion of the system is not required to perform license renewal intended functions and is not in scope. The Primary Containment Instrument Gas System has several interfacing systems that are not in the license renewal boundary of the Primary Containment Instrument Gas System.

The purpose of the Primary Containment Instrument Gas System is to provide clean and dried compressed gas to pneumatically operated instruments and valves. To accomplish this purpose, this system takes gas from inside of the Primary Containment or Reactor Building, and processes the gas through intake screen, filters, gas compressors, intercoolers/aftercoolers/moisture separators, thermo-siphons, gas dryers, gas receivers and gas headers for distribution to components in support of plant operation.

System Operation

The Primary Containment Instrument Gas System is comprised primarily of two redundant full capacity, skid mounted compressor trains. Each train consists of an inlet filter, compressor, intercooler/aftercooler/moisture separator, thermo-siphon, dryer prefilter, dryer, outlet filter, and receiver. All of the equipment is skid mounted (except the receiver) and located in the Reactor Building. The flow path begins at the intake screen to the compressor and terminates at the attachment points to the host pneumatic components or users, which are the supplied instruments, gas operated valves and other gas operated components. These host pneumatic components or users are evaluated in other associated license renewal systems.

The inlet gas passes through a full flow inlet particulate filter to each compressor. The compressor is a positive displacement three-cylinder, two-stage, single acting reciprocating compressor driven via belts from an electric motor. The gas compressor has cooling and lubricating oil support systems. Two of the three cylinders are for the first stage and the other cylinder is for the second stage. The gas supply is distributed evenly to the two first stage cylinders where the gas is compressed. The gas temperature increases due to the act of compression. The gas is routed through an intercooler and moisture separator to cool the gas and remove moisture prior to the second stage. After a second stage of compression, the gas is again routed through an aftercooler and moisture separator where it is cooled and moisture is removed before entering the dryer. The moisture separators utilize chevrons to rapidly change the direction of gas motion thereby trapping the heavier moisture, which is removed via an orifice to dirty radwaste.

When the gas is compressed by the compressor, there are two types of heat generated by the compressor. One is the heat due to friction of compressed metals in the cylinder; this heat is removed by the cylinder cooling system. The other is the heat of compression from the gas. This heat is removed by the cooling water system.

The compressor cylinder cooling system is comprised of a thermo-siphon, coolant reservoir and associated piping. The cooling water is supplied from the safety auxiliaries cooling plant system, which is part of the Closed Cycle Cooling Water license renewal system. As the coolant of water/glycol absorbs heat from the cylinder, a difference in density establishes natural circulation. After the heated coolant rejects heat to the cooling water of safety auxiliaries cooling plant system in the thermo-siphon, it returns to the original cooled state and completes the flow loop.

The compressor cooling water system is comprised of the intercooler and aftercooler and associated piping. The cooling water is supplied from the safety auxiliaries cooling plant system, which is part of the Closed Cycle Cooling Water license renewal system. Both the intercooler and aftercooler are tube and shell type heat exchangers. The compressed gas with high temperature flows through the shell side while the cooling water in the tube side removes the heat from the gas. The heat exchangers associated with the intercooler, aftercooler and thermo-siphon are evaluated for aging management as part of the Closed Cycle Cooling Water System.

The dryer package consists of a pre-filter, an outlet filter, solenoid operated valves, dual desiccant towers as well as piping and valves. The dryer package receives the compressed gas from the compressor, dries the gas via a heatless desiccant and then routes the dry gas into the receiver tank. The gas receiver tank feeds separate instrument gas headers inside the primary containment and reactor building. The users that obtain instrument gas from the gas headers include: main steam safety relief valves, main steam inboard isolation valves, chilled water valves for drywell coolers (unit cooler, equipment drain sump cooler, recirculation pump motor cooler), residual heat removal isolation valve and equalizer check valve, core spray isolation valve and equalizer check valve, drywell/torus vacuum relief valves and traversing incore probe drive mechanism/purge system. After leaving the receiver tanks but before continuing into the primary containment, branch connections are provided to the reactor building-to-torus vacuum breaker valve accumulators through motor operated emergency supply valves.

During normal plant operation, the two trains are interconnected downstream of the receivers isolation valves. Suction is taken from the drywell through a common suction line and intake screen. The gas compressors operate continuously to supply gas needed to support plant operations. Instrument gas is required to be provided to host components or users for normal plant operation that includes certain important functions such as opening the main steam safety relief valves when needed, closing chilled water valves for drywell coolers when needed, opening isolation and check valves for Residual Heat Removal and Core Spray when needed, supplying gas to the operators and accumulators of main steam inboard isolation valve, backing up the Compressed Air System for reactor building-to-torus vacuum breakers, and backing up the nitrogen bottles for traversing in-core probe drive mechanism. These host pneumatic components or users are evaluated in other associated license renewal systems.

In the event of a loss-of-offsite power, the compressors will trip and will not be automatically loaded onto the standby diesel generators. No changes to the system valve positions or modes for compressor operation are made to the system after restarting. When the drywell temperature increases enough to affect the Primary Containment Instrument Gas System temperatures, the compressor suction will be manually transferred from the drywell to the Reactor Building air space. All valves that could require a source of gas before the compressors are restarted are provided with individual accumulators to ensure operability.

During loss-of-coolant accident operation, the LOCA signal will close all of the primary containment isolation valves, the intertie line isolation valves, and the drywell header isolation valves. The plant operators as directed by procedure will restart the compressors and override the LOCA signal to establish a flow path to the safety relief valves including those controlled by the Automatic Depressurization System. However, the suction from the drywell is isolated and each compressor takes suction from inside of the Reactor Building through its own suction line and intake screen. Valves such as the safety relief valves, which may be required immediately following the LOCA but before restarting the Primary Containment Instrument Gas System, are provided with local accumulators to ensure availability.

One design feature in the Primary Containment Instrument Gas System is the instrument gas penetrations of the drywell at P-28A, P-28B, P-39, and J-211. These drywell penetrations have piping that penetrates the drywell and perform the primary containment boundary intended function. All of these penetrations except J-211 have two normally open automatic isolation valves that are located both inside and outside the drywell. Penetration J-211 has two normally open automatic isolation valves that are located on the outside of the drywell. Another design feature is the connection of Compressed Air System to the Primary Containment Instrument Gas System to support maintenance. This connected portion of Compressed Air System to the Primary Containment Instrument Gas System is not safety-related.

For more detailed information, see UFSAR Section 9.3.6.

<u>System Boundary</u>

The Primary Containment Instrument Gas System begins at the gas intake screen located inside the drywell, and continues through the containment penetration (P-39) and associated isolation valves. Outside the drywell, the system divides into two trains, and the boundary continues through the inlet filter to the gas compressor in each train, consisting of an intercooler, moisture separator and thermo-siphon. The boundary for each train continues through an aftercooler, additional moisture separator, prefilter, gas dryer, outlet filter and instrument gas receiver tank. Each train boundary continues through separate drywell penetrations (P-28A, P-28B) with associated isolation valves, to the redundant instrument gas headers inside the drywell. Each train includes a branch line connecting upstream of the separate drywell penetrations (P-28A, P-28B), that continues through a motor operated isolation valve and check valve to a gas accumulator. Each branch line boundary continues through a solenoid valve and ends at the connection to the reactor building-to-torus vacuum breaker butterfly valve air actuator in the Vacuum Relief Valve System. Each train also includes an additional gas intake screen that ties in upstream of the compressor inlet filter and is located outside the drywell in the Reactor Building.

Inside the drywell, each safety-related header boundary continues through branch connections to check valves, accumulators and solenoid valves supplying the main steam safety relief valves air actuators. Each header also continues past the main steam safety relief valves branch connections, through a safety-related isolation valve to the common nonsafety-related header, and then ends at the attachment points to the host pneumatic components or users. The common nonsafety-related header boundary includes a branch connection to the safety-related check valves, accumulators and air actuators on the inboard main steam isolation valves.

The Primary Containment Instrument Gas System boundary also includes a common intertie line between the redundant trains, connecting downstream of the instrument gas receiver tanks and continuing through the motor operated emergency supply crosstie valves. The intertie line includes a branch connection that continues through a common line to a torus penetration (J-211) and associated isolation valves and ends at the connection with the Vacuum Relief Valve System compressed gas supply to the torus to drywell vacuum breakers. The intertie line includes an additional branch connection that ends at the compressed gas supply connection to the Traversing Incore Probe System. The intertie line also includes a branch line that continues through a motor operated isolation valve and ends at the connection to the Compressed Air System.

All associated piping, components and instrumentation contained within the flow path described above are included in the system boundary.

Also included in the license renewal scoping boundary of the Primary Containment Instrument Gas System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor. Included in this boundary are components relied upon to preserve the structural support intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the scope of license renewal is the portion of the Primary Containment Instrument Gas System located inside the drywell, from the instrument gas containment supply header valves located downstream of the branch connection to the main steam safety relief valves, to the attachment points to the host pneumatic components or users, as this portion of the system is gas filled and is not safety-related.

Also not included in the Primary Containment Instrument Gas System scoping boundary are the host pneumatic components or users which consist of pneumatic instrumentation, pneumatically operated valves and other components supplied by the Primary Containment Instrument Gas System in the systems such as: Main Steam System, Vacuum Relief Valve System, Automatic Depressurization System, Traversing Incore Probe System, Chilled Water System, Residual Heat Removal System, and Core Spray System. The host pneumatic components or users are separately evaluated in their associated license renewal systems.

Not included in the Primary Containment Instrument Gas System license renewal scoping boundary are the following interfacing systems, which are separately evaluated as a license renewal system:

Closed Cycle Cooling Water System
Compressed Air System
Main Steam System
Vacuum Relief Valve System
Automatic Depressurization System
Reactor Protection System
Chilled Water System
Residual Heat Removal System
Core Spray System
Traversing Incore Probe System

Also not included in the scoping boundary of the Primary Containment Instrument Gas System are items such as drywell and torus penetrations, which are separately evaluated with the Primary Containment structure for license renewal scoping.

Reason for Scope Determination

The Primary Containment Instrument Gas System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48) and Environmental Qualification (10 CFR 50.49). The Primary Containment Instrument Gas System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Anticipated Transient Without Scram (10 CFR 50.62) or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide primary containment boundary. Supply lines penetrating primary containment are provided with isolation valves. 10 CFR 54.4(a)(1)

2. Provide motive power to safety-related components. Safety-related accumulators are connected to gas operated pneumatic components. 10 CFR 54.4(a)(1)

3. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The safety-related/nonsafety-related interface has components relied upon to preserve the structural support intended function. 10 CFR 54.4(a)(2)

4. 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). The Primary Containment Instrument Gas System is required to supply compressed gas to pneumatic components to support safe shutdown for Fire Protection. 10 CFR 54.4(a)(3)

5. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Primary Containment Instrument Gas System has components that are in the Environmental Qualification Program. 10 CFR 54.4(a)(3)

UFSAR References

9.3.6

License Renewal Boundary Drawings

LR-M-41-1, Sheet 1
LR-M-41-1, Sheet 2
LR-M-57-1, Sheet 1
LR-M-59-1, Sheet 1
LR-M-59-1, Sheet 2

Table 2.3.3-19 Primary Containment Instrument Gas System
Components Subject to Aging Management Review

Component Type	Intended Function
Accumulator	Pressure Boundary
Bolting	Mechanical Closure
Compressor	Structural Support
Drain Traps	Structural Support
Filter Housing (Inlet, Outlet, Prefilter, Intake Screen)	Pressure Boundary
Filter Housing (Inlet, Outlet, Prefilter, Intake Screen)	Structural Support
Flow Element	Pressure Boundary
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Evaluated with the Closed Cycle Cooling Water System
Heat Exchanger Components (Thermo-Siphon)	Evaluated with the Closed Cycle Cooling Water System
Hoses	Pressure Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Tanks (Gas Dryer)	Pressure Boundary
Tanks (Moisture Separator)	Pressure Boundary
Tanks (Receiver)	Pressure Boundary
Valve Body	Pressure Boundary
Valve Body	Structural Support

The aging management review results for these components are provided in:

Table 3.3.2-19 Primary Containment Instrument Gas System
Summary of Aging Management Evaluation

2.3.3.20 Primary Containment Leakage Rate Testing System

System Purpose

The Primary Containment Leakage Rate Testing (PCLRT) System is a license renewal system that provides the means to measure the leakage from the Primary Containment.

The Primary Containment Leakage Rate Testing System consists of the following subsystems: Type A Testing subsystem, Type B Testing subsystem and Type C Testing subsystem. The Type A Testing subsystem is used to pressurize the Primary Containment to a test pressure so that the integrated leakage rate of the containment can be determined and compared with the appropriate acceptance criteria. The determination of Primary Containment leakage is accomplished with a data acquisition center. The Type B Testing subsystem is used to pressurize and measure local leakage across pressure or leakage limiting boundaries other than valves. Similarly, the Type C Testing subsystem is used to pressurize and measure local leakage rates across containment isolation valves.

Portions of both Type A and B testing subsystems are in the scope of license renewal. The Type C testing subsystem is not in the scope of license renewal.

System Operation

Type A Testing Subsystem

This subsystem is comprised of a pressurization facility/connection unit and a data acquisition center. The pressurization facility contains test equipment used to perform integrated leakage rate testing of the Primary Containment boundary. The pressurization facility is not safety-related and is isolated from the Primary Containment during normal operation by test connection manual isolation valves. The connection unit that connects the pressurization facility to the Primary Containment is not safety-related and is gas-filled. The connection unit is normally isolated from the Primary Containment attachment point by a removable spool piece and isolated from the pressurization facility at a permanently installed connection point by test connection manual isolation valves.

The data acquisition center is a data collection and data calculation station. A portion of the data collection station is safety-related piping and valves. This portion includes the safety-related piping and three valves that are an extension from the Primary Containment and are located at penetrations J36C, J36D and J209. The penetrations will be evaluated under the license renewal Primary Containment structure. The piping and valves in the remaining portion of the data collection station that are located from the first seismic anchor to the flexible connection point are not safety-related. The data calculation station is not safety-related and is isolated from the primary containment during normal operation by closed manual isolation valves.

The portion of the data collection station associated with penetrations J36C, J36D and J209 as described above is required to function to support the (a)(1) Primary Containment intended function. This portion is included in the scope of license renewal because it is safety-related and will be evaluated as part of this Primary Containment Leakage Rate Testing license renewal system.

The pressurization facility/connection unit, nonsafety-related portion of data collection station, and data calculation station of the Type A Testing subsystem are not required to function to support license renewal intended functions. They are not included in the scope of license renewal because they are not safety-related and are isolated from the primary containment during normal operation.

Type B Testing Subsystem

This subsystem is comprised of various pressurization units and test units. The pressurization unit consists of test equipment used to perform the local leakage rate testing (LLRT) for the test unit. The pressurization unit is not safety-related and is isolated from the test unit during normal operation by manually closed isolation valves. The test unit is comprised of test components, piping and valves that connect the test components and pressurization unit. The test components are electrical penetration seals, mechanical penetration seals, mechanical expansion bellows, drywell airlock door and other Type B boundaries. These test components are evaluated with the Primary Containment Structure.

The portion of piping and valves between the test component and boundary valve is safety-related. This portion is required to function to support the (a)(1) Primary Containment intended function. It is included in the scope of license renewal because it is safety-related and will be evaluated as part of this Primary Containment Leakage Rate Testing license renewal system.

The pressurization unit and test unit associated with equipment hatch C2 and containment doors is evaluated in the Compressed Air System for license renewal scoping.

The pressurization unit is not required to function to support license renewal intended functions. It is not included in the scope of license renewal because it is not safety-related and is isolated from the test unit during normal operation by manually closed isolation valves.

Type C Testing Subsystem

This subsystem is comprised of various pressurization units and system containment isolation valve test units. The pressurization unit is test equipment used to perform the LLRT for the containment isolation valve test unit. The pressurization unit is not safety-related and is disconnected from the containment isolation valve test unit during normal operation. The system containment isolation valve test units allow connection and removal of the above described test equipment to perform Type C leakage rate testing on an associated containment isolation test volume. The test unit includes the system test connection piping, test manual isolation valves and associated system containment isolation valve test volume which is in other license renewal systems that include containment isolation valves in their system boundaries. These Type C containment isolation test units are evaluated with these other license renewal systems that have containment isolation valves in their system boundary.

The pressurization unit is not required to function to support license renewal intended functions. It is not included in the scope of license renewal because it is not safety-related and is disconnected from the test unit during normal operation.

For more detailed information, see UFSAR Section 6.2.6.

System Boundary

The license renewal scoping boundary of Primary Containment Leakage Rate Testing System (PCLRT) consists of the following Type A, B and C Testing subsystems.

Type A Subsystem

The Type A subsystem consists of the pressurization facility/connection unit and data acquisition center.

The boundary for the pressurization facility/connection unit begins at the permanently installed connection point for the pressurization facility. It continues through the connection unit and ends at the primary containment attachment point. This portion of the system is not safety-related and is not required to perform an intended function. In addition, since this portion of the system contains gas it does not support the system leakage boundary intended function. Therefore, this portion of the Primary Containment Leakage Rate Testing System is not required to perform an intended function and is not included in the scope of license renewal.

The boundary for the data acquisition center begins at the pressure sensing points inside the primary containment atmosphere and suppression chamber. It continues through their corresponding piping/valves at penetrations J36C, J36D and J209, first seismic anchor, isolation valves, flexible connection point and terminates at the data calculation station. The data calculation station and the portion from the first seismic anchor to the flexible connection point are not in scope because this portion of the system is not safety-related and is isolated during normal operation by manually closed isolation valves.

Type B Subsystem

The Type B subsystem boundary begins at the pressurization units that are disconnected from the test units during normal operation. The boundary continues through the piping and the boundary valve closest to each test component and terminates at the attachment points to each test component (e.g., penetration, expansion bellow and airlock door). These test components are evaluated with the Primary Containment Structure for license renewal scoping. The portion of the system between the inlet to the boundary valve closest to the test component and the attachment point of each test component (e.g., penetration, expansion bellow and airlock door) is safety-related, required to perform an intended function and is included in the scope of license renewal. The remaining portion of the system, from the pressurization units that are disconnected from the test units during normal operation to the first seismic anchor, is not safety-related. In addition, since this portion of the system contains gas it does not support the system leakage boundary intended function. Therefore, this portion of the system is not required to perform an intended function and is not included in the scope of license renewal.

Type C Subsystem

The pressurization unit for the Type C subsystem is not safety-related and is disconnected during normal operation. Therefore, this portion of the system is not required to perform an intended function and is not included in the scope of license renewal. As previously discussed, the Type C containment isolation valve test units are in other license renewal system boundaries and are evaluated with these other license renewal systems.

Also included in the license renewal scoping boundary of the Primary Containment Leakage Rate Testing System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor. Included in this boundary are components relied upon to preserve the structural support intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the scoping boundary of the Primary Containment Leakage Rate Testing System license renewal are items such as penetrations, penetration seals, expansion bellows, and airlock door seals, which are separately evaluated in the Primary Containment Structure.

Not included in the Primary Containment Leakage Rate Testing license renewal scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Primary Containment
Compressed Air System

Reason for Scope Determination

The Primary Containment Leakage Rate Testing System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Environmental Qualification (10 CFR 50.49). The Primary Containment Leakage Rate Testing System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48), Anticipated Transient Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide primary containment boundary. Testing lines penetrating primary containment are provided with isolation valves. 10 CFR 54.4(a)(1)

2. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety related function. The safety-related/nonsafety-related interface has components relied upon to preserve the structural support intended function. 10 CFR 54.4(a)(2)

3. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Primary Containment Leakage Rate Testing System has components that are in the Environmental Qualification Program. 10 CFR 54.4(a)(3)

UFSAR References

6.2.6

License Renewal Boundary Drawings

LR-M-55-1, Sheet 1
LR-M-60-1, Sheet 1

Table 2.3.3-20 Primary Containment Leakage Rate Testing System Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-20 Primary Containment Leakage Rate Testing System Summary of Aging Management Evaluation

2.3.3.21 Process and Post-Accident Sampling Systems

System Purpose

The Process and Post-Accident Sampling Systems is a normally operating system that consists of the process sampling plant system and the post-accident sampling system.

The process sampling plant system is designed to permit a representative sample to be taken from all process streams related to plant power operation and liquid radwaste processing. The sample is in a form which can be used in the laboratory and which safeguards against change in the constituents to be examined, minimizes the contamination and radiation at the sample point and reduces decay and sample line plateout as much as possible.

The purpose of the process sampling plant system is to monitor the operation of equipment, and to supply information for making operating decisions where these are influenced by water chemistry. It accomplishes this by collecting steam, gaseous and liquid samples throughout the facility. The intended function of the Process Sampling Plant System for license renewal is to maintain leakage boundary integrity to preclude system interactions. For this reason, portions of this system's pressure retaining components located in proximity to other components performing safety-related functions have been included in the scope of license renewal. This system is not required to operate to support license renewal intended functions, and portions of this system are in scope for potential spatial interaction.

Similarly, the post-accident plant sampling system is designed to obtain representative liquid and gas grab samples from the reactor coolant system and from the primary containment and reactor building atmospheres for radiological and chemical analysis under accident conditions. The grab samples are subsequently transported to the onsite laboratory for chemical and radioisotopic analysis or shipped offsite for analysis.

The purpose of the post-accident sampling plant system is to permit collection and processing of liquid and gaseous samples. The post-accident sampling plant system accomplishes its purpose by providing piping to collect these samples during normal and post-accident conditions, and a system to analyze the samples during post-accident conditions. The post-accident sampling plant system was originally installed to meet the requirements of Item II.B.3 of NUREG 0737. While no longer required by the Technical Specifications, the post-accident sampling plant system continues to be maintained and operation of the system is described in approved plant procedures. This system contains containment isolation valves that are required to operate to support license renewal intended functions, and portions of this system are in the scope of license renewal.

System Operation

Process Sampling Plant System

The process sampling plant system is comprised of three sample stations: reactor building sample station, auxiliary building sample station, and turbine building sample station. Each station provides the service of collecting and analyzing samples obtained from the plant systems in the respective building.

The process sampling station consists of centrally located, prefabricated, shop-assembled panels that contain sample conditioning equipment that reduces the pressure and controls the flow and temperature of the samples. All sample stations are provided with stainless steel sinks that are hooded and ventilated to remove entrained gases liberated during normal sampling. The sinks drain into one of three drainage systems, depending on the service of the water being sampled. The three drainage systems are clean radwaste system, dirty radwaste system and chemical radwaste drain system.

Exceptions to this include some drainage from the reactor building sample station, which is routed to the main condenser, and drainage from the Turbine Building sampling station, which is routed to the condensate drain tank. Where possible, automatic analyzers are used to measure critical analysis parameters. Data are recorded on strip chart recorders and in the plant computer. The grab sample facilities allow operators to collect samples for chemical or radiological analysis.

Sample flow rates to the analyzer and grab sample panels are designed to provide turbulent flow and to supply a representative sample. Where the sample temperature is too high, the sample will be cooled down through cooler prior to the analysis. The cooling water for the coolers are provided by the reactor auxiliaries cooling water plant system. Furthermore, if the temperature is a critical parameter for the sample analysis, an isothermal bath is available in the sample line. The cooling water for the isothermal bath is provided by the chilled water plant system.

The Reactor Building sample station collects and analyzes sample for the following plant systems: residual heat removal system, control rod drive hydraulic system, reactor recirculation system, reactor water cleanup system and cleanup filter/demineralizer system. This sample station is not required to operate to support license renewal intended functions, but is included in the scope of license renewal as this liquid filled station is located within an area adjacent to the components performing a safety related function.

The Auxiliary Building sample station collects and analyzes sample for the following plant systems: auxiliary steam, fuel pool filter demineralizer, liquid radwaste equipment drain processing, liquid radwaste floor drain processing, liquid radwaste chemical waste processing, liquid radwaste regenerant waste processing and solid waste collection. This sample station is not required to operate to support license renewal intended functions, and is not included in the scope of license renewal as this liquid filled station is not located within an area adjacent to the components performing a safety related function.

The Turbine Building sample station collects and analyzes sample for the following plant systems: chiller water system, feedwater, condensate and refueling water storage and transfer, vents and drains heaters, condensate demineralizer, condensate, main steam, and condensate pre-filter system. This sample station is not required to operate to support license renewal intended functions, and is not included in the scope of license renewal as this liquid filled station is not located within an area adjacent to the components performing a safety related function.

Post-Accident Sampling Plant System

The post-accident sampling plant system is primarily comprised of three subsystems: a liquid and gas sample station; a separate but interconnected rack mounted piping station; and a control panel with interconnecting and required panel wiring. A separate refrigeration unit is provided for gas sample cooling purpose. The liquid and gas sample station are each contained in a separate shielded enclosure mounted on a common structure frame. Enclosed within the sample station are equipment trays that contain modularized liquid and gas samplers. The piping station that is installed within the reactor building includes sample coolers and control valves which select sample points. Demineralized water and nitrogen gas are provided as support systems for the post-accident sampling plant system.

The post-accident sampling plant system is designed to operate in two sampling modes: liquid sampling mode and gas sampling mode.

For liquid sampling mode, the liquid sample station collects a small liquid sample, large volume liquid sample, or dissolved gas sample from either the reactor coolant or suppression pool. Sample of reactor coolant is obtained from one jet pump instrument line when the reactor is at pressure. Alternatively, when the reactor is depressurized, sample can be obtained from the RHR pump discharge when in the shutdown cooling mode. Suppression pool sample is obtained from the residual heat removal pump discharge when in the suppression pool cooling mode. All samples are cooled prior to arrival at the sample station by small coolers of piping station located in reactor building. The cooling water for the coolers is supplied from safety auxiliaries cooling plant system. The liquid sample station is designed to allow demineralized water flushing of the system lines from a point in the piping station through the sampling needles. The liquid sample lines are flushed from a demineralized water tank, which is pressurized from the nitrogen gas supply. The purge flow is adjusted by the operator through control panel to maintain turbulent flow in the sample line. Flow is established to the sample station, through a four-way ball valve and back to the suppression pool after merging with the liquid as collected in the liquid collector. A radiation monitor in the sampling unit provides an assessment of sample activity level and also monitors the effectiveness of system flushing following sample operation. The residual dissolved gas will be vented into the Reactor Building atmosphere through the gas pump of gas sample station.

For gas sampling mode, the gas sample station collects the gas samples from the drywell, suppression chamber, or reactor building atmospheres. The gas as sampled from the mentioned is cooled by a refrigeration unit to remove moisture and associated iodine. Gas samples are analyzed onsite with a gamma spectrometer and a gas chromatograph. When purging the drywell and suppression chamber gas sample lines to obtain a representative sample, the flow is pumped back to the suppression chamber. During purging of the reactor building line and when flushing the sample panel lines with nitrogen, flow is pumped back to the Ractor Building. The gas sample lines are insulated and electrically heat traced. The heat tracing is evaluated as an electrical commodity.

The post-accident sampling plant system sampling line penetrations, although not in use during power operation, have piping that either connects to the existing primary containment penetration or penetrates the primary containment and performs a primary containment boundary intended function. Each of the penetrations is isolated during power operation by two safety-related automatic isolation valves. The piping and safety-related valves associated with penetrations will be in the scope of the Process and Post-Accident Sampling license renewal system.

For more detailed information, see UFSAR Section 9.3.2.

System Boundary

Process Sampling Plant System

The license renewal scoping boundary of the process sampling plant system encompasses the liquid filled portions of the system that are located in proximity to equipment performing a safety-related function. This includes the sample associated piping with the sampling stations located within the reactor building. Included in this boundary are pressure retaining components relied upon to preserve the leakage boundary intended function of this system. For more information, refer to the license renewal boundary drawings for identification of this boundary, shown in red.

Not included in the scope of license renewal are the piping and components located within the liquid sample station panel enclosures in the Reactor Building, as these enclosures do not contain safety-related equipment. The enclosures provide physical shielding, and the enclosed components do not have the potential for spatial interaction with safety-related components. The enclosure prevents leakage or spray from impacting safety-related components. The enclosure is in scope and evaluated as a structural commodity.

Post-Accident Sampling Plant System

The post-accident sampling plant system boundary for liquid sampling mode begins at the attachment point to a calibrated jet pump instrument line outside the primary containment and upstream of the excess flow check valve and the attachment point to the upstream of the first isolation valve in the Residual Heat Removal System sample line at the discharge of each residual heat removal exchanger. All sample piping merges and continues through the coolers and the ball valve at which two branches emerge. One branch piping continues through the four-way ball valve and ends at the small liquid volume sample bottle. The other branch piping continues through the closed liquid loop that contains hold-up cylinder and gas breakdown pump and ends at either gas collection chamber or large volume liquid sample bottle. The boundary includes the piping to flush the residual liquid sample in the liquid sample station. The flushing piping begins at the demineralized water tank, which is pressurized from the nitrogen gas supply. The piping continues through the whole liquid sample station and return to the suppression pool after merging with the piping connected with the liquid collector. Also included in the boundary is the piping to vent the residual dissolved gas from the liquid sample. The vent piping begins at the attachment point upstream of the gas collection chamber and continues through the branch connection line for liquid collector vent, gas pump in the gas sample station, and ends at the Reactor Building atmosphere. All associated piping, components and instrumentation contained within the flow path described above are included in the system boundary.

The post-accident sampling plant system boundary for gas sampling mode begins at the attachment points to the atmospheres of the drywell, suppression chamber and reactor building. The sample lines continuing from the attachment points meet at the multi-port sample valve and continue through gas cooler, and then end at the gas sample bottle. The boundary includes the piping to purge the residual gas sample in the gas sample station. The purging piping begins at the attachment point to the upstream of the gas sample bottle and continues through the branch connection point of liquid collector vent, gas pump, and then ends at the suppression chamber when both the drywell and suppression chamber gas sample lines are purged or ends at the reactor building atmosphere when the reactor building sample line is purged. All associated piping, components including the refrigerant unit and instrumentation contained within the flow path described above are included in the system boundary.

Included in the license renewal scoping boundary of the post-accident sampling plant system are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor and Auxiliary buildings. Included in this boundary are pressure-retaining components relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the License Renewal Boundary Drawing for identification of this boundary, shown in red.

Not included in the scope of license renewal are the piping and components located inside the liquid sample station, gas sample station, and piping station, as these enclosures do not contain safety-related equipment. The enclosures provide physical shielding, and the enclosed components do not have the potential for spatial interaction with safety-related components. Also not included in the scope of license renewal are the demineralized water tank, control panel, nitrogen supply bottles and refrigeration unit, as they are nonsafety-related and physically located in the radwaste corridor that does not have components performing a safety-related function.

Not included in the Process and Post-Accident Sampling Systems license renewal scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Residual Heat Removal System
Control Rod Drive System
Reactor Recirculation System
Reactor Water Cleanup System
Auxiliary Steam System
Fuel Pool Cooling and Cleanup System
Radwaste System
Chilled Water System
Feedwater System
Condensate Storage and Transfer
Main Turbine and Auxiliary System
Condensate System
Main Steam System
Hydrogen Water Chemistry System
Equipment and Floor Drainage System
Closed Cycle Cooling Water System

There are some portions of the Process and Post-Accident Sampling Systems boundary that are in scope for license renewal for the primary containment boundary intended function. These portions of the system are associated with the sampling line penetrations, although not in use during power operation. These penetrations have piping that either connects to the existing primary containment penetration or penetrates the primary containment. Each of the penetrations is isolated during power operation by two safety-related automatic isolation valves. The piping and safety-related valves associated with containment penetrations will be in the scope of the Process and Post-Accident Sampling license renewal system.

Reason for Scope Determination

The Process and Post-Accident Sampling Systems meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The Process and Post-Accident Sampling Systems is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48), Environmental Qualification (10 CFR 50.49), Anticipated Transient Without Scram (10 CFR 50.62) and Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide primary containment boundary. Sampling lines penetrating primary containment are provided with isolation valves. Flow orifices are provided to limit reactor coolant loss from a rupture of the sample lines. 10 CFR 54.4(a)(1)

2. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The safety-related/nonsafety-related interface has components relied upon to preserve the structural support and leakage boundary intended function. 10 CFR 54.4(a)(2)

UFSAR References

9.3.2

License Renewal Boundary Drawings

LR-M-23-1, Sheet 2
LR-M-38-0, Sheet 1
LR-M-38-0, Sheet 2
LR-M-44-1, Sheet 1

Table 2.3.3-21 <u>Process and Post-Accident Sampling Systems</u>
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Bolting (Class 1)	Mechanical Closure
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Restricting Orifices	Pressure Boundary
Restricting Orifices	Throttle
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary
Valve Body (Class 1)	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-21 Process and Post-Accident Sampling Systems
Summary of Aging Management Evaluation

2.3.3.22 Radwaste System

System Purpose

The Radwaste System is a normally operating mechanical system designed to process liquid radioactive waste for reuse by the plant or for discharge to the Delaware River. The Radwaste System also processes and packages solid radioactive waste for shipment to an offsite repository. The Radwaste System consists of the following plant systems: liquid radwaste, solid radwaste, and radioactive laundry. The liquid radwaste system is designed to collect, store, process, and dispose of or recycle all radioactive or potentially radioactive liquid waste generated by plant operation or maintenance. The solid radwaste system collects and processes wet and dry radioactive wastes generated by the plant, packages and monitors the resultant solid radioactive product, and provides temporary storage facilities prior to offsite shipment and permanent disposal. The radioactive laundry collects and processes detergent drains from the laundry and personnel decontamination facilities and discharges it to the Delaware River.

The purpose of the Radwaste System is to provide for collection and processing of potentially radioactive liquid and solid wastes generated by the plant. The Radwaste System accomplishes this through the use of tanks, demineralizers, filters, coolers, piping, valves and pumps required to process liquid radwaste, and waste containers and drums to process solid radwaste.

The drywell floor and equipment drain sump discharge piping, a portion of the liquid radwaste system, contains safety-related piping and automatic containment isolation valves that support the primary containment intended function, and are included in scope for license renewal. Other portions of both the liquid and solid radwaste systems have water filled piping in the vicinity of safety-related equipment and are in the scope of license renewal for spatial interaction only. The remainder of the system, including the various tanks and associated processing equipment, is not in the scope of license renewal because it does not perform an intended function.

System Operation

Liquid waste input originates from equipment leakage, drainage, and process waste produced by plant operations. Radioactive wastes collected throughout the plant are transferred to the appropriate collection tanks in the Auxiliary Building Service and Radwaste Area. Waste inputs are processed, following neutralization if necessary, on a batch basis through various combinations of filters and mixed bed demineralizers based on the waste source point and expected destination. The processed waste intended for reuse are collected in one of the sample tanks for chemical and radioactivity analysis. If acceptable, the tank contents are returned to the condensate storage tank for plant reuse. A recycle routing from the sample tank allows the sampled water that does not meet demineralized water quality requirements to be pumped back to a collector tank for additional processing by filtration and demineralization, or to the waste surge tank for transfer or other processing. If the plant condensate inventory is high, or there is no intent to return it to the plant, the sampled waste water is discharged to the cooling tower blowdown line for dilution prior to discharge to the Delaware River.

The solid radwaste system receives powdered and bead resin and filter media slurries from the Condensate, Reactor Water Clean Up, Fuel Pool Cooling and Radwaste systems. The slurries then go to a bypass of the solid radwaste system provided upstream of the centrifuge feed tank which is no longer used. This bypass enables the processing of resins by a portable system supplied by a vendor. Permanent flanged connections are provided on the south wall of the radwaste truck bay to enable processing of filter media, waste sludge and/or resin slurries by the portable dewatering system. Space is provided outside the truck bay, for a temporary control panel with an adjacent 480 V AC power supply connection. This provides maximum system flexibility and minimizes radiation exposure. The condensate is returned to the waste sludge phase separator and the solids are put into a high integrity container for storage.

The solid radwaste system also accepts dry solid trash. Noncompactable trash, e.g., tools and components, is packaged in a suitable sized container, which meets DOT requirements.

The radioactive laundry system collects and processes detergent drains. These drains are high in soaps and may be high in organics and are treated with an anti-foamant, buffer, and pH chemicals as needed. The radioactive laundry system does not perform an intended function and is not in the scope of license renewal.

For more detailed information, see UFSAR Sections 6.2.4, 11.2 and 11.4.

<u>System Boundary</u>

The Radwaste System boundary begins at the attachment point to the interfacing system piping (Equipment and Floor Drainage, Reactor Water Clean Up, Fuel Pool Cooling, Condensate, and Decontamination Facilities) or the laundry facility and continues to the appropriate collection tanks, waste sludge phase separator, or spent resin tank in the Auxiliary Building Service and Radwaste Area. From the tanks, the waste is processed through filters and demineralizers for the liquid radwaste, or solidification and drying components for the solid radwaste. Once water purity has been confirmed, the liquid is returned to the plant, discharged to the Delaware River, or returned for reprocessing. The system ends at the condensate storage tank or discharge to the river.

The Radwaste System supports the primary containment intended function. This portion of the system begins with the drywell floor and equipment drains inboard isolation valves, continues through the drywell penetrations (one each for the drywell equipment drain sump and the floor drain sump pump discharge lines) and ends at the outboard isolation valves.

Also included in the license renewal scoping boundary of the Radwaste System are those water filled portions of nonsafety-related piping and equipment located in proximity to equipment performing a safety-related function. This includes the nonsafety-related portions of the system located in the Primary Containment and Reactor Building. Included in this boundary are pressure-retaining components relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the license renewal boundary drawings for identification of this boundary, shown in red.

The Radwaste System piping and components located in Turbine Building and Auxiliary Building Service and Radwaste Area are not in the vicinity of safety-related equipment and are not required to support intended functions. This portion of the Radwaste System is not included in scope for license renewal.

Not included in the Radwaste System license renewal scoping boundary are the following interfacing systems which are separately evaluated as license renewal systems:

Auxiliary Building Service and Radwaste Ventilation Systems
Circulating Water System
Compressed Air System
Condensate System
Condensate Storage and Transfer System
Equipment and Floor Drainage System
Fuel Pool Cooling and Cleanup System
Main Condenser Air Extraction System
Residual Heat Removal System
Reactor Water Cleanup System

Reason for Scope Determination

The Radwaste System is in scope under 10 CFR 54.4(a)(1) because portions of the system are safety-related or relied upon to remain functional during and following design basis events. The Radwaste System is in scope under 10 CFR 54.4(a)(2) because failure of non-safety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The system is in scope under 10 CFR 54.4(a)(3) because it is relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49), and Station Blackout (10 CFR 50.63). The Radwaste System is not relied upon in any safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48) or Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provides primary containment boundary. The Radwaste System (drywell floor and equipment drain portion) isolation valves close automatically on isolation signals. 10 CFR 54.4(a)(1)

2. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Radwaste System includes nonsafety-related water filled lines in the Reactor Building that have the potential for spatial interaction (spray or leakage) with safety-related SSCs. 10 CFR 54.4(a)(2)

3. Relied upon in the safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10CFR 50.49). The Radwaste System (drywell floor and equipment drain portion) isolation valves are expected to operate in a post LOCA environment. 10 CFR 54.4(a)(3)

4. 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). The Radwaste System (drywell floor and equipment drain portion) isolation valves are credited in the Station Blackout analysis for maintaining primary containment integrity. 10 CFR 54.4(a)(3)

UFSAR References

11.2
11.4

License Renewal Boundary Drawings

LR-M-61-1, Sheet 1
LR-M-61-1, Sheet 2
LR-M-66-0, Sheet 1

Table 2.3.3-22 Radwaste System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Pump Casing	Leakage Boundary
Tanks	Leakage Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-22 Radwaste System
Summary of Aging Management Evaluation

2.3.3.23 Reactor Building Ventilation System

System Purpose

The Reactor Building Ventilation System is a continuously operating mechanical system with containment pre-purge capability, heating and cooling capability and an isolation mode. The system is designed to provide filtering, cooling and heating to the reactor building compartments during startup, full power, shutdown and some portions remain operational during design basis accidents. The Reactor Building Ventilation System consists of the following plant systems: reactor building ventilation system, equipment area cooling system, containment pre-purge cleanup system, steam tunnel cooling system and electric unit heaters. However, portions of the Reactor Building Ventilation System are not required to perform intended functions and are therefore, not in scope. The Reactor Building Ventilation System has several interfaces with other systems that are not in the license renewal boundary of the Reactor Building Ventilation System.

The purpose of the Reactor Building Ventilation System is to maintain compartment temperatures at acceptable limits, it regulates the static pressure within the reactor building to maintain air flow from areas of lesser contamination to areas of greater contamination, and provides for safe disposal of airborne contaminants.

It accomplishes the above by maintaining the reactor building pressure at a slightly negative pressure with respect to outdoor pressure while ventilating the reactor building with filtered air and exhausting outdoors through a high efficiency particulate air (HEPA) filter.

The Reactor Building Ventilation System is also used during inerting and de-inerting of the primary containment and provides a flow path for Filtration, Recirculation, and Ventilation System for design basis events. In addition the Reactor Building Ventilation System is used to provide compartmental heating or cooling to Emergency Core Cooling System (ECCS) pump compartments and steam tunnel during normal and abnormal conditions.

During normal plant operation, the Reactor Building Ventilation System is in service and the Filter, Recirculation and Ventilation System is in standby. The containment pre-purge cleanup system is normally out of service and only operates during inerting and de-inerting operations. During a design basis accident, the Reactor Building Ventilation System automatically shuts down and the secondary isolation dampers will close. The Filter, Recirculation and Ventilation System automatically starts and uses the Reactor Building Ventilation System ductwork within the reactor building during design basis events. The safety-related reactor building equipment area cooling plant system unit coolers will continue to operate during normal and emergency operating conditions providing cool air to the safety-related pump compartments.

System Operation

The reactor building ventilation plant system is comprised of a supply and exhaust sub-system. The reactor building plant supply sub-system is part of the reactor building ventilation system and is comprised of three 50% capacity supply trains. During normal plant operations, two of the three trains are operating. During refueling operations, all three supply fans are placed in service to maintain proper internal building pressures on the refuel floor. Each reactor building plant supply system train consists of a common intake louver and plenum, a particulate filter, high efficiency filter, steam heating coil, chilled water cooling coil, in-duct housing supply fan, ductwork, controls, induct electric heating coils, dampers and instruments. The Reactor Building Ventilation System chilled water cooling coils are evaluated with the Chilled Water System. The flow path for all three trains start at the common intake plenum, air flows from the plenum into the reactor building ventilation housing where it is filtered and tempered. Air continues through the housing fan, through the exhaust ductwork where the air re-combines into a common duct header. The airflow continues past the two safety-related secondary containment isolation dampers, one inboard and one outboard. Flow continues into the reactor building and is distributed throughout the entire reactor building. The system boundary ends at the compartment louvers throughout the reactor building and refuel floor exhaust registers. Also in the boundary are the High Pressure Coolant Injection (HPCI), Reactor Core Isolation Cooling (RCIC) and standby liquid control room's in-duct safety-related electric heating coils, which are used to maintain these compartments at a minimum temperature.

The reactor building ventilation plant exhaust sub-system is comprised of three 50% capacity trains. Each reactor building ventilation plant exhaust system is part of the reactor building ventilation system. Each train consists of a low efficiency filter, HEPA filter, flexible ductwork connections, controls, dampers, exhaust fan and instruments. During normal plant operations, two of the three exhaust fans are operating. During refueling operations, all three exhaust fans are placed in service to maintain proper internal building pressures on the refuel floor. The flow path begins at the return registers located within the reactor building and refuel floor compartments. Airflow travels through the return ductwork from all elevations in the reactor building. The airflow combines into a common ductwork header, flows across the in-duct radiation detectors and the airflow pass through two in-series safety-related secondary containment isolation dampers, one inboard and one outboard. An isolation of the Reactor Building Ventilation System will occur on detected high radiation levels. These radiation detectors are evaluated in the Leak Detection and Radiation Monitoring System. The airflow continues through the secondary isolation dampers and airflow splits into three ducts feeding each of the reactor building exhaust units. Air flows through the low efficiency and HEPA filter, and continues through the exhaust fan and airflow re-combines into a common duct header. The flow path ends as the common duct header exhaust air from the reactor building ventilation plant system to the south plant vent stack. During abnormal conditions the supply and exhaust containment isolation dampers close, the reactor building supply and exhaust plant systems shutdown and the Filter, Recirculation and Ventilation System automatically starts. The reactor building ventilation plant system ductwork contained inside the reactor building and refuel floor is used by the Filter Recirculation Ventilation System to process the reactor building air during accident conditions.

The equipment area cooling plant system is comprised of both safety-related and nonsafety-related cooling units. Each equipment compartment contains two 100% capacity cooler units. Each cooler unit contains a cooling coil, fan housing and associated ductwork, piping and controls. The cooling water to the cooling coil is provided either from the Control Area Chilled Water System (SACS Room Coolers) or the Closed Cycle Cooling Water System (RCIC, HPCI, RHR, and Core Spray Room Coolers). The cooling coils are evaluated for aging management review in either the Control Area Chilled Water System or Closed Cycle Cooling Water System, respectively. Also included in the scope of license renewal is the safety-related, reactor building compartment steam flooding isolation dampers, which also have an active safety-related function in the Reactor Building Ventilation System. The function of the dampers is to contain the steam resulting from a pipe break within the equipment compartment in which the break occurs and to prevent the spread of the steam through the HVAC openings or ductwork into adjacent spaces. These dampers are normally open, redundant series mounted, fast closing, counterweighted back pressure dampers. Closure of the dampers is actuated by a pressure switch sensing the rise in pressure created by the discharge of fluid from a broken pipe. The flow path for all cooling units begins with the warm compartment air flowing across the cooling coil, which is contained within the cooling unit housing. The air continues into the inlet of the unit cooler fan where it finally ends as the air exhausts back into the equipment compartment lowering the room temperatures. The cooling units for each of the safety-related compartments are actuated by a temperature switch located within the equipment compartment to maintain appropriate equipment compartment temperatures.

Not included in the scope of license renewal is the nonsafety-related portion of the Reactor Building Ventilation System equipment area cooling system located within the control rod drive (CRD) repair shop and control rod drive control room compartments. Some compartments containing equipment area cooling plant systems also contain safety-related steam flooding isolation dampers, which are installed on the common supply and exhaust duct headers leading to and from the adjacent compartments which contain safety-related equipment. These isolation dampers are designed to close when a line break occurs.

The containment pre-purge cleanup plant sub-system is comprised of one nonsafety-related full capacity ventilation train. This train consists of a housing unit, which contains a low efficiency filter, electric heating coil, HEPA filter, charcoal filter and high efficiency filter. Also included in this plant system is a external full capacity fan, along with dampers, safety-related primary containment isolation valves, ductwork instruments and controls. The safety-related isolation dampers (valves) are used to isolate the system from the torus and primary containment during normal and abnormal plant conditions. The safety-related torus and primary containment isolation valves are evaluated with the Containment Inerting and Purging System. This nonsafety-related system is used to pre-purge the drywell and torus prior to aligning Reactor Building Ventilation System for final purging operations. The drywell and torus atmosphere is first recirculated by the containment pre-purge cleanup plant system, as required, to reduce the level of atmospheric radioactivity to within radiological effluent technical specification limits. The system is then connected in parallel with the Reactor Building Ventilation System ductwork. The containment pre-purge cleanup plant system also contains safety-related steam flooding isolation dampers, which are installed on the common supply and exhaust duct headers leading to and from the torus and primary containment. These isolation dampers are designed to close when a line break occurs.

The steam tunnel cooling plant system is comprised of one full capacity nonsafety-related unit cooler, which contains two chilled water cooling coils and two 100% capacity fans, ductwork, piping and controls. Cooling is supplied by the Chilled Water System. The cooling coils are evaluated with the Chilled Water System. Warm air enters the steam tunnel unit cooler and passes over the two in series cooling coils. Airflow continues to one of the full capacity fans and the flow ends as it exits the exhaust ductwork from the operating fans. The steam tunnel cooling plant system does not support any intended function of the reactor building ventilation system and is not in scope of license renewal.

The nonsafety-related electric unit plant heaters consist of heating coils that are controlled by local room thermostats. These nonsafety-related unit heaters are located throughout the reactor building room compartments. There is no pressure boundary associated with the electric unit heaters. Since there is no pressure boundary or housing associated with the electric unit heaters and does not support any intended function of the reactor building ventilation system, this component type is not subject to an aging management review.

For more detailed information, see UFSAR Section 9.4.2.

System Boundary

The reactor building ventilation plant system has both a supply and exhaust portion to this system. The reactor building ventilation plant sub-system supply boundary begins at the common intake louver located on the reactor building and continues to a common supply plenum. The supply ductwork then continues into the three supply ducts. Each of the ducts leads to a reactor building ventilation supply train. Each supply train consists of an inlet damper, particulate filter, high efficiency filter, in-duct steam heating coil, in-duct chilled water coil and supply fan. The steam heating coil is provided by the Auxiliary Steam System, which supplies steam to the heating coils. Chilled water is provided by the Chilled Water System and supplies chilled water to the cooling coil. The steam system and chilled water piping and connections are included and evaluated for aging management review with their respective systems for license renewal. The system boundary continues through the external 50% capacity supply fan and isolation damper and combines into a common supply duct connecting all three reactor building supply trains together. As the supply duct passes through the reactor building, the ductwork contains a pair of in-series safety-related secondary containment supply isolation dampers, one inboard and one outboard damper. The reactor building ventilation plant supply air system boundary continues into the reactor building supply safety-related ductwork, which supplies all eight elevations within the reactor building, and into the individual room compartments on each elevation. The system boundary ends at the reactor building compartment supply registers located in these room compartments. For the HPCI, RCIC and standby liquid control rooms, the compartment ducts also contain safety-related electric heaters, which are used to maintain minimum temperatures in these compartments. During accident conditions, an alternate reactor building flow path connects the reactor building ventilation supply and exhaust ductwork with the Filtration, Recirculation and Ventilation System. The reactor building ventilation supply and exhaust sub-systems will shutdown, all secondary containment safety-related dampers will close and the Filtration, Recirculation and Ventilation System will use the reactor building ductwork to recirculate air throughout the reactor building and venting of air from the reactor building to the vent at the top of the reactor building. The Filtration, Recirculation and Ventilation System is evaluated as a separate system for license renewal.

The reactor building ventilation exhaust plant sub-system boundary begins at the reactor building compartment return registers located at all eight elevations within the reactor building. The return ductwork from these compartments continues into the common exhaust duct. The exhaust ductwork contains in-duct radiation monitors, which are used to isolate the Reactor Building Ventilation System and start the Filtration, Recirculation and Ventilation System on high radiation levels. The ductwork continues and passes through a pair of in-series safety-related secondary containment isolation dampers, one inboard and one outboard damper. The system boundary continues as the nonsafety-related ductwork splits into three separate ducts. Each exhaust duct supplies one of the reactor building ventilation system exhaust filter units. Each filter unit consists of a back draft damper, low efficiency filter and a HEPA filter. Flow exits the filter housing and flows to the inlet of a 50% capacity exhaust fan. The system boundary continues with the exhaust air from the exhaust fan, passing through a balancing damper where flow from all three exhaust filter units combine into a common duct connecting to the south plant vent. The system boundary ends as airflow exhausts outdoors through the south plant vent.

The equipment area cooling plant system boundary begins at the inlet to the unit coolers and passes over the in-duct cooling coils. Air continues through the unit cooler housing and into the inlet of the unit cooler fan. The system boundary ends at the unit cooler fan discharge to the equipment compartment. The in-duct cooling coils are evaluated with the Control Area Chilled Water System or the Closed Cycle Cooling Water System for license renewal.

The containment pre-purge cleanup plant system boundary begins at the exhaust ductwork connected to the containment isolation valves from the torus and primary containment. The primary containment isolation valves (exhaust and supply) are evaluated with the Containment Inerting and Purging System for license renewal. The ductwork from the torus pass through a pair of compartment steam flooding safety-related isolation dampers and combine with the return ductwork from primary containment to a common duct header. This header continues to the nonsafety-related containment pre-purge cleanup filter housing, which consists of low and high efficiency filters, electric heating coil, HEPA filter and a charcoal filter. The boundary continues to the nonsafety-related containment pre-purge fan and continues into the exhaust ductwork. The ductwork returns back either to the torus or primary containment where the boundary ends at the primary containment valves. The pre-purge cleanup plant system ductwork also connects to the reactor building supply and exhaust ductwork where the torus and primary containment can be either vented or exhausted using the Reactor Building Ventilation System.

Not included in the scope of license renewal is the nonsafety-related portions of the Reactor Building Ventilation System, including the nonsafety-related portions of the reactor building ventilation supply sub-system (the nonsafety-related supply trains, dampers and ducting leading to the safety-related secondary containment isolation dampers), and portions of the reactor building ventilation exhaust sub-system, including the nonsafety-related exhaust filter units, dampers and ducting after the safety-related secondary containment isolation dampers leading to the nonsafety-related reactor building ventilation exhaust units. The reactor building ventilation supply and exhaust sub-system fan units, dampers and ductwork is not in scope of license renewal because they are not safety-related and do not support the safety related portions of the Reactor Building Ventilation System during design basis events. During a design basis event, the safety-related supply and exhaust secondary containment isolation valves will close and isolate the reactor building and shutdown the reactor building ventilation supply and exhaust fan units, allowing the Filter, Recirculation and Ventilation System to circulate air within the reactor building using the Reactor Building Ventilation System safety-related dampers and ducting. The Filter, Recirculation and Ventilation System is separately evaluated for licensing aging management review. The portions of the equipment area cooling plant systems for the CRD and CRD control room compartments are not in the scope of license renewal because these compartments do not contain safety-related equipment. Cooling of these components is not required to support licensing renewal intended functions. The nonsafety-related containment pre-purge cleanup plant system is used to vent and purge to torus and primary containment during outages and prior to unit startup and therefore is not required to support license renewal intended functions. The containment pre-purge cleanup plant system is not in the scope of license renewal because it does not support the in scope portions of the Reactor Building Ventilation System. The nonsafety-related steam tunnel cooling plant system provides supplemental ventilation in the steam tunnel compartment only. The steam tunnel cooling plant system is not required to support intended functions and is not included within the scope of license renewal. The nonsafety-related electric room heaters are not within the scope of license renewal because these heaters only provide supplemental heating to building compartments within the reactor building and are not required to support license renewal intended functions.

Also included within the Reactor Building Ventilation System is the reactor building pressure monitoring instrumentation.

Not included in the Reactor Building Ventilation System scoping boundary are the following systems, which are separately evaluated as license renewal systems:

Auxiliary Steam System
Chilled Water System
Closed Cycle Cooling Water System
Compressed Air System
Containment Inerting and Purging System
Control Area Chilled Water System
Filtration, Recirculation and Ventilation System
Leak Detection and Radiation Monitor System

Reason for Scope Determination

The Reactor Building Ventilation System meets 10 CFR 54.4(a)(1) because portions of the system are safety-related and relied on to remain functional during and following design basis events. The Reactor Building Ventilation System meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified in 10 CFR 54(a)(1). The Reactor Building Ventilation System meets 10 CFR 54(a)(3) because it is relied upon in the safety analyses and 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), and Station Blackout (10 CFR 50.63). The Reactor Building Ventilation System is not relied upon in any safety analyses or plant evaluation to perform a function that demonstrates compliance with the Commission's regulation for Anticipated Transients Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide secondary containment boundary. Provides secondary containment isolation of the reactor building ventilation exhaust and supply dampers during emergency conditions. 10 CFR 54.4(a)(1)

2. Maintain emergency temperature limits within areas containing safety related components. Provide ventilation cooling and isolation capability within the reactor building to maintain environmental conditions at acceptable limits during normal and abnormal conditions. 10 CFR 54.4(a)(1)

3. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Reactor Building Ventilation System includes nonsafety-related piping that connects to and provides structural support for safety-related piping. 10 CFR 54.4(a)(2)

4. Relied upon in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection (10 CFR 50.48). The unit coolers are credited to maintain the safety-related pump rooms within temperature limits during fire conditions. 10 CFR 54.4(a)(3)

5. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's requirements for Environmental Qualification. (10 CFR 50.49) The unit coolers are credited in maintaining acceptable room conditions within the safety-related pump compartments during pump operation. 10 CFR 54.4(a)(3)

6. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's requirements for Station Blackout (10 CFR 50.63). The unit coolers are credited in maintaining acceptable room conditions within the safety-related pump compartments during pump operation. 10 CFR 54.4(a)(3)

<u>UFSAR References</u>

9.4.2

<u>License Renewal Boundary Drawings</u>

LR-M-83-1, Sheet 1
LR-M-84-1, Sheet 1
LR-M-76-1, Sheet 1

Table 2.3.3-23 Reactor Building Ventilation System
Components Subject to Aging Management Review

Component Type	Intended Function
Accumulator	Pressure Boundary
Bolting	Mechanical Closure
Damper Housing	Pressure Boundary
Door Seal	Pressure Boundary
Ducting and Components	Pressure Boundary
Electric Heaters (Housing)	Pressure Boundary
Fan Housing	Pressure Boundary
Flow Device	Pressure Boundary
Heat Exchanger Components (RBVS Supply System)	Evaluated with the Chilled Water System
Heat Exchanger Components (Room Unit Coolers)	Evaluated with the Closed Cycle Cooling Water System
Heat Exchanger Components (SACS Room Unit Coolers)	Evaluated with the Control Area Chilled Water System
Louver	Pressure Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Sensor Element (Temperature)	Pressure Boundary
Sensor Element (Radiation Detector)	Pressure Boundary
Thermowell	Pressure Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-23 Reactor Building Ventilation System
Summary of Aging Management Evaluation

2.3.3.24 Reactor Water Cleanup System

System Purpose

The Reactor Water Cleanup System is a filtration and demineralization system that maintains the purity of the water in the reactor coolant system. It can be operated during startup, shutdown, and refueling modes, as well as during power operation. The primary purpose of the Reactor Water Cleanup System is to: reduce the deposition of water impurities on fuel surfaces, thus minimizing heat transfer surface fouling; reduce secondary sources of beta and gamma radiation by removing corrosion products, impurities and fission products from the reactor coolant; reduce the concentration of chloride ions to protect steel components from chloride stress corrosion; and maintain or lower water level in the reactor vessel during startup, shutdown and refueling operations, in order to accommodate reactor coolant swell during heatup and to accommodate water inputs from the Control Rod Drive System. The secondary purpose of the Reactor Water Cleanup System is to minimize thermal stratification of the reactor vessel during periods of no recirculation flow; to provide an alternate means of vessel cooldown; and to provide continuous water quality monitoring for conductivity, pH, oxygen, and silica. The Reactor Water Cleanup System accomplishes these purposes by forced circulation of reactor coolant through heat exchangers and filter-demineralizers.

Portions of the Reactor Water Cleanup System are considered reactor coolant system pressure boundary. The Reactor Water Cleanup System has automatic valve actuation signals that isolate the system from the reactor coolant pressure boundary.

The Reactor Water Cleanup System includes the noble chemical mitigation monitoring and data acquisition system.

System Operation

The Reactor Water Cleanup System is comprised of reactor water cleanup recirculation pumps, regenerative heat exchangers, non-regenerative heat exchangers, isolation and throttle valves, piping, cleanup filters and auxiliaries (e.g., precoat tank, precoat pump, filter demineralizer, holding pump, etc.), and reactor drain lines. The noble chemical mitigation monitoring and data acquisition system is also part of the Reactor Water Cleanup System operation.

Reactor coolant flows from the A and B recirculation loops, and the bottom reactor head drain line, through the reactor water cleanup system supply isolation valves, then continues to the suction of the reactor water cleanup recirculation pumps. The discharge from the pumps is cooled in the regenerative and non-regenerative heat exchangers (in series) to protect the powdered resin, processed through the filter-demineralizer, reheated through the regenerative heat exchanger and returned back to the reactor through the reactor feedwater lines. The Reactor Water Cleanup System simultaneously takes suction from the reactor vessel bottom drain to assist in preventing thermal stratification in the lower vessel head region and removes any impurities that may settle in the lower head region. The Reactor Water Cleanup System can be used to remove excess water from the reactor in order to maintain reactor water level during startup, shutdown, and refueling evolutions. To lower reactor level, some of the cleanup system effluent flow is directed through the blowdown flow path to the condensate system or to the Radwaste System.

At the primary containment penetration the reactor water cleanup supply piping has one motor operated isolation valve inside the drywell and one motor operated isolation valve outside the drywell. The reactor water cleanup supply isolation valves will close and consequently the reactor water cleanup recirculation pumps will stop automatically under any of the following conditions: low-low reactor level, actuation of the Standby Liquid Control System, non-regenerative heat exchanger high outlet temperature (closes the outboard isolation valves), high differential flow between reactor water cleanup influent and effluent, reactor water cleanup equipment compartment high ambient temperature, and high differential temperature across the reactor water cleanup equipment compartment ventilation ducts.

The reactor water cleanup return piping to the feedwater lines has one motor-operated check valve before teeing off to the feedwater lines, and one check valve on each of the feedwater loops outside the drywell. Check valves both inside and outside the drywell are also provided on the feedwater return flow paths to the reactor to provide primary containment isolation. These valves are not included in the Reactor Water Cleanup System boundary and will be evaluated with the Feedwater System.

Also, the Reactor Water Cleanup System automatically isolates the reactor water cleanup blowdown flow path to the Condensate System or to the Radwaste System upon high downstream pressure or low upstream pressure as sensed by those downstream and upstream pressures at the location of the blowdown line restricting orifice. This section of the system piping is safety-related to support the Reactor Water Cleanup System differential flow high energy line break isolation flow element, which is an input to the Containment Isolation System.

The noble chemical mitigation monitoring and data acquisition system, which is part of the Reactor Water Cleanup System, is skid mounted equipment that collects, processes, and stores data necessary to determine the electrochemical corrosion potential of the reactor coolant system. The noble chemical mitigation monitoring and data acquisition system is comprised of an electrochemical corrosion potential monitor, a durability monitor, and a data acquisition system. The noble chemical mitigation monitoring and data acquisition system draws a small flow of reactor coolant from a common header at discharge of the reactor water cleanup recirculation pumps and returns it to the common suction line for each reactor water cleanup recirculation pumps.

Also, included in the Reactor Water Cleanup System is a safety-related flow element, associated transmitters and valves that monitors the crack monitoring system flow rate.

For more detailed information, see UFSAR Section 3.6.1.2.1.5 & 5.4.8.

System Boundary

The Reactor Water Cleanup System boundary begins at the attachment to the reactor recirculation pump A and B suction piping and the attachment to the reactor vessel bottom drain. The boundary continues through the reactor water cleanup supply isolation valves, reactor water cleanup recirculation pumps, tube side of the regenerative heat exchangers, tube side of the non-regenerative heat exchangers (the shell side of the non-regenerative heat exchangers are evaluated with the Closed Cycle Cooling Water System), cleanup filter demineralizers, shell sides of the regenerative heat exchangers, reactor water cleanup return isolation valves, and ends at the feedwater loops A and B discharge piping. Included within the system boundary is the noble chemical mitigation monitoring and data acquisition system, which is supplied from the reactor water cleanup pump discharge and returns to the reactor water cleanup pump suction. Also included within the Reactor Water Cleanup System boundary is the reactor water cleanup blowdown flow path to the condensate system or to the Radwaste System. Additionally, the safety-related flow element, associated transmitters and valves that monitor the crack monitoring system flow rate is included within the Reactor Water Cleanup System boundary. The remaining portions of the crack monitoring system are evaluated in the Hydrogen Water Chemistry System. All associated piping and components contained within the flowpaths described above are included in the Reactor Water Cleanup System evaluation boundary.

Included in the license renewal boundary of the Reactor Water Cleanup System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor Building and the Auxiliary Building, which specifically includes the whole noble chemical mitigation monitoring and data acquisition system, as this system is located entirely within the Reactor Building. Also, included in the boundary are the pressure retaining components located in the Reactor Building and the Auxiliary Building relied upon to preserve the leakage boundary intended function of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the Reactor Water Cleanup System license renewal scoping boundaries are the following interfacing systems, which are separately evaluated as license renewal systems:

Closed Cycle Cooling Water System
Condensate System
Compressed Air System (instrument air)
Feedwater System
Hydrogen Water Chemistry System
Process and Post-Accident Sampling System
Radwaste System
Reactor Protection System
Reactor Recirculation System

<u>Reason for Scope Determination</u>

The Reactor Water Cleanup System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the 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), ATWS (10 CFR 50.62), and Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide reactor coolant pressure boundary. The Reactor Water Cleanup System trips and fully isolates from the reactor coolant pressure boundary upon indication of a Reactor Water Cleanup System high energy line break. 10 CFR 54.4(a)(1)

2. Introduce emergency negative reactivity to make the reactor subcritical. The Reactor Water Cleanup System trips and isolates from the reactor coolant pressure boundary upon standby liquid control flow. 10 CFR 54.4(a)(1)

3. Provide primary containment boundary. The Reactor Water Cleanup System trips and fully isolates from the Primary Containment. 10 CFR 54.4(a)(1)

4. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Reactor Water Cleanup System contains nonsafety-related water filled lines in the Reactor Building and pipe chase room, which all have spatial interactions (spray or leakage) with safety-related SSCs. 10 CFR 54.4(a)(2)

5. 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). The reactor water cleanup isolation valves are credited as high/low pressure interfaces. This also includes the isolation valves, which are credited with isolating the reactor water cleanup blowdown flow path to the main condenser or to the liquid radwaste equipment drain processing system. 10 CFR 54.4(a)(3)

6. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The primary containment isolation valves within the Reactor Water Cleanup System are environmentally qualified. 10 CFR 54.4(a)(3)

7. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Anticipated Transients Without Scram (10 CFR 50.62). The inboard and outboard containment isolation valves for the Reactor Water Cleanup System will close upon start of the standby liquid control pumps. The Reactor Water Cleanup System prevents the standby liquid reactivity control material from being removed from the reactor coolant when required for shutdown. 10 CFR 54.4(a)(3)

8. 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). The Reactor Water Cleanup System receives isolation signal upon initiation of the Station Blackout. 10 CFR 54.4(a)(3)

UFSAR References

3.6.1.2.1.5
5.2.3.2.2
5.4.8

License Renewal Boundary Drawings

LR-M-23-1, Sheet 2
LR-M-43-1, Sheet 1
LR-M-44-1, Sheet 1
LR-M-44-1, Sheet 2
LR-M-45-1, Sheet 1
LR-M-66-0, Sheet 1
LR-M-101-0, Sheet 3

Table 2.3.3-24 Reactor Water Cleanup System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Bolting (Class 1)	Mechanical Closure
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary
Filter Housing	Leakage Boundary
Flow Element	Leakage Boundary
Flow Element	Pressure Boundary
Flow Element (Class 1)	Pressure Boundary
Heat Exchanger Components (Non-Regen)	Leakage Boundary
Heat Exchanger Components (Non-Regen)	Shell Side components evaluated with the Closed Cycle Cooling Water System
Heat Exchanger Components (Pump HX)	Leakage Boundary
Heat Exchanger Components (Regen)	Leakage Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings (Class 1)	Pressure Boundary
Pump Casing (Holding)	Leakage Boundary
Pump Casing (Precoat)	Leakage Boundary
Pump Casing (Recirculation)	Leakage Boundary
Restricting Orifices	Leakage Boundary
Restricting Orifices	Pressure Boundary
Restricting Orifices	Throttle
Restricting Orifices (Class 1)	Pressure Boundary
Restricting Orifices (Class 1)	Throttle
Sensor Element	Leakage Boundary
Sight Glasses	Leakage Boundary
Strainer Body	Leakage Boundary
Tanks (Autoclave)	Leakage Boundary
Tanks (Demineralizer)	Leakage Boundary
Tanks (Precoat)	Leakage Boundary
Thermowell	Leakage Boundary
Thermowell (Class 1)	Pressure Boundary
Valve Body	Leakage Boundary

Component Type	Intended Function
Valve Body	Pressure Boundary
Valve Body (Class 1)	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-24 Reactor Water Cleanup System
Summary of Aging Management Evaluation

2.3.3.25 Remote Shutdown Panel Room HVAC System

System Purpose

The Remote Shutdown Panel Room HVAC System is a mechanical system designed to maintain air temperature, quality, humidity and maintain the remote shutdown panel compartment at a slight positive pressure ensuring the proper operation of controls and equipment that can be used to safely shut down the plant if the main control room is unusable. The purpose of the Remote Shutdown Panel Room HVAC System is to provide a continuous supply of filtered and conditioned air and maintain the remote shutdown panel room compartment at a slightly positive pressure to prevent infiltration of fire, smoke, fumes, and airborne radioactivity from surrounding areas into the remote shutdown panel room compartment. The Remote Shutdown Panel Room HVAC System accomplishes this purpose by providing adequate ventilation flow capacity into the remote shutdown panel room compartment to prevent infiltration when the ventilation system is manually placed in service.

System Operation

The Remote Shutdown Panel Room HVAC System is comprised of a 100% capacity fan housing consisting of low and high efficiency filters, two chilled water cooling coils, an electric heating coil, humidifier and full capacity supply fan, ducting, dampers, instruments, piping, controls and associated ductwork. The Control Area Chilled Water System supplies the chilled water to each of the cooling coils. During control room fire and evacuation, the Remote Shutdown Panel HVAC System can be manually placed in service to provide proper environmental conditions in the remote shutdown panel room compartment. During operation, a portion of the compartment air is recirculated back to the inlet of the fan housing and is mixed with outside air to provide air back to the remote shutdown panel room compartment. Although the system is not safety related, during accident conditions the system can be manually restarted to provide ventilation to the remote shutdown panel room compartment.

For more detailed information, see UFSAR section 9.4.3.1.3.

System Boundary

The Remote Shutdown Panel Room HVAC System boundary begins at the inlet louver, and continues through the inlet ductwork to the fan supply housing. The fan supply housing includes a low efficiency filter, high efficiency filter, electric heating coil, two chilled water cooling coils, humidifier, full capacity supply fan, piping, instruments and associated ductwork. The system boundary continues through the supply ductwork to the remote shutdown panel room compartment where the boundary ends at the discharge registers. The return boundary for the Remote Shutdown Panel Room HVAC system begins at the return registers in the remote shutdown panel room compartment. The boundary continues through the return air ductwork and the boundary ends at the inlet to the fan supply housing where return air is mixed with outdoor air within the fan supply housing.

Not included in the Remote Shutdown Panel Room HVAC System are the following interfacing systems, which are separately evaluated as license renewal systems:

Control Area Chilled Water System
Makeup Demineralizer System

Reason for Scope Determination

The Remote Shutdown Panel Room HVAC System is not in scope under 10 CFR 54.4(a)(1) because no portions of the system are safety-related or relied upon to remain functional during and following design basis events. The Remote Shutdown Panel Room HVAC System is in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system would could prevent satisfactory accomplishment of functions(s) identified for 10 CFR 54.4(a)(1). The system is in scope under 10 CFR 54.4(a)(3) because it is 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). The Remote Shutdown Panel Room HVAC System is not relied upon in any safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Environmental Qualification (10 CFR 50.49), Anticipated Transient Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Remote Shutdown Panel Room HVAC System is non-seismic category I, except for the cooling coils and housing of the remote shutdown panel room supply unit. 10 CFR 54.4(a)(2)

2. Relied upon in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection(10 CFR 50.48). The Remote Shutdown Panel Room HVAC System maintains the compartment habitability within the remote shutdown panel room compartment during a fire condition in the main control room allowing the shutdown of the plant. 10 CFR 54.4(a)(3)

UFSAR References

9.4.3.1.3

License Renewal Boundary Drawings

LR-M-93-0, Sheet 2

Table 2.3.3-25 Remote Shutdown Panel Room HVAC System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Damper Housing	Pressure Boundary
Door Seal	Pressure Boundary
Ducting and Components	Pressure Boundary
Electric Heaters (Housing)	Pressure Boundary
Fan Housing	Pressure Boundary
Filter Housing	Pressure Boundary
Flexible Connection	Pressure Boundary
Heat Exchanger Components	Evaluated with the Control Area Chilled Water System
Louver	Pressure Boundary
Piping and Fittings	Pressure Boundary
Sensor Element	Pressure Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-25 Remote Shutdown Panel Room HVAC System
Summary of Aging Management Evaluation

2.3.3.26 Service Water Intake Ventilation System

System Purpose

The Service Water Intake Ventilation System is a normally operating forced air ventilation system designed to remove waste heat produced from the components located in the Service Water Intake Structure. The Service Water Intake Ventilation System consists of the Service Water Pump Area Ventilation subsystem and the Traveling Screen Motor Room Ventilation subsystem. The Service Water Intake Ventilation System is in scope for License Renewal.

The purpose of the Service Water Intake Ventilation System is to maintain the temperatures in the two service water pump areas and traveling screen motor room within design conditions. The Service Water Intake Ventilation System accomplishes this purpose by supplying fresh air and re-circulated air throughout the Service Water Intake Structure. This ventilation system is designed as a safety related system and will remain operational during accident conditions.

The Service Water Intake Ventilation System provides ventilation to the two service water pump areas and the traveling screen motor room. The Service Water Pump Area Ventilation subsystem is located in two separate compartments of the Service Water Intake Structure. Each service water pump area compartment contains two separate service water pumps along with two redundant supply and exhaust fans, ventilation dampers and several electric unit room heaters along with associated instruments and controls. The Intake Structure Traveling Screen Motor Room Ventilation subsystem houses two full capacity supply fans along with electric unit room heaters, ventilation dampers, tornado dampers and the associated instruments and controls for this ventilation system.

System Operation

The Service Water Intake Ventilation System is located in the Service Water Intake Structure. In each of the two service water pump area compartments there are two full capacity supply and two full capacity exhaust fans and all associated controls, ventilation dampers and compartment electric unit room heaters. Normally, one supply and exhaust fan is operating to provide sufficient air to regulate temperatures in the service water pump area rooms. If a running supply fan has low airflow, then the running supply and exhaust fans will stop. The standby supply and exhaust fans will start if the room temperature is above the room high temperature switch set point. The low flow trip will activate a common trouble alarm both locally and remotely at the main control room.

In addition to the fan start and stop temperature switches, a high-low temperature switch is located in each pump room. The temperature switch alarms both locally and activates a common trouble alarm in the main control room on abnormal high or low room temperature. During Service Water Pump outages, if required, electric unit room heaters, which are controlled by wall-mounted thermostats, can provide supplemental heating. These heaters are nonsafety-related and do not support and is not required to perform an intended function and is not subject to an aging management review.

For the common traveling screen motor room ventilation compartment, there are two full capacity supply fans along with the associated controls, ventilation dampers, tornado dampers and unit electric heaters provided to control compartment temperatures. A high-low room temperature switch is used in this compartment that will alarm both locally and remotely at the main control room. A supply fan flow switch will start the standby fan when in "auto" mode if the running fan exhibits low airflow. A room thermostat modulates the outdoor, return and exhaust air dampers to control compartment temperatures. During traveling screen motor room supply fan maintenance outages, if required, electric unit room heaters, which are controlled by wall-mounted thermostats, can provide supplemental heating. These heaters are nonsafety-related and do not support and is not required to perform an intended function and is not subject to an aging management review.

For more detailed information, see UFSAR Section 9.4.7.

<u>System Boundary</u>

The boundary of the Service Water Intake Ventilation System supply to the Service Water Motor Pump rooms begins at the outside air intake louvers, and continues through the intake dampers and inlet bell and screen through the supply fan and into the supply ducting which provides air to all compartment elevations. Warm exhaust air flows from the Service Water Pump Area compartment through the inlet bell and screen through the exhaust fan to the exhaust compartment and discharges the air through the exhaust damper and outdoors through the exhaust louvers and wire mesh screen. The Service Water Pump Area Ventilation System includes a recirculation damper located between the exhaust compartment of the exhaust fan and the inlet of the supply fan to allow for operation in a recirculation mode for temperature control. All associated ductwork, components, and instrumentation contained within the flow path described above are included in the Service Water Intake Ventilation System.

The boundary of the Traveling Screen Motor Room Ventilation System supply to the Traveling Screen Motor Room begins at the outside wire mesh screen, through the tornado and control dampers and out through the supply fan and into the compartment. Exhaust air from the Traveling Screen Motor Room compartment flows through a gravity relief damper, through a tornado damper and exits outside through a wire mesh screen. The Traveling Screen Motor Room Ventilation System includes ducting and recirculation control dampers to allow for warm air to recycle to the inlet of the supply fan. All associated ductwork, components, and instrumentation contained within the flow path described above are included in the Service Water Intake Ventilation System.

Not included in the Service Water Intake Ventilation System license renewal scoping boundary are the following interface systems, which are separately evaluated as license renewal systems:

Service Water Intake Structure
Service Water System

<u>Reason for Scope Determination</u>

The Service Water Intake Ventilation System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. The Service Water Intake Ventilation System is not in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system would not prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It meets 10 CFR 54.4(a)(3) because it is 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). The Service Water Intake Ventilation System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Environmental Qualification (10 CFR 50.49) and Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide heat removal from safety-related equipment. The Service Water Intake Ventilation System removes waste heat from the Service Water System components located in the Service Water Intake Structure to maintain temperature limits. 10 CFR 54.4(a)(1).

2. Relied upon in safety analyses and plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection (10 CFR 50.48). The Service Water Intake Ventilation System supports the operation of the Service Water System during postulated fire events. 10 CFR 54.4(a)(3)

3. 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). The Service Water Intake Ventilation System supports the operation of the Service Water System during restoration from a Station Blackout event. 10 CFR 54.4 (a)(3)

UFSAR References

9.4.7.1

License Renewal Boundary Drawings

LR-M-81-0, Sheet 1

Table 2.3.3-26 Service Water Intake Ventilation System
Components Subject to Aging Management Review

Component Type	Intended Function
Bird Screen	Filter
Bolting	Mechanical Closure
Damper Housing	Pressure Boundary
Ducting and Components	Pressure Boundary
Fan Housing	Pressure Boundary
Flexible Connection	Pressure Boundary
Louver	Pressure Boundary
Piping and Fittings	Pressure Boundary
Sensor Element	Pressure Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-26 Service Water Intake Ventilation System
Summary of Aging Management Evaluation

2.3.3.27 Service Water System

System Purpose

The Service Water System is a normally operating open loop cooling system designed to provide cooling water from the Delaware River, the ultimate heat sink, to perform both safety-related and nonsafety-related functions. The Service Water System consists of the following plant subsystems: station service water system, service water screens and backwash system and service water hypochlorination system. The Service Water System is in scope for License Renewal. However, portions of the Service Water System are not required to perform intended functions and are not in scope. The Service Water System has several interfaces with other systems that are not in the license renewal boundary of the Service Water System.

The purpose of the Service Water System is to provide river water cooling for the closed loop cooling water systems, safety and turbine auxiliary cooling system (SACS) and the reactor auxiliary cooling system (RACS). The reactor auxiliary cooling plant system heat exchanger shell side components are evaluated with the Closed Cycle Cooling Water System. The Service Water System accomplishes its purpose by supplying strained river water from the ultimate heat sink (evaluated with the Service Water Intake Structure) to the tube side of the SACS and RACS heat exchangers and discharging the heated water to the cooling tower basin or overboard discharge. During normal operating conditions and loss of offsite power conditions the Service Water System provides river water cooling to SACS and RACS. During a loss-of-coolant accident (LOCA) and other design basis accidents, the Service Water System provides river water only to SACS, and RACS is automatically isolated. The Service Water System operation is initiated manually or automatically. Automatic operation includes Service Water System pump starts and isolation of nonsafety-related components.

System Operation

The Service Water System is comprised of two independent loops, each with two main pumps that supply river water to a separate safety and turbine auxiliary cooling system (SACS) loop. Either one of these service water loops can be used for cooling the reactor auxiliary cooling system (RACS) heat exchangers. Each redundant service water loop is comprised of traveling water screens, pumps, strainers, piping, valves, heat exchangers, rupture disks, controls and instrumentation. The pumps in this System are the service water pumps taking suction directly from the river, spray water booster pumps used for removing debris from the traveling water screens and a dewatering pump located in the reactor building for pumping down the service water drain tank to support maintenance activities.

River water flows through a common trash rack (evaluated with the Service Water Intake Structure) and flows into separate pump sumps. Each Service Water sump is provided with a traveling water screen to prevent large debris from passing further into the system. A self-cleaning strainer located downstream of each Service Water pump is provided to remove small particles from the pump discharge to prevent heat exchangers from clogging. The strainer, traveling water screen and the spray water booster pump operate continuously when the associated service water pump is running. Each loop is equipped with two service water pumps in parallel that discharge to an underground seismic category I header and flows to the reactor building. Each service water loop header flows to a separate SACS loop heat exchangers and through crosstie valves to the RACS heat exchangers. The effluent from the heat exchangers discharges through seismic lines and then to a common, non-seismic category I header located outside of the reactor building. Water from the header discharges to the cooling tower basin and serves as makeup for the Circulating Water System. In the event of a failure that causes blockage in the non-seismic discharge line to the cooling tower, service water discharge from the SACS heat exchangers is diverted separately to the yard through seismic category I overboard discharge lines. The overboard discharges are emergency bypass lines provided with motor operated valves that automatically open if the non-seismic category I discharge line has gradual blockage. However, for a sudden blockage, rupture disks are installed in parallel with the motor operated valves and are rated to rupture, which allows discharge to the yard.

During normal plant operation, two station service water pumps, one in each loop, are required. The second pump in each loop is on standby and starts automatically if the operating pump in that loop fails. The number of service water pumps required to be in service depends on the river water temperature and the SACS and RACS heat loads. Each service water pump, its associated motor operated discharge valve, and traveling water screen form a load group that receives control and power supplied from a corresponding channel of Class 1E power systems. The pump discharge motor operated valves are interlocked to automatically open on a pump start.

During emergency plant operation such as loss-of-coolant accident (LOCA) concurrent with Loss of Offsite Power (LOP), all four service water pumps with corresponding traveling water screens and strainers are automatically started, powered by standby diesel generators to provide flow through the redundant cooling water loops to the SACS heat exchangers. The three valves connected to the common header supplying the RACS heat exchangers and the common outlet valve automatically close in the event of a LOCA or a signal from the RACS room flooding instrumentation. In the event of a LOP without a LOCA, all four service water pumps start to cool all SACS and RACS heat exchangers. However, only one service water loop with two pumps is required to safely shut down the plant.

Service water pump bearing lubrication is supplied from a branch connection off of the Service Water System downstream of the strainer. The lubrication water leaves the pumps from the bottom bearings and drains to the pump sumps.

The traveling water screens are cleaned with strained water supplied by the spray water booster pumps (one pump per traveling water screen). These pumps are capable of being crosstied to clean the alternate traveling water screen in that loop. The screens are also provided with an air driven bubbler level monitoring system for automatic screen speed selection if the differential water level across the screen is too high. The level monitoring system consists of air compressors, a tank and flow control stations and dip tubes. The air is routed to four individual flow control stations and through two dip tubes, one at each side of the screens. Under a loss of air flow condition the associated traveling water screen will automatically shift to high speed. This feature eliminates the need for the compressors and flow control station to be safety related. However the dip tubes on each side of the screens are safety related because their structural failure could affect traveling water screen operation. The traveling water screens are considered active short-lived components. The traveling screens are structurally supported by embedded slots at each of the pump bays which are evaluated with the Service Water Intake Structure.

Biological growth in the Service Water System is prevented by the injection of a dilute solution of sodium hypochlorinate. The system mixes river water with sodium hypochlorite for injection to the Service Water System downstream of the traveling water screen. The service water hypochlorination system and structures are located east of the Service Water Intake Structure. The service water hypochlorination structures are evaluated with the Service Water Intake Structure.

The Service Water System has connections to supply an emergency backup source of water to the Residual Heat Removal (RHR) System, fuel pool water inventory and SACS expansion tank. This section of the Service Water System also has a fire hose fill connection to supply fresh water into the system.

A drain tank and a dewatering pump located in the Reactor Building are part of the Service Water System and are used during maintenance activities to keep relatively dirty, chlorinated river water from entering the Reactor Building sump and being processed as radwaste.

Ventilation for service water components located in the service water iIntake structure is evaluated with the Service Water Intake Ventilation System.

Service water intake structure drainage is evaluated with the Equipment and Floor Drainage Systems.

For more detailed information, see UFSAR Sections 7.3.1.1.11.1 and 9.2.1.

System Boundary

The Service Water System boundary begins at the traveling water screens and continues through to the service water pumps, associated check valves, strainers and pump discharge motor operated valves. It continues to the underground supply headers to the designated Safety and Turbine Auxiliary Cooling System (SACS) heat exchangers and through crosstie valves to the reactor auxiliary cooling system (RACS) heat exchangers located in the reactor building. The boundary continues through the heat exchangers to an underground discharge header located outside of the reactor building and terminates at the attachment to the cooling tower basin. Included in the Service Water System boundary is an alternate flow path for service water discharge from the SACS heat exchangers through the overboard discharge piping.

The Service Water System boundary also includes the branch connections for the service water pump bearing lubrication water, the service water strainer backwash system, and a crosstie line from the service water loops at the intake structure to provide dilution water for the service water hypochlorination system.

In addition the Service Water System boundary includes the spray water booster pumps for the traveling water screen spray water and the piping for the sodium hypochlorite solution which injects downstream of the traveling water screens which are located at the intake structure. The Service Water System boundary also includes a service water drain tank and dewatering pump located in the reactor building.

All associated piping, components, and instrumentation contained within the flowpath described above are also included in the service water boundary.

Included in the license renewal scoping boundary of the Service Water System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the service water intake structure and the reactor building such as the service water strainer backwash piping and the service water drain tank and dewatering pump. Included in this boundary are pressure retaining components relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

The service water trash racks upstream of the traveling water screens as well as the structural support for the traveling screens are evaluated with the Service Water Intake Structure.

Not included in the Service Water System license renewal scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Closed Cycle Cooling Water System
Residual Heat Removal System
Fuel Pool Cooling and Cleanup System
Circulating Water System
Service Water Intake Ventilation System
Equipment and Floor Drainage Systems

The service water hypochlorination system function of injecting sodium hypochlorite to preserve the heat exchanger function by preventing biofouling is not required to support any intended functions. Failure of the service water hypochlorination system does not impact the operability of the Service Water System. The chlorination function is not required to support any service water intended functions for license renewal and therefore, is not in the scope of license renewal.

The instrumentation and logic for the traveling water screen differential level monitoring is designed such that under a loss of air flow condition the associated traveling water screen will automatically shift to high speed. This design feature eliminates the need for the compressors and flow control station to be in the scope of license renewal since the failure of these components will not impact operability or any intended functions of the Service Water System. However the dip tubes on each side of the screens are safety related because their structural failure could affect traveling water screen operation.

Reason for Scope Determination

The Service Water System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied on to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analyses and plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for for Fire Protection (10 CFR 50.48), Environmental Qualification (10 CFR 50.49), and Station Blackout (10 CFR 50.63). The Service Water System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide heat removal from safety related heat exchangers. Provides river water from the ultimate heat sink to remove heat from the safety and turbine auxiliary cooling system heat exchangers. Also provides strained water for the service water pump bearing lubrication, and traveling water screen cleaning. 10 CFR 54.4(a)(1)

2. Provide emergency heat removal from primary containment and provide containment pressure control. In Residual Heat Removal mode of containment cooling, the Service Water provides river water from the ultimate heat sink to remove heat from the Residual Heat Removal heat exchanger via the safety and turbine auxiliary cooling system. 10 CFR 54.4(a)(1)

3. Resist nonsafety related SSC failure that could prevent satisfactory accomplishment of a safety related function. The Service Water System includes nonsafety-related water filled lines located at the service water intake structure and in the reactor building that have the potential for spatial interactions (spray or leakage) with safety-related system, structure or components.10 CFR 54.4(a)(2)

4. 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). Provides river water cooling during post-fire safe shutdown. 10 CFR 54.4(a)(3)

5. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). Service Water valves located in the reactor building are designed to accomplish their safety-related function during exposure to the applicable environmental conditions. 10 CFR 54.4(a)(3)

6. 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). Provides river water cooling during station blackout recovery phase. 10 CFR 54.4(a)(3)

UFSAR References

7.3.1.1.11.1
9.2.1
9.2.8
Table 3.2-1

License Renewal Boundary Drawings

LR-M-10-1, Sheet 1
LR-M-10-1, Sheet 2
LR-M-10-1, Sheet 3
LR-M-10-1, Sheet 4
LR-M-13-1, Sheet 1
LR-M-24-0, Sheet 3

Table 2.3.3-27 **Service Water System**
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Diffuser	Direct Flow
Heat Exchanger Components (RACS)	Leakage Boundary
Heat Exchanger Components (SACS)	Heat Transfer
Heat Exchanger Components (SACS)	Pressure Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Pump Casing (SW Dewatering)	Leakage Boundary
Pump Casing (SW main pump)	Pressure Boundary
Pump Casing (Spray Water Booster)	Pressure Boundary
Rupture Disks	Pressure Boundary
Spray Nozzles	Spray
Strainer Body	Pressure Boundary
Tanks (Drain)	Leakage Boundary
Thermowell	Pressure Boundary
Traveling Water Screen Support Structure	Evaluated with the Service Water Intake Structures
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-27 Service Water System
Summary of Aging Management Evaluation

2.3.3.28 Standby Diesel Generator Area Ventilation Systems

System Purpose

The Standby Diesel Generator Area Ventilation System is a normally operating mechanical system designed to provide proper environmental conditions within each of the compartments contained in the Auxiliary Building Control/Diesel Structure. The Standby Diesel Generator Area Ventilation System consists of the following plant systems: diesel area safety-related battery room exhaust systems, switchgear room cooling systems, diesel area class 1E panel room supply system, standby diesel generator room recirculation system, battery room supply system, diesel area supply system, diesel area exhaust system, diesel area nonsafety-related battery exhaust system, and unit heaters located throughout the standby diesel generator area.

The purpose of the Standby Diesel Generator Area Ventilation System is to maintain compartment environmental conditions using cooling, heating and ventilation throughout the diesel portion of the auxiliary building control/diesel generator area building. The Standby Diesel Generator Area Ventilation System accomplishes this purpose by regulating temperature and ventilating air in the diesel building compartments during normal and accident conditions.

System Operation

The diesel area safety-related battery room exhaust plant systems consists of four 100% capacity safety related fans located on elevation 146' and two 100% capacity safety-related fans located on elevation 163'. The four trains located on elevation 146', consists of a tornado damper, ductwork, controls, dampers and instruments. The flow path for these four safety-related battery room trains start at the intake registers from each of the four battery compartments, continuing through ductwork, into the suction of the exhaust fan, through the shutoff and tornado dampers and exhaust outside the building. The battery room exhaust systems exhaust air continuously from these four battery rooms. The fans are started by handswitches located on the local panel. A low flow computer input actuates an alarm in the main control room upon low airflow conditions. The one safety-related train located on elevation 163', consists of a tornado damper, ductwork, controls, dampers and instruments. The flow path for these two safety-related battery room trains start at the intake registers from each of the two battery compartments, into a common header continuing through ductwork, into the suction of the exhaust fans, through the shutoff and tornado dampers and exhaust outside the building. A low flow computer input actuates an alarm in the main control room upon loss of airflow and starts the redundant fan automatically. There is a cross-tie connecting the exhaust ductwork from both trains together requiring only one 100% capacity fan to be in-service to ventilate each of the battery compartments. The diesel area safety-related battery room exhaust plant systems are designed to maintain battery room compartment temperatures.

There are four switchgear rooms, each having a cooling system. Each switchgear room cooling plant system consists of a 100% capacity fan, roughing filter, in-duct chilled water cooling coils, in-duct electric heating coils, dampers, instruments and controls. The switchgear room cooling plant system is safety-related and designed to provide cooled, filtered fresh and recycled air to the switchgear room, emergency diesel control room, battery room, and battery charger rooms. The Control Area Chilled Water System provides the chilled water to the cooling coils. The general airflow path takes outside and recycled air and passes the air through the filter unit and chilled water cooling coil. Flow continues through the supply fan providing air to the battery and switchgear rooms. A portion of the air enters into the battery compartment rooms. The air can be heated by an in-duct safety-related electric heating coil to maintain switchgear temperatures in the safety related battery compartments. The switchgear room cooling plant system is designed to maintain compartment temperatures. The low flow switch for each fan actuates an alarm at the local panel, and in the main control room.

The diesel area class 1E panel room supply plant system consists of two separate trains each containing a 100% capacity safety-related fan, intake tornado damper, ductwork, low and high capacity filters, in-duct chilled water cooling coils, in-duct electric heating coils (entering the battery compartments), dampers, instrument and controls. Both trains are tied together at their supply ductwork, but isolated by normally closed dampers. The discharge ductwork from both trains connects to a common discharge ductwork feeding the battery rooms, inverter compartments and corridors with filtered, tempered air. The general flow path takes outside air, filters it, heats or cools the air and supplies it to the battery rooms, inverter rooms, control equipment compartments or corridors. The air can be heated by an electric in-duct safety-related heating coil which is part of the filter housing to maintain diesel area equipment compartment temperatures. The air can be cooled by induct cooling coils. The safety-related Control Area Chilled Water System supplies the chilled water for the cooling coils, and is evaluated with the Control Area Chilled Water System. Normally one train is operating and the remaining train is in standby. The low flow switch actuates a local alarm upon loss of airflow and starts the standby unit. The diesel area class 1E panel room supply plant system is designed to maintain compartment temperatures for the control equipment rooms, inverter rooms, battery charger rooms and diesel generator within acceptable limits.

The standby diesel generator room recirculation plant system consists of four emergency diesel compartment ventilating systems. Each ventilation system is comprised of two safety related trains. Each train contains a 100% capacity recirculation fan, two in-duct cooling coils, ductwork, dampers, instruments and controls. Cooling is supplied by the safety auxiliary cooling system, and is evaluated with the Closed Cycle Cooling Water System. The general flow path takes air from the diesel generator compartment, cools it and re-circulates the air back into the diesel compartment. The standby diesel generator room recirculation systems are normally interlocked to start with the respective emergency diesel generator. They may be manually started from handswitches located at the local panel. The auto lead fan runs when the standby diesel generator runs or room temperature is high. The auto standby fan runs if the auto lead fan fails, or when the standby diesel generator runs and room temperature is high. The low flow switch across the operating fan actuates an alarm upon loss of airflow. The standby diesel generator room recirculation plant system is designed to maintain compartment temperatures at or below 120° F when the diesel generators are in-service.

The battery room supply plant system electric in-duct heaters consist of both safety and non-safety related heaters to maintain the battery room compartment at design temperature conditions. Airflow is provided by the switchgear room unit cooling plant system for elevation 146', or the diesel area class 1E panel room supply plant system for elevation 163'. The air can be heated by an in-duct safety-related electric heating coil to maintain temperatures in the safety related battery compartments or nonsafety-related electric heating coils to maintain temperatures for nonsafety-related battery compartments. Individual thermostats control the induct heaters. During loss of offsite power, duct heaters for safety-related battery rooms are automatically connected to emergency Class 1E power. The battery room supply plant system operates only if the room temperature drops below a preset temperature.

The diesel area supply plant system consists of two nonsafety-related trains. Each train contains a 50% capacity nonsafety-related fan, roughing and high capacity filters, electric heating coils, ductwork, controls and dampers. Normally both nonsafety-related trains are in service. The general airflow path is taking outside air, filtering it and heating the air if required and discharging the air into the emergency diesel area corridors, stairwells and electrical chases. The diesel area supply plant system operates continuously to provide filtered and tempered outdoor air to maintain satisfactory ambient conditions.

The diesel area exhaust plant system consists of two nonsafety-related 50% capacity exhaust fans, ductwork, dampers, instruments and controls. Both diesel area exhaust fans are normally in service exhausting air from the emergency diesel area corridors, fuel oil storage rooms, electrical chases, emergency diesel generator rooms and stairwells. The fans discharge outside the building and into the atmosphere. The general airflow path is to remove air from the diesel area, and exhaust the air outside of the building. Upon loss of airflow, the low flow switch for each fan actuates an alarm on a local panel. The diesel area exhaust plant system exhausts air continuously from all spaces supplied by the diesel area supply plant system.

The diesel area nonsafety-related battery room exhaust plant system consists of two nonsafety-related, 100% capacity exhaust fans. One fan is normally operating with the second fan in standby. The airflow path starts at the inlet registers flowing through the ductwork, into the suction of the exhaust fans, through the shutoff and tornado dampers and exhausting outside the building. The two nonsafety-related battery rooms have common exhaust ductwork used to connect both of the exhaust fans together. A low flow computer input actuates an alarm in the main control room upon loss of airflow, and automatically starts the redundant fan.

The unit heaters consist of electric heating coils that are controlled by local room thermostats. These nonsafety-related unit heaters are located throughout the Auxiliary Building Control/Diesel Generator Area. The unit heaters run only when the room temperature drops to 60° F. These nonsafety-related heaters are not in scope for license renewal. Safety-related areas that require heating are provided with safety-related in-duct electric heaters as previously described.

For more detailed information, see UFSAR Section 9.4.6.

System Boundary

The diesel area safety-related battery room exhaust plant systems consists of two separate battery compartment exhaust fan systems located on two different elevations within the auxiliary building control/diesel structure. One system provides ventilation for battery rooms located on elavation 163' system and the other system provides ventilation for battery rooms located on the 146' elevation.

The system boundary for the battery rooms located on elevation 163', begins at the room compartments inlet registers and continues through the ductwork leading to the diesel area battery exhaust fans. The system boundary continues through the exhaust fan and through the discharge ductwork, dampers and a tornado damper. The system boundary ends at the discharge ductwork as it exhausts outdoors.

The system boundary for the battery rooms located on elevation 146', begins at the room compartment inlet registers. The system boundary continues to the inlet of the exhaust fan, through the fan, discharge ductwork and through the dampers and tornado dampers. The system boundary ends at the discharge ductwork as it exhausts outdoors.

The switchgear room cooling plant systems boundary begins at the outdoor intake louver, which includes the tornado and isolation dampers, intake ductwork, and switchgear room unit cooler. The system boundary continues through the switchgear room unit cooler, containing a low efficiency filter and the two chilled water-cooled cooling coils and a supply fan. The system boundary continues through the supply fan then splits into two duct headers, feeding either the switchgear room or the safety-related battery room. For the switchgear room the boundary ends at the return room registers in the switchgear compartments. The system boundary for the battery room continues past an electric in-duct heater with the system boundary ending at the discharge registers to the battery rooms.

The diesel area class 1E panel room supply plant system boundary begins at the inlet louver of the auxiliary building which includes a tornado damper and control damper, inlet ductwork leading to the diesel area panel room supply unit. Also included is a crosstie connecting both of the trains supply ductwork together. The system boundary continues through the diesel area class 1E panel room supply unit, which contains a low and high particulate filter, electric heating coil, chilled water coil and the supply fan. The chilled water cooling coil is supplied from the Control Area Chilled Water System. The coils are evaluated with the Control Area Chilled Water System. The system boundary continues through the supply fan, through the discharge ductwork, into the battery rooms, which contain an in-duct heating coil, inverter rooms, control equipment rooms and the common corridor. The system boundary ends at the room discharge registers.

The standby diesel generator room recirculation plant system boundary begins at the inlet registers located in the diesel generator rooms. The system boundary continues through the inlet ductwork, cooling coil and recirculation fan and the exhaust ductwork. The system boundary ends back at the discharge registers located in each of the diesel compartments.

The boundary for the safety related portions of the battery room supply plant system electric in-duct heaters begins at the ductwork from the switchgear room unit coolers, which contain the in-duct safety-related electric heaters. Airflow from the switchgear room unit cooler passes over the in-duct electric heaters to maintain air temperatures. The system boundary ends as air exhausts from the discharge registers into each of the battery compartments.

Not included in the scope of license renewal is the nonsafety-related portions of the battery room supply plant system. This plant system is not safety-related and does not perform or required to support license renewal intended functions and is not included in the scope of license renewal. Failure of this system will not prevent satisfactory accomplishment of any of the intended functions of the safety-related portions of the Standby Diesel Generator Area Ventilation System.

Not included in the scope of license renewal is the diesel area nonsafety-related battery room exhaust plant system. The diesel area supply plant system boundary begins at the inlet louver of the auxiliary building continues to the supply fan housing containing low and high efficiency filters, electric heating coil and supply fan. The boundary continues from the fan housing and through the supply ductwork with the boundary ending at the nonsafety-related compartment air registers in the diesel area. This plant system does not perform or required to support license renewal intended functions and therefore is not included in the scope of license renewal. Failure of this system will not prevent satisfactory accomplishment of any of the intended functions of the safety-related portions of the Standby Diesel Generator Area Ventilation System.

Not included in the scope of license renewal is the diesel area exhaust plant system, which is nonsafety-related. The diesel area exhaust plant system boundary begins at the return registers from the nonsafety-related diesel area compartments, and continues through the exhaust ductwork to the fan housing. The boundary continues from the fan housing and through the exhaust ductwork with the boundary ending as it exhausts outdoors. This plant system does not perform or required to support license renewal intended functions and therefore not included in the scope of license renewal. Failure of this system will not prevent satisfactory accomplishment of any of the intended functions of the safety-related portions of the Standby Diesel Generator Area Ventilation System.

Not included in the scope of license renewal is the diesel area nonsafety-related battery room exhaust plant system, which is nonsafety-related. The diesel area nonsafety-related battery room exhaust plant system boundary begins at the two nonsafety-related battery compartments return registers, through the exhaust ductwork to the exhaust fan. Flow continues from the exhaust fan through the discharge ductwork and the boundary ends as it exhausts outdoors. This plant system does not perform or required to support license renewal intended functions and therefore not included in the scope of license renewal. Failure of this system will not prevent satisfactory accomplishment of any of the intended functions of the safety-related portions of the Standby Diesel Generator Area Ventilation System.

Not included in the Standby Diesel Generator Area Ventilation System license renewal scoping boundary are the following interfacing systems, which are evaluated as separate license renewal systems:

Closed Cycle Cooling Water System
Control Area Chilled Water System

Reason for Scope Determination

The Standby Diesel Generator Area Ventilation System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. The Standby Diesel Generator Area Ventilation System is not in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system would not prevent satisfactory accomplishment of functions(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is 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). The Standby Diesel Generator Area Ventilation System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49), or Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Maintain emergency temperature limits within areas containing safety-related components. The Standby Diesel Generator Area Ventilation System maintains operating conditions for safety-related equipment (diesel area safety-related battery room exhaust plant systems, switchgear room cooling plant systems, diesel area class 1E panel room supply plant systems, standby diesel generator room recirculation plant system, battery room supply plant system) within the ventilation boundary. 10 CFR 54.4 (a)(1)

2. Relied upon in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Fire Protection (10 CFR 50.48). The Standby Diesel Generator Area Ventilation System provides ventilation for equipment required during safe shutdown. 10CFR 54.4 (a)(3)

3. Relied upon in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Station Blackout (10 CFR 50.63). The diesel area safety-related battery room exhaust plant system, switchgear room cooling plant system, diesel area class 1E panel room supply plant system, standby diesel generator room recirculation plant system and safety-related battery room supply plant system provide environmental controls on loss of power event. 10 CFR 54.4 (a)(3)

UFSAR References

9.4.6

License Renewal Boundary Drawings

LR-M-88-1, Sheet 1
LR-M-88-1, Sheet 2

Table 2.3.3-28 Standby Diesel Generator Area Ventilation Systems Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Damper Housing	Pressure Boundary
Door Seal	Pressure Boundary
Ducting and Components	Pressure Boundary
Electric Heaters (Housing)	Pressure Boundary
Fan Housing	Pressure Boundary
Filter Housing	Pressure Boundary
Flexible Connection	Pressure Boundary
Flow Device	Pressure Boundary
Flow Element	Pressure Boundary
Heat Exchanger Components (Class 1E Diesel Area Panel Room Supply System)	Evaluated with the Control Area Chilled Water System
Heat Exchanger Components (Diesel Generator Room Recirc System)	Evaluated with the Closed Cycle Cooling Water System
Louver	Pressure Boundary
Piping and Fittings	Pressure Boundary
Thermowell	Pressure Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-28 Standby Diesel Generator Area Ventilation Systems Summary of Aging Management Evaluation

2.3.3.29 Standby Diesel Generators and Auxiliary Systems

System Purpose

Standby Diesel Generators and Auxiliary Systems are standby mechanical systems designed to provide power to Class 1E and selected non-Class 1E loads that are needed for safe and orderly shutdown of the reactor, maintaining the plant in a safe shutdown condition and mitigating the consequences of the design bases accident in the event that the preferred power is not available. The Standby Diesel Generators and Auxiliary Systems are in the scope of license renewal.

The purpose of the Standby Diesel Generators and Auxiliary Systems is to independently provide sufficient power to energize all equipment required for safely shutting down the reactor. The Standby Diesel Generators and Auxiliaries System accomplishes this purpose by utilizing diesel engines to rotate electric generators attached to the diesel engines. The system uses four diesel generator units located in separate rooms of the Auxiliary Building. Each standby diesel generator is equipped with self-contained auxiliary support systems that include startup air, jacket water cooling, engine lubricating oil, intercooler and injector cooling, crankcase vacuum, combustion air intake and exhaust, and diesel fuel oil storage and transfer.

Each diesel engine will be automatically started under loss of coolant accident conditions (reactor low-low level, a high drywell pressure signal), and or loss of power condition, (undervoltage condition in the 4160V AC System), or by Core Spray System manual initiation.

System Operation

The Standby Diesel Generators and Auxiliary Systems are comprised of four diesel driven generators and associated auxiliary equipment. The sizing of the standby diesel generators and loads assigned among them is such that any combination of three out of four of these standby diesel generators is capable of shutting down the plant safely. Each diesel engine powers a generator at a voltage compatible to the plant electrical distribution systems. Each standby diesel generator is equipped with self-contained auxiliary support systems that include startup air, jacket water cooling, intercooler and injector cooling, engine lubricating oil, crankcase vacuum, combustion air intake and exhaust, and diesel fuel oil storage and transfer. The standby diesel generators with their auxiliaries are located in separate rooms within the Auxiliary Building. Also included in the diesel assembly are directly attached piping, valves, starters, fans, filters, speed governor, instrumentation and other equipment. The diesels are automatically started under loss of coolant accident conditions (reactor low-low level, high drywell pressure signal), and or loss of power condition, which is an under voltage condition in the 4160V AC System, or by Core Spray System manual initiation. The diesels can be manually started remotely from the control room and the 1E switchgear room or at the local standby diesel generator switchgear panels. The safety function of the standby diesel generator is to supply emergency power to components and systems required for safe and orderly shutdown of the reactor when normal power is not available.

Each standby diesel generator startup air auxiliary system consists of an air compressor, air dryer, two air receiver tanks, filters, shutdown tank, valves and piping. The two air receiver tanks provide redundancy for the starting air system. The safety function of the startup air auxiliary system is to provide for reliable starting of the standby diesel generators.

Each standby diesel generator jacket water cooling auxiliary system consists of a closed loop cooling system that removes heat from the diesel engine and maintains the operating temperature for each diesel engine. The engine-driven jacket water pump circulates cooling water through the engine headers and turbocharger via a three-way thermostatically controlled valve. The three-way valve directs the water through the standby diesel generator jacket water heat exchanger where the water is cooled by the Closed Cycle Cooling Water System. The heat exchangers are evaluated with the Closed Cycle Cooling Water System. If the water temperature is too low, the valve automatically bypasses the diesel generator jacket water heat exchanger. The jacket water keep warm pump maintains the jacket water temperature when the standby diesel generator is in standby. The jacket water expansion tank accommodates thermal expansion of the process fluids in the jacket water and intercooler and injector cooling. Makeup to the jacket water expansion tank comes from the Demineralized Water System. The safety function of the jacket water cooling auxiliary system is to remove excess heat from the engine and its accessory components, and to maintain the temperature of the system in the normal operating range.

The safety function of the standby diesel generator auxiliary intercooler and injector cooling auxiliary system is to remove excess heat of compression from the combustion air during engine operation. The system also removes heat from the engine fuel injectors and outboard bearings on the generator. The system has engine driven intercooler and injector cooling pumps, three-way thermostatically controlled valve and an intercooler heat exchanger. Cooling water for the intercooler heat exchanger is provided by the Closed Cycle Cooling Water System. The heat exchangers are evaluated with the Closed Cycle Cooling Water System.

The safety function of the standby diesel generator lubrication system is to supply oil continuously to all surfaces requiring lubrication. Each standby diesel generator is lubricated by a closed-cycle engine lube oil auxiliary system. Lube oil is pumped from an engine driven pump through a three-way valve, the lube oil cooler, a strainer, and back to the engine. A motor driven lube oil keep warm pump, heater and filter are also included in the loop. A lube oil makeup tank stores fresh lube oil for use in replacing the oil that is consumed and/or lost during operation of the engine. Cooling water for the lube oil cooler is provided by the Closed Cycle Cooling Water System. The heat exchangers are evaluated with the Closed Cycle Cooling Water System.

The safety function of the auxiliary crankcase vacuum, and combustion air intake and exhaust auxiliary system is to supply combustion air of reliable quality to the diesel engines, and exhaust the products of combustion from the diesel engine to the atmosphere. The system has an air intake filter, silencer, and engine driven turbochargers.

The standby diesel generator diesel fuel oil storage and transfer system is required to support the sustained operation of the diesel engine. The safety function of the diesel fuel oil storage and transfer system is to provide an uninterrupted supply of fuel oil to the standby diesel generators in the event of a design basis accident. The system has two diesel fuel oil storage tanks. Each tank has a fuel oil transfer pump that maintains level on the diesel fuel oil day tank. Interconnections are provided to enable the fuel oil storage and transfer supply from any one engine to service the day tank of another engine.

The Standby Diesel Generator Area Ventilation System provides sufficient outside airflow through the diesel generator rooms and control area to maintain temperatures within suitable range to assure reliable operation of the diesel-generators and their associated equipment.

The Standby Diesel Generator Area Ventilation System is evaluated as a separate system for license renewal.

For more detailed information, see UFSAR sections 8.3.1.1.3 and 9.5.4 through 9.5.8.

System Boundary

The Standby Diesel Generators and Auxiliary Systems boundary encompasses the diesel engines, startup air flow path, jacket water cooling flow path, intercooler and injector cooling flow path, engine lubricating oil flow path, crankcase vacuum, combustion air intake and exhaust flow path, and diesel fuel oil storage and transfer flow path.

The standby diesel generator startup air auxiliary system boundary begins at the air compressor and continues through an air dryer, and two air-receiver tanks and ends at the connection point to the diesel engine main air start valves.

The standby diesel generator jacket water cooling auxiliary system and the engine driven intercooler water auxiliary system are interconnected. The standby diesel generator jacket water cooling auxiliary boundary begins at the jacket water expansion tank and continues to the attachment point to the diesel engine. The jacket water continues through the engine driven jacket water pump, cooling the diesel engine and turbo, and exits the engine at two piping lines. The first line continues to the jacket water heat exchanger and returns to the diesel engine. Included also is the keep warm line that contains the jacket water motor driven keep warm pump, jacket water keep warm heater and ends at the attachment point to the diesel engine. The second line continues and connects to the engine driven intercooler water system. The engine driven intercooler water system begins at the pump discharge line, through the intercooler heat exchanger, to the cooled engine components including the outboard bearing, intercoolers and fuel injection nozzles, and returns to the engine driven intercooler water pump suction.

The standby diesel generator engine lubricating oil flow auxiliary system boundary begins at the lube oil makeup tank and continues to the lubricating oil sump. The engine oil recirculation loop begins at the suction strainer, and continues through the engine driven oil pump, flexible coupling and lube oil cooler, and returns to the engine lubricating oil sump. Additional lubricating oil system flow paths include the motor driven keep warm pump, filters, heaters, strainers, valves, instrumentation and fill and drain piping.

The crankcase vacuum, combustion air intake and exhaust auxiliary system boundary has three flow paths. The crankcase vacuum begins at the attachment point of the diesel engine continues through the oil separator and flexible connector and ends at the atmosphere vent. The air intake starts at the intake filter, includes the intake silencer and ends at the attachment point of the diesel engine. The air exhaust begins at the attachment point of the diesel engine, continues through a silencer and ends at the atmosphere vent.

The diesel fuel oil storage and transfer system boundary begins with the oil storage tanks and includes the diesel fuel pumps that take suction through individual suction headers from the oil storage tank, through the pump to the discharge piping, continues through the oil day tank, filter, and the motor driven fuel pump, and ends at the connection point to the diesel engine. Included are the interconnections that allow the storage fuel oil to be transferred from any one engine to the day tank of any another engine. Also included is the fuel oil emergency fill and overflow connection lines to the oil storage tanks.

Also included in the license renewal scoping boundary of the Standby Diesel Generators and Auxiliary Systems are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Auxiliary Building. Included in this boundary are pressure retaining components relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the Standby Diesel Generators and Auxiliary Systems license renewal scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Closed Cycle Cooling Water System
Makeup Demineralizer System
Standby Diesel Generator Area Ventilation Systems

Reason for Scope Determination

The Standby Diesel Generators and Auxiliary Systems meet the scoping requirements of 10 CFR 54.4(a)(1) because it is a safety-related system which is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It does meet 10 CFR 54.4(a)(3) because it is relied upon in the 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). The Standby Diesel Generators and Auxiliary Systems is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Environmental Qualification (10 CFR 50.49) and Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide motive power to safety-related components. The Standby Diesel Generators and Auxiliary Systems is required to power safety-related equipment in the event normal power supplies are not available. 10 CFR 54.4(a)(1)

2. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety related function. The Standby Diesel Generators and Auxiliary Systems includes nonsafety-related water, oil, and diesel filled lines in the Auxiliary Building that have the potential for spatial interactions (spray or leakage) with safety-related SSCs. 10 CFR 54.4(a)(2)

3. 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). Standby Diesel Generators and Auxiliary Systems provide onsite power during restoration. Diesel fuel oil and transfer supports standby diesel generators operation during restoration. 10 CFR 54.4(a)(3)

4. 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). Standby Diesel Generators and Auxiliary Systems is part of Appendix R shut down method. 10CFR54.4(a)(3)

UFSAR References

9.5
8.3.1.1.3

License Renewal Boundary Drawings

LR-M-12-1, Sheet 1
LR-M-30-1, Sheet 1
LR-M-30-1, Sheet 2
LR-M-30-1, Sheet 3
LR-M-30-1, Sheet 4

Table 2.3.3-29 Standby Diesel Generators and Auxiliary Systems Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Electric Heaters (Jacket Water)	Pressure Boundary
Electric Heaters (Lube Oil)	Pressure Boundary
Expansion Joints	Pressure Boundary
Filter Housing (Combustion Intake)	Pressure Boundary
Filter Housing (Fuel Oil)	Leakage Boundary
Filter Housing (Fuel Oil)	Pressure Boundary
Filter Housing (Lube Oil)	Pressure Boundary
Filter Housing (Start Air)	Pressure Boundary
Flame Arrestor (Conservation Vent)	Pressure Boundary
Flow Element	Pressure Boundary
Heat Exchanger Components (Intercooler)	Evaluated with the Closed Cycle Cooling Water System
Heat Exchanger Components (Jacket Water)	Evaluated with the Closed Cycle Cooling Water System
Heat Exchanger Components (Lube Oil)	Evaluated with the Closed Cycle Cooling Water System
Hoses	Pressure Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Pump Casing (Fuel Oil - Motor)	Pressure Boundary
Pump Casing (Fuel Oil - Storage Transfer)	Pressure Boundary
Pump Casing (Lube Oil - Keepwarm)	Pressure Boundary
Pump Casing (Rocker Lube Oil - Motor)	Pressure Boundary
Pump Casing (Water Jacket - Keepwarm Motor)	Pressure Boundary
Silencer/ Muffler	Pressure Boundary
Strainer Body	Leakage Boundary
Strainer Body	Pressure Boundary
Tanks (Air Receiver)	Pressure Boundary
Tanks (Fuel Oil Day)	Pressure Boundary
Tanks (Fuel Oil Storage)	Pressure Boundary
Tanks (Jacket Water Expansion)	Pressure Boundary

Component Type	Intended Function
Tanks (Lube Oil)	Pressure Boundary
Thermowell	Pressure Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary
Valve Body	Structural Support

The aging management review results for these components are provided in:

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems Summary of Aging Management Evaluation

2.3.3.30 Standby Liquid Control System

System Purpose

The Standby Liquid Control System is a standby and redundant sodium pentaborate injection system that is used if the normal reactivity control provisions become inoperative. The system is designed to bring the reactor to a shutdown condition at any time in core life independent of control rod capabilities. The Standby Liquid Control System operates independently from the Control Rod Drive System. The most severe requirement for which the system is designed is shutdown from a full power operating condition assuming complete failure of the Control Rod Drive System to respond to a scram signal.

The purpose of the Standby Liquid Control System is to provide sufficient capacity for controlling the reactivity difference between the steady state rated operating condition of the reactor and the cold shutdown condition, including shutdown margin, thereby ensuring complete shutdown capability from the most reactive condition, at any time in core life. The Standby Liquid Control System accomplishes this purpose by injecting sodium pentaborate solution into the reactor vessel to absorb thermal neutrons. The neutron absorber is dispersed within the reactor core in sufficient quantity to provide a reasonable margin for dilution leakage, and imperfect mixing. The Standby Liquid Control System is not provided as a backup for reactor trip functions, since most transient conditions that require reactor trip occur too rapidly to be controlled by the Standby Liquid Control System. Standby Liquid Control operation is initiated automatically by signals from Redundant Reactivity Control System or can be initiated manually.

The Standby Liquid Control System is capable of satisfying the requirements of the Standby Liquid Control System generic design basis as well as the requirement for the reduction of risks from an Anticipated Transient Without Scram (ATWS) as specified in 10 CFR 50.62 (ATWS Rule).

System Operation

The Standby Liquid Control System is comprised of an atmospheric tank for sodium pentaborate solution storage (standby liquid control tank), two separate pump suction headers which feed their respective redundant parallel high pressure positive displacement pumps, two explosive actuated shear plug valves, two motor operated stop-check shutoff valves, a common discharge header, a test tank, associated piping, valves, and instumentation and controls. The Standby Liquid Control System is manually initiated from the main control room through the use of key lock switches or automatically initiated upon receipt of a low-low reactor water or high reactor vessel dome pressure signal from the Redundant Reactivity Control System, which starts both pumps and actuates the explosive actuated valves.

The Standby Liquid Control System pumps take suction from the standby liquid control tank. Flow is provided by one or both of the positive displacement pumps. The pumps and piping are protected from overpressure by relief valves which discharge back to the associated standby liquid control pump suction line. Following system initiation, the explosive valve associated with the selected pump is actuated to provide a flowpath to the reactor vessel via the Core Spray System. The sodium pentaborate solution is pumped to the vessel through a common discharge header, through two (2) parallel motor operated stop check valves and delivered to the Core Spray System piping (evaluated with Core Spray System) which continues to the core spray loop A sparger (evaluated with the Reactor Internals system). The solution enters the reactor vessel through the sparger inlet nozzle and is sprayed radially over the top of the core.

An electric heater is installed in the standby liquid control tank and the pump suction lines are provided with electrical heat tracing and thermal insulation to prevent crystallization of the sodium pentaborate solution. Provisions for recirculating the sodium pentaborate solution are included to assure the readiness of the standby liquid control tank and the pump suction. A test tank with demineralized water is provided for functional testing of the standby liquid control pumps and injection valves without injecting boron solution.

A standby liquid control pump starting will provide a signal to isolate the Reactor Water Cleanup System to prevent loss or dilution of the boron in the vessel through the reactor water cleanup demineralizers or through reactor water cleanup letdown.

The Standby Liquid Control System injection piping containment penetration is provided with one inboard check valve and two (2) out board motor operated primary containment isolation valves that are included in the license renewal boundary for SLC System.

For more detailed information, see UFSAR section 9.3.5.

<u>System Boundary</u>

The Standby Liquid Control System boundary begins with the standby liquid control tank and includes the standby liquid control positive displacement pumps, relief valves, pump discharge check valves, explosive actuated valves, two (2) parallel motor operated stop-check shutoff valves, and terminates at the attachment point on the Core Spray System piping. The boundary includes the standby liquid control tank heaters, heat trace, the standby liquid control test tank and demineralized water lines, system drain lines, and drain tank.

The Standby Liquid Control System boundary also includes the demineralized water supply line and service compressed air supply line attached to the standby liquid control tank used for the filling and mixing of the boron solution through the standby liquid control tank air sparger. This portion of the boundary extends from the standby liquid control tank out to the Standby Liquid Control System check valves located on the demineralized water and service air supply lines (evaluated with the Makeup Demineralizer System and Compressed Air System respectively).

All associated piping, components, and instrumentation contained within the flow path described above are included in the Standby Liquid Control System boundary.

Included in the license renewal boundary of the Standby Liquid Control System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor Building. Also included in the boundary are pressure-retaining components located in the Reactor Building relied upon to preserve the leakage boundary intended function of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the scoping boundary of the Standby Liquid Control System is the core spray loop A sparger, which is evaluated with the Reactor Internals.

Not included in the Standby Liquid Control System license renewal scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Core Spray System
Makeup Demineralizer System
Compressed Air System
Primary Containment

Reason for Scope Determination

The Standby Liquid Control System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It does meet 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of functions identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49), Anticipated Transient Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63). The Standby Liquid Control System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48).

System Intended Functions

1. Provide reactor coolant pressure boundary. The Standby Liquid Control System contains and provides isolation from the reactor coolant pressure boundary. The Standby Liquid Control System enters the reactor vessel via the Core Spray System. 10 CFR 54.4(a)(1)

2. Introduce emergency negative reactivity to make the reactor subcritical. The Standby Liquid Control System injects sodium pentaborate solution as an alternate negative reactivity method for reactor shutdown when normal reactivity control provisions become inoperative. 10 CFR 54.4(a)(1)

3. Provide primary containment boundary. The Standby Liquid Control System injection piping contains valves, which are considered primary containment isolation devices. 10 CFR 54.4(a)(1)

4. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The system contains nonsafety-related piping that has the potential to spatially and structurally interact with safety-related portions of this system. 10 CFR 54.4(a)(2)

5. Relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Standby Liquid Control System has components that are in the Environmental Qualification program. 10 CFR 54.4(a)(3)

6. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Anticipated Transients without Scram (10 CFR 50.62). The Standby Liquid Control System injects sodium pentaborate solution as an

alternate negative reactivity method for reactor shutdown when normal reactivity control provisions become inoperative. 10 CFR 54.4(a)(3)

7. Relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Station Blackout (10 CFR 50.63). Standby Liquid Control System provides 24VDC power for instrumentation during shutdown coping and recovery. 10 CFR 54.4(a)(3)

UFSAR References

9.3.5

License Renewal Boundary Drawings

LR-M-41-1, Sheet 1
LR-M-48-1, Sheet 1

Table 2.3.3-30 Standby Liquid Control System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Bolting (Class 1)	Mechanical Closure
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary
Electric Heater (Housing)	Pressure Boundary
Flow Element	Leakage Boundary
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Pump Casing (SLC Injection)	Pressure Boundary
Tank (Standby Liquid Control)	Pressure Boundary
Tank (Test)	Leakage Boundary
Thermowell	Pressure Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary
Valve Body (Class 1)	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-30 Standby Liquid Control System
Summary of Aging Management Evaluation

2.3.3.31 Torus Water Cleanup System

System Purpose

The Torus Water Cleanup System is a mechanical system designed to maintain torus water purity, clarity, and level within specified limits. Torus Water Cleanup System has no function related to the safe shutdown of the plant. It can be operated during startup, shutdown, and refueling modes, as well as during power operation. The Torus Water Cleanup System is in scope for license renewal.

The purpose of the Torus Water Cleanup System is to maintain suppression pool water quality within its limits. The Torus Water Cleanup System accomplishes this purpose by processing torus water through the Fuel Pool Cooling and Cleanup System's filter demineralizer.

Portions of the Torus Water Cleanup System are considered primary containment pressure boundary. The Containment Isolation System, upon indications of high drywell pressure, low-low reactor water level or high-high reactor building ventilation radiation exhaust, provides automatic isolation signals for containment isolation valves in the Torus Water Cleanup System.

The Torus Water Cleanup System is manually initiated and operated intermittently, as necessary, to maintain suppression pool water quality within the its limits.

System Operation

The Torus Water Cleanup System is comprised of one suction header, two suction isolation valves, one centrifugal pump, its associated piping, local valves and instrumentation, and two discharge isolation valves. The System is manually initiated and operated intermittently, as necessary, to maintain suppression pool water quality. The pump is automatically stopped on low suction.

Following system initiation, the torus water cleanup pump takes suction from the torus through a strainer. Torus water flows from the suction header, through two (2) motor operated isolation valves prior to entering the torus water cleanup pump. Torus water is pumped to the Fuel Pool Cooling and Cleanup system filter demineralizer (evaluated with Fuel Pool Cooling and Cleanup System). The Torus Water Cleanup System discharge line continues at the point where the return piping from the Fuel Pool Cooling and Cleanup System filter demineralizer is attached to the Torus Water Cleanup System. The Torus Water Cleanup System flows through two (2) motor operated isolation valves and then returns back to the torus.

The Torus Water Cleanup System is also used for partially draining the torus. In this mode of operation, the torus water cleanup pump takes suction from the torus and circulates the water through a fuel pool filter demineralizer (evaluated with Fuel Pool Cooling and Cleanup System) and provides a flow path to the condensate storage tank (evaluated with Condensate Storage and Transfer System) for partial draining of the torus.

Portions of the Torus Water Cleanup System are considered primary containment pressure boundary. Indications of high drywell pressure, low-low reactor water level or high-high reactor building ventilation exhaust radiation provides automatic isolation signals for containment isolation valves in the Torus Water Cleanup System.

For more detailed information, see UFSAR section 9.1.3.

System Boundary

The boundary of the Torus Water Cleanup System begins with the suction strainer located in the torus and includes one suction header, two motor operated suction isolation valves, one centrifugal pump, its associated piping, local valves and instrumentation up to the attachment point for the Fuel Pool Cooling and Cleanup System. At this point the Torus Water Cleanup System piping is connected to the Fuel Pool Cooling and Cleanup System filter demineralizer (evaluated with Fuel Pool Cooling and Cleanup System). The Torus Water Cleanup System discharge line continues at the point where the return piping from the Fuel Pool Cooling and Cleanup System filter demineralizer is attached to the Torus Water Cleanup System. The Torus Water Cleanup System discharge piping includes the two (2) motor operated discharge isolation valves and terminates at the discharge line attachment point to the torus.

Also included in the license renewal scoping boundary of the Torus Water Cleanup System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor and Auxiliary Buildings included in this boundary are pressure retaining components relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

All associated piping, components, and instrumentation contained within the flowpath described above are included in the Torus Water Cleanup System boundary.

Not included in the Torus Water Cleanup System license renewal scoping boundary is the following system, which is separately evaluated as license renewal system:

Fuel Pool Cooling and Cleanup System

Reason for Scope Determination

The Torus Water Cleanup System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It does meet 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Torus Water Cleanup System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48), Anticipated Transient Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provides primary containment boundary. The Torus Water Cleanup System suction and discharge piping contains valves, which are considered containment isolation devices. 10 CFR 54.4(a)(1)

2. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The system contains nonsafety-related piping that has the potential to spatially and structurally interact with safety-related portions of this system. 10 CFR 54.4(a)(2)

3. Relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The primary containment isolation valves within the Torus Water Cleanup System are environmentally qualified. 10 CFR 54.4(a)(3)

UFSAR References

9.1.3

License Renewal Boundary Drawings

LR-M-53-1, Sheet 2

Table 2.3.3-31 Torus Water Cleanup System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Pump Casing (Torus Water Clean-up)	Leakage Boundary
Strainer	Structural Support
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-31 Torus Water Cleanup System
Summary of Aging Management Evaluation

2.3.3.32 Traversing Incore Probe System

System Purpose

The Traversing In-Core Probe (TIP) System is an electrical instrumentation system designed to provide neutron flux data to be used for calibration of the Local Power Range Monitor (LPRM) detectors and to determine axial neutron flux levels for core power distribution measurements. The TIP system includes mechanical component types that are responsible for providing primary containment integrity.

The purpose of the TIP system is to measure core neutron flux at various positions throughout the core. The TIP system accomplishes its purpose by utilizing a set of fission chamber detector instruments identical to those used by the LPRM system and a positioning system capable of moving the fission chamber detectors to various locations in the core corresponding to the locations of the LPRM detectors. The moveable TIP detectors, as with the fixed LPRM detectors, generate signals that are processed to indicate neutron flux levels in the vicinity of each detector.

Since the TIP detectors are capable of being fully withdrawn from the core and outside of primary containment, the TIP system consists of mechanical components designed to assure primary containment integrity. The TIP system does not generate any signals for protection of the reactor; however, the portion responsible for providing primary containment integrity is in scope for license renewal. The TIP system is not credited with a reactor coolant pressure boundary integrity function since the in-vessel located dry tubes that provide the reactor coolant pressure boundary are evaluated with the Reactor Internals system. The majority of the TIP system is not in scope for license renewal.

System Operation

The Traversing Incore Probe System is comprised of two subsystems. One is the purge equipment subsystem and the other is drive mechanism subsystem. The TIP purge equipment subsystem is comprised of the nitrogen bottle station, TIP purge equipment, and purge air control unit. The purge equipment subsystem maintains a dry atmosphere within TIP system components to prevent rusting of the TIP detector cabling and to minimize the deterioration of the TIP guide tube lubricant. The nitrogen bottle station serves as the normal purge supply for the TIP indexing mechanisms. When the nitrogen bottle station is not available, the Compressed Air System can supply the required backup air to the indexing mechanisms.

The TIP drive mechanism subsystem is comprised of five trains, each consisting of a fission chamber detector identical to the LPRM fission chamber detectors, attached to a triaxial drive and signal cable which is helically wrapped in carbon steel. Each detector is driven by a drive mechanism consisting of a drive reel assembly capable of inserting and withdrawing the detector at either a low or high drive speed. A digital position indicator provides core top and bottom indication, and continuous digital indication of detector position. A chamber shield consisting of a cylindrical cask filled with lead shot is associated with each detector and drive mechanism. It houses and shields the detector when fully withdrawn from the drywell. TIP guide tubing provides a guide for the TIP detector throughout its travel from the chamber shield to the core top position inside the reactor vessel. The dry tubes inside the reactor vessel are evaluated with the Reactor Internals system. An indexing mechanism associated with each detector allows the selection of any of ten locations for each detector, including a core location common to all five detectors for purposes of calibration. The TIP flux probe monitor consists of a dual channel amplifier and a power supply. The amplifier conditions the detector signal to provide an input to the plant computer for determining flux level. The power supply provides operating power to the flux amplifier and to the detector for biasing. The drive control unit provides control of detector insertion and retraction. It determines and displays detector position in the core, monitoring the TIP detector throughout its operation with status lights.

For each of the five drive mechanism trains, there are explosive-actuated shear valve and ball valve located outside the drywell. The ball valve is normally closed except when the detector is inserted. The ball valve can be manually controlled, but is normally opened and closed automatically, with interlocks to open the valve when the detector leaves the shield, and to deenergize the drive mechanism should the ball valve not open after the insert operation is selected for the TIP detector. Upon receipt of a containment isolation signal, an inserted TIP detector is fully retracted at the high travel speed and the ball valve automatically closes when the detector reaches the chamber shield. The shear explosive valve is used only to isolate a leak while a detector is inserted and power is lost to the drive mechanism or some other fault has occurred which prevents retraction of the TIP. A keylock switch manually activates the shear explosive valve. When actuated, a guillotine will cut the TIP guide tube and detector cable inside it and will seal the guide tube. The valve control monitor controls the valve interlocks and indicates position of the ball and shear explosive valves. The keylock operator for the explosive actuated shear valve is located and powered from the valve control monitor.

Similar to the TIP purge subsystem, the TIP drive mechanism also requires compressed gas to maintain a dry environment for the TIP detectors and cables. The Primary Containment Instrument Gas System serves as the normal supply for the compressed gas. When the Primary Containment Instrument Gas System is not available, the nitrogen bottle station can be aligned to supply the TIP drive mechanism. When neither Primary Containment Instrument Gas System nor the nitrogen bottle station is available, the Compressed Air System can supply the backup air to the drive mechanisms via a portion of the Primary Containment Instrument Gas System piping.

For more detailed information, see UFSAR Section 9.3.6.

<u>System Boundary</u>

The TIP system boundary begins at the branch piping connection from the Primary Containment Instrument Gas System. The TIP system has two separate branch piping connections that provide compressed gas supply to the drive mechanism and the purge equipment subsystems. For the branch piping connection to the drive mechanism subsystem, the piping continues through the TIP drive mechanism isolation valve, TIP drive mechanisms, chamber shields outside the primary containment where the detectors are stored when fully retracted, shear valve assemblies and to the containment penetrations (P34A-E & G). Inside the primary containment, the branch piping continues through the TIP guide tubes, inboard isolation valves, indexing mechanisms, from which multiple TIP guide tubes proceed to the reactor vessel and then ends at the core top position inside the vessel. Included are the five-way connector (which provides a pathway for each indexer to send a detector to the same location for calibration), triaxial drive and signal cables, detectors, and electronic equipment necessary to obtain and process the TIP signals. For the branch piping connection to the purge equipment subsystem, the branch piping continues through the normally closed TIP purge equipment isolation valve. The system includes the normal compressed gas supply from the nitrogen bottle station, which connects the supply line of nitrogen bottle station right after the TIP purge equipment isolation valve. The branch piping continues through the TIP purge equipment, outboard isolation valve, and to the containment penetration (P34F). Inside the primary containment, the piping continues through the purge air control unit and ends at the indexing mechanisms. All associated safety-related piping, components and instrumentation contained within the flow paths described above are included in the system boundary.

Also included in the license renewal scoping boundary of the TIP system are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor. Included in this boundary are components relied upon to preserve the structural support intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the system boundary of the Traversing Incore Probe System are the dry tubes inside the reactor vessel, which are included in the Reactor Internals scoping boundary. Also not included in the system boundary are the TIP guide tube containment penetrations (P34A-F), which are separately evaluated for license renewal scoping in the Primary Containment structure.

Not included in the Traversing Incore Probe System license renewal scoping boundary are the following interfacing systems, which are separately evaluated as a license renewal system:

Compressed Air System
Primary Containment Instrument Gas System
Reactor Internals

There are two portions of the TIP system boundary that are in scope for license renewal for the primary containment boundary intended function. These portions of the system are in the drive mechanism subsystem and the purge equipment subsystem. For the drive mechanism subsystem, it is comprised of the TIP guide tubing from the shear valve assembly on each of the five TIP system trains to the primary containment penetration. This boundary includes the ball valve associated with each train, which is downstream of the shear explosive valve. For the purge equipment subsystem, it is comprised of piping from outboard isolation valve to the inboard isolation check valve inside primary containment. All nonsafety-related portions except those relied upon to preserve the structural support intended function of the TIP system are not in scope for license renewal as they are not required to support the intended function of providing primary containment boundary.

Reason for Scope Determination

The Traversing Incore Probe System meets 10 CFR 54.4(a)(1) because it is a safety-related system that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in the safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Environmental Qualification (10 CFR 50.49). The Traversing Incore Probe System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48), Anticipated Transient Without Scram (10 CFR 50.62) or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide primary containment boundary. Supply lines penetrating primary containment are provided with isolation valves. 10 CFR 54.4(a)(1)

2. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety related function. The safety-related/nonsafety-related interface has components relied upon to preserve the structural support intended function. 10 CFR 54.4(a)(2)

3. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Traversing Incore Probe System has components that are in the Environmental Qualification Program. 10 CFR 54.4(a)(3)

UFSAR References

6.2.4
7.6.1
7.7.1.13
9.3.6

License Renewal Boundary Drawings

LR-M-59-1, Sheet 3

Table 2.3.3-32 Traversing Incore Probe System
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.3.2-32 Traversing Incore Probe System
Summary of Aging Management Evaluation

2.3.4 STEAM AND POWER CONVERSION SYSTEMS

The following systems are addressed in this section:

- Condensate Storage and Transfer System (2.3.4.1)
- Feedwater System (2.3.4.2)
- Main Condenser System (2.3.4.3)
- Main Steam System (2.3.4.4)

2.3.4.1 Condensate Storage and Transfer System

System Purpose

Condensate Storage and Transfer System is a condensate storage, makeup and supply system designed to distribute water to the High Pressure Coolant Injection, Reactor Core Isolation Cooling, Core Spray, Control Rod Drive, Residual Heat Removal, Reactor Water Clean Up, Fuel Pool Cooling & Cleanup, Condensate, Feedwater, and Radwaste Systems for normal and testing operational modes. The system is normally filled by the Makeup Demineralizer System. The system operates continuously during plant power operation. The Condensate Storage and Transfer System has no safety-related function, except for that of supplying condensate to the suction line of the high pressure coolant injection and reactor core isolation cooling pumps. Large portions of the Condensate Storage and Transfer System are not required to perform intended functions and are not in scope.

The Condensate Storage and Transfer System consists of the condensate and refueling water storage tank plant systems. The Condensate Storage and Transfer System purpose is to provide for bulk storage of condensate, surge volume capability for the Condensate System, condensate supply for the condensate demineralizer resin transfer, flushing, seal water, resin regeneration, and makeup to the Fuel Pool Cooling & Cleanup System. The Condensate Storage and Transfer System also supplies condensate to the suctions of the high pressure coolant injection, reactor core isolation cooling, core spray, and control rod drive pumps. The system also supplies condensate to various plant systems and makeup supply for various plant systems. Condensate Storage and Transfer System accomplishes this purpose by continuously delivering pressurized condensate from the condensate transfer, condensate transfer jockey, or the refueling water pumps to individual plant systems. It also provides a flow path between plant water supplies and various equipment when the appropriate manual or remote manual line-ups are made. System demand control is achieved through both local and remote manual manipulation of the Condensate Storage and Transfer System components.

System Operation

The Condensate Storage and Transfer System is a normally operating condensate delivery system comprised of the condensate storage tank, condensate transfer pumps, condensate transfer jockey pumps, refueling transfer pumps, condensate supply header, expansion tank, and condensate branch lines that provide flow to various plant systems and components. It also is used to deliver water through its piping system to support various plant functions and it provides a surge volume for the Condensate System.

The Condensate Storage and Transfer System is relied on to provide a flow path from the condensate storage tank to the suction of the high pressure coolant injection and reactor core isolation cooling pumps. The function of this line is to ensure that the High Pressure Coolant Injection and Reactor Core Isolation Cooling Systems have adequate suction water to perform the transfer from the condensate storage tank to the torus.

The Condensate Storage and Transfer System consists of three basic flow paths. The first is the condensate storage tank to the high pressure coolant injection and reactor core isolation cooling pump suction lines. The second is the condensate transfer, condensate transfer jockey and refueling water pumps supply, and third is for main condenser makeup and reject.

The condensate storage tank to high pressure coolant injection and reactor core isolation cooling pump suction lines provide High Pressure Coolant Injection and Reactor Core Isolation Cooling Systems with condensate directly from the condensate storage tank. This same suction line supplies the Core Spray System pumps. There is also a flow path from the high pressure coolant injection and reactor core isolation cooling pump discharge lines that returns condensate to the condensate storage tank. This same return line also provides a flow path from the control rod drive water pumps discharge line to the condensate storage tank.

The condensate transfer, condensate transfer jockey and refueling water pumps take suction from a common header supplied by the condensate storage tank through the tank isolation valve. The water flows from the common suction header into the individual pump suction lines and on to the pumps. The pumps then discharge to a common discharge header. Normally one condensate transfer jockey pump operates continuously to supply system demands and the other pumps are placed on standby. A recirculation line from the discharge of each pump directs a portion of the pumps discharge back to the condensate storage tank. Recirculation flow is necessary during periods of low system demand to ensure that pump minimum flow requirements are met. Condensate from the combined pump discharge header flows from the Turbine Building to the Auxiliary and Reactor Buildings. Building branch lines from these headers supply systems and components with the required water. The Condensate Storage and Transfer System also provides condensate to the reactor well, dryer/separator pool, cask pool and returns the water to the condensate storage tank as necessary.

The Condensate Storage and Transfer System main condenser makeup and reject line directly connects to the main condenser and condensate storage tank, which provides bulk storage and supply of condensate to maintain the desired hotwell level. Water for filling the condensate storage tank is supplied from the Demineralized Water System.

Condensate Storage and Transfer System has a seismically qualified dike that surrounds the condensate storage tank. The system's valves and piping sections that penetrate the dike are seismically qualified.

The condensate transfer, condensate transfer jockey and refueling water pumps are controlled by individual pump control switches on a control room panel. Normally both condensate transfer pumps are in standby with a jockey pump maintaining system pressure and supplying system loads. In the event that system load exceeds the capacity of the jockey pumps, the condensate transfer pumps will start and provide additional flow. The refueling water pumps are normally aligned to supply Condensate Storage and Transfer System loads. In the event condensate transfer pumps cannot maintain system demand the refueling water pumps are used. By operating manual valves the refueling water pumps can pump from the condensate storage tank to the reactor well, dryer/separator pool, and the spent fuel pool or from the reactor well, dryer/separator pool, and the spent fuel pool to the condensate storage tank. The refueling water pumps can be operated from a remote panel. The condensate storage tank is vented to the atmosphere. Tank level is indicated remotely on a control room panel and locally at the tank. The condensate storage tank's steam heating coils (evaluated with Auxiliary Steam System) receive steam from the Auxiliary Steam System to maintain water temperature and prevent freezing. The Condensate Storage and Transfer System lines from the condensate storage tank to where the pipe goes underground are provided with electrical heat tracing and thermal insulation to prevent freezing.

For more detailed information, see UFSAR sections 9.2.6.

System Boundary

The Condensate Storage and Transfer System boundary begins at the condensate storage tank and continues down the common suction header to the condensate transfer, condensate transfer jockey and refueling water pumps suction lines and on through the pumps to the common discharge header. Each pump's recirculation line is included. The system continues through the main header in the Turbine Building and runs into the Auxiliary Building header. Auxiliary Building header splits and runs into the Reactor Building header.

The Reactor Building header includes the piping up to the connection point with High Pressure Coolant Injection, Reactor Core Isolation Cooling, Core Spray, Residual Heat Removal, Reactor Water Clean Up, and Fuel Pool Cooling & Cleanup (including the reactor well, dryer/separator pool, cast pool and refuel services boxes) Systems. The Auxiliary Building header begins at the entry point to the building and terminates at the connection points to the Radwaste System loads, fuel pool filter demineralizer, and the individual hose stations throughout the Auxiliary Building. The Turbine Building Header boundary includes the piping up to the connection point to the Condensate, Feedwater, and Process and Post-Accident Sampling Systems.

The boundary of the condensate storage tank to the high pressure coolant injection and reactor core isolation cooling pump suction lines begins at the condensate storage tank, and continues through to the attachment point at the High Pressure Coolant Injection and Reactor Core Isolation Cooling Systems. Also included in this boundary are the lines from the high pressure coolant injection and reactor core isolation cooling pump discharge that return condensate to the condensate storage tank. The boundary includes the line that provides suction to the core spray pumps. The boundary also includes the control rod drive pump minimum flow line attachment point to this return line.

The Condensate Storage and Transfer System main condenser makeup and reject boundary begins at the condensate storage tank and terminates at the connection point to the Condensate and Control Rod Drive Systems.

All associated piping, components, and instrumentation contained within the flow path described above are included in the Condensate Storage and Transfer System boundary.

Also included in the license renewal scoping boundary of the Condensate Storage and Transfer System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor Building. Included in this boundary are pressure-retaining components relied upon to preserve the leakage boundary intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the Condensate Storage and Transfer System license renewal boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Auxiliary Steam System
Condensate System

Control Rod Drive System
Core Spray System
Demineralized Water System
Feedwater System
Fuel Pool Cooling & Cleanup System
High Pressure Coolant Injection System
Main Condenser System
Process and Post-Accident Sampling System
Radwaste System
Reactor Core Isolation Cooling System
Reactor Water Clean Up System
Residual Heat Removal System

Not included in the scope of license renewal is the portion of the Condensate Storage and Transfer System located within the Turbine Building and the Auxiliary Building Service Radwaste Area as these portions of the system are not located within an area in proximity of components performing a safety-related function. Components that are not required to support the system's leakage boundary intended functions or any other intended function are not included in the scope of license renewal. The Condensate Storage and Transfer System supplies and accepts return condensate from systems and equipment in these areas. These portions of the system are not safety-related, are not required to support an intended function, and are not included in the scope of license renewal.

The overflow and demineralized water makeup piping from the connection to the condensate storage tank is not required to support intended functions and is not included in the scope of license renewal.

<u>Reason for Scope Determination</u>

The Condensate Storage and Transfer System meets the scoping requirements of 10 CFR 54.4(a)(1) because it is a safety-related system which is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It does meet 10 CFR 54.4(a)(3) because it is relied upon in the 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), and Station Blackout (10 CFR 50.63). The Condensate Storage and Transfer System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Anticipated Transient Without Scram (10 CFR 50.62).

<u>System Intended Functions</u>

1. Provide emergency core cooling where the equipment provides coolant directly to the core. The Condensate Storage and Transfer System provides suction condensate to the High Pressure Coolant Injection System. 10 CFR 54.4(a)(1)

2. Remove residual heat from the Reactor Coolant System. The Condensate Storage and Transfer System provides suction to the Reactor Core Isolation Cooling System. 10 CFR 54.4(a)(1)

3. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Condensate Storage and Transfer System includes nonsafety-related water filled lines in the Reactor Building that have the potential to spatially (spray or leakage) and structurally interact (spray or leakage) with safety-related SSCs. 10 CFR 54.4(a)(2)

4. 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). Condensate Storage and Transfer System provides water source for High Pressure Coolant Injection System and Reactor Core Isolation Cooling System to control reactor vessel pressure and level. This function supports Station Blackout coping, shutdown and restoration. 10 CFR 54.4(a)(3)

5. 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). The condensate storage tank is part of Appendix R shut down method. Condensate storage tank is the preferred source of makeup water to the reactor vessel and will be used if available. 10 CFR 54.4(a)(3)

6. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The Condensate Storage and Transfer System has components that are in the EQ program. 10 CFR 54.4(a)(3)

<u>UFSAR References</u>

9.2.6

<u>License Renewal Boundary Drawings</u>

LR-M-08-0, Sheet 1
LR-M-08-0, Sheet 2
LR-M-44-1, Sheet 1
LR-M-45-1, Sheet 1
LR-M-49-1, Sheet 1
LR-M-51-1, Sheet 1
LR-M-51-1, Sheet 2
LR-M-52-1, Sheet 1
LR-M-53-1, Sheet 1
LR-M-53-1, Sheet 2
LR-M-55-1, Sheet 1
LR-M-66-0, Sheet 1

Table 2.3.4-1 Condensate Storage and Transfer System
Components Subject to Aging Management Review

Component Type	Intended Function
Bird Screen	Filter
Bolting	Mechanical Closure
Expansion Joints	Structural Support
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Piping and Fittings (Pipe Sleeve)	Shelter, Protection
Tanks (CST)	Pressure Boundary
Thermowell	Pressure Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.4.2-1 Condensate Storage and Transfer System
Summary of Aging Management Evaluation

2.3.4.2 Feedwater System

System Purpose

The Feedwater System is a normally operating system designed to provide preheated feedwater to the reactor pressure vessel. It provides water to the reactor at a flow rate equivalent to what is being generated into steam by boil-off and removed by the Main Steam System. The Feedwater System is essential for power operations. The portion of the system from the feedwater pump suction isolation valve to, but not including, the outboard primary containment isolation check valve, are nonsafety-related. The portion of the Feedwater System from the outboard primary containment isolation check valve to the Reactor Pressure Vessel is safety-related. The Feedwater System is in scope for license renewal, however, large portions of the Feedwater System are not required to perform intended functions and are not in scope. The Feedwater System consists of the following plant systems: feedwater system, reactor feed pump turbine system, and the feed pump turbine lube oil system.

The purpose of the Feedwater System is to provide preheated feedwater to the reactor pressure vessel during normal operation. Feedwater System accomplishes this purpose by delivering high-pressure feedwater to the reactor vessel. The Feedwater System automatically maintains the desired reactor pressure vessel water level for all normal reactor-operating conditions.

The Feedwater System provides cooling water to the reactor core during a loss of coolant accident but is not credited in the accident analyses and is not considered part of the emergency core cooling system or credited to support safe shutdown.

System Operation

The Feedwater System is comprised of three one-third capacity steam turbine-driven feedwater pumps arranged in a parallel array, three strings of high-pressure feedwater heaters, and the necessary valves, piping, instrumentation and controls required to deliver sufficient feedwater flow to the Reactor Pressure Vessel during all modes of operation. When operating at 100% of rated reactor power, all three reactor feedwater pumps are normally in-service.

The feedwater pumps take suction on a common header downstream of the Condensate System's low-pressure feedwater heaters. The normal feedwater flowpath for each string is through the steam turbine-driven feedwater pumps, discharge check valve, heater string flow element and continues to a common header. Flow then goes through the high-pressure heater tubes and into another common discharge header. The flow then splits into two main headers each with a flow element, an outboard air operated isolation check valve, one inboard isolation check valve, and an inboard motor operated isolation valve. Finally feedwater flow is delivered to the reactor vessel (evaluated with the Reactor Pressure Vessel) through six feedwater nozzles. The shell side of the high-pressure heaters receive main turbine extraction steam to preheat the feedwater (evaluated with the Main Turbine and Auxiliary System) prior to delivery to the reactor pressure vessel. The Feedwater System has steam driven reactor feed pump turbines that utilize steam from the Main Steam System. The Feedwater System (reactor feedwater pump turbine lube oil) provides lubrication to the reactor feed pumps and turbines.

The Feedwater System (digital feedwater control) controls the flow of feedwater into the reactor vessel to maintain the vessel water level within predetermined limits during all normal plant operating modes. The Feedwater System uses vessel water level, steam flow, and feedwater flow as a three-element control to automatically regulate feedwater flow to maintain a normal level control range. A change in level or steam flow will cause a change (mismatch) in feed flow and the reactor feedwater pump turbines will respond accordingly to correct the mismatch.

Each reactor feedwater pump has a minimum flow line, for pump protection, routed from the discharge of the reactor feed pump to each condenser shell. The three high-pressure heaters have a common bypass line used during plant start-up. The Feedwater System startup recirculation line is used to flush the system and improve water chemistry.

For more detailed information, see UFSAR section 10.4.7.

System Boundary

The Feedwater System boundary begins at the feedwater pumps suction isolation valves and ends at the feedwater attachment point to the Reactor Pressure Vessel nozzles (evaluated with the Reactor Pressure Vessel System). The system includes three strings, each of which include a feedwater pump, flow element, common pump discharge header, and the tube side of the high-pressure heaters. The three strings combine into a common header downstream of the high-pressure heaters. The common header then splits into two main headers that each includes a feedwater system flow element, an outboard air operated isolation check valve, inboard isolation check valve, and an inboard motor operated isolation valve. Six lines attach to the reactor pressure vessel. Not included in the scoping boundary of the Feedwater System are the discharge spray spargers, which are evaluated with the Reactor Internals.

Each feedwater pump has a minimum flow line routed from the discharge of the reactor feed pump to each condenser shell. The three high-pressure heaters have a common bypass line used during plant start-up. The boundary includes the line that goes to the Condensate System (zinc injection system) from the common pump discharge header. Also included in the system boundary is the startup recirculation line used to improve water chemistry, which returns to the main condenser.

The Feedwater System boundary includes the reactor feed pump turbine steam system that begins at the attachment point to the Main Steam System. High-pressure steam is supplied from the main steam bypass line and low-pressure steam from the outlet of the main turbine moisture separators. The steam flows through their respective stop and control valves, mix in the steam chest, and enters the reactor feedwater pump turbines where it is condensed and drained to the main condensers. The main condensers are evaluated with the Main Condenser System.

The Feedwater System includes the closed loop reactor feed pump turbine lube oil system for each feedwater pump. Each loop includes a lube oil console, which includes an oil tank, pumps valves, lube oil cooler and filter. The lube oil is delivered to the reactor feed pump and turbine where the oil cascades back to the oil reservoir. The reactor feed pump turbine lube oil system includes the oil centrifuge that takes suction from each pump's oil reservoir to remove impurities and returns the clean oil back to its respective oil reservoir.

Included in the license renewal scoping boundary of the Feedwater System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Reactor and Auxiliary Buildings, which provide leakage boundary intended functions, and a portion of piping extending into the Turbine Building, which provide a structural support intended function. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

All associated piping, components, and instrumentation contained within the flow path described above are included in the Feedwater System boundary.

Not included in the Feedwater System license renewal boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Auxiliary Steam System
Closed Cycle Cooling Water System
Compressed Air System
Condensate System
High Pressure Coolant Injection System
Main Condenser System
Main Steam System
Main Turbine and Auxiliary System
Primary Containment
Process and Post Accident Sampling System
Reactor Core Isolation Cooling System
Reactor Internals
Reactor Pressure Vessel
Reactor Water Cleanup System

Not included in the scope of license renewal is the portion of the Feedwater System including the reactor feed pumps turbine subsystem, reactor feed pump turbine lube oil subsystem and other portions of the Feedwater System that are located within the Turbine Building that are not required for structural support. These portions of the system are not located within an area in proximity of components performing a safety-related function. Components and sub-systems that are not required to support the system's leakage boundary intended functions or any other intended function are not included in the scope of license renewal.

There are some portions of the Feedwater System boundary that are in scope for license renewal for primary containment and reactor coolant pressure boundary intended functions. This portion of the Feedwater System is from the outboard primary containment isolation check valve to the Reactor Pressure Vessel. Two feedwater lines penetrate the primary containment. Primary containment isolation in each line is provided by a motor operated stop check valve and an air assisted check valve outside the containment, and a check valve and a motor operated gate valve inside the containment. The piping and safety-related valves associated with containment isolation and reactor coolant pressure boundary will be in the scope of the Feedwater license renewal system.

Reason for Scope Determination

The Feedwater System meets the scoping requirements of 10 CFR 54.4(a)(1) because it is a safety-related system which is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It does meet 10 CFR 54.4(a)(3) because it is relied upon in the 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), Station Blackout (10 CFR 50.63) and Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide primary containment boundary. The Feedwater System piping contains valves, which are considered containment isolation devices. 10 CFR 54.4 (a)(1)

2. Provide reactor coolant pressure boundary. The Feedwater System provides isolation from the reactor coolant pressure boundary. 10 CFR 54.4 (a)(1)

3. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. The Feedwater System includes nonsafety-related water filled lines in the Reactor and Auxiliary Buildings that have the potential for spatial interactions (spray or leakage) with safety-related SSCs, and portions of piping in the Turbine Building that is relied upon for structural support. 10 CFR 54.4(a)(2)

4. 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). Feedwater System has components, and isolation valves inside primary containment, which are part of the Appendix R shut down component list. 10 CFR 54.4 (a)(3)

5. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). Feedwater System has components that are in the Environmental Qualification program. 10 CFR 54.4 (a)(3)

6. Relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Anticipated Transients Without Scram (10 CFR 50.62). The Feedwater System upon the receipt of a high pressure signal from the Redundant Reactivity Control System, including confirmation of no scram, limits the feedwater flow injection to the Reactor Pressure Vessel (feedwater pump runback). 10 CFR 54.4(a)(3)

7. 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). Feedwater System lines are used to inject High Pressure Coolant Injection and Reactor Core Isolation Cooling flow to the Reactor Pressure Vessel during coping, shutdown and restoration. 10 CFR 54.4 (a)(3)

UFSAR References

10.4.7

License Renewal Boundary Drawings

LR-M-41-1, Sheet 1
LR-M-44-1, Sheet 1
LR-M-49-1, Sheet 1
LR-M-55-1, Sheet 1

Table 2.3.4-2 **Feedwater System**
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Bolting (Class 1)	Mechanical Closure
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary
Flow Element	Structural Support
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Piping and Fittings (Class 1)	Pressure Boundary
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary
Valve Body (Class 1)	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.4.2-2 Feedwater System
Summary of Aging Management Evaluation

2.3.4.3 Main Condenser System

System Purpose

The Main Condenser System is a license renewal system that consists mainly of the main condenser. The Main Condenser System is a heat sink for the turbine exhaust steam, turbine bypass steam, and other flows. It also deaerates and stores the condensate for reuse after a period of radioactive decay. Additionally, the Main Condenser system provides for post accident containment and holdup of activity products.

The Main Condenser is designed:

a. To accept a portion of turbine bypass steam flow without exceeding the turbine exhaust pressure and temperature limitations.

b. To receive, in addition to the main turbine exhaust, vents and drains from the regenerative feedwater heating system and from various other components and systems of the heat cycle.

c. To provide time for radioactive isotope decay by retaining sufficient water in the hotwell, without makeup and with turbine throttle valves wide open.

The purpose of the Main Condenser System is to condense and deaerate low pressure turbine exhaust from each of the low pressure turbines, reactor feed pumps turbine exhaust steam, main turbine bypass steam and other steam influents. It also provides a retention time to allow for the decay of short-lived radionuclides. The main condenser accomplishes this by transferring heat to the circulating water system and by ensuring sufficient retention time in the hotwell to allow for the decay of short lived isotopes.

System Operation

The Main Condenser license renewal system is comprised of three single pass shells, with divided waterboxes, one each for the three low pressure sections of the main turbine. Each shell is rigidly supported on a concrete foundation and is connected to the corresponding low pressure turbine cylinder casing by means of an expansion joint.

Equalizing connections between condenser shells limit the pressure differential between adjacent shells. These connections also allow use of one single vacuum breaker for all three shells.

During normal operation, steam, after expanding through the low pressure turbine, exhausts directly downward, through exhaust openings in the turbine casings into the condenser shells. The steam passes over the outside of the tubes and forms condensate that enters the hotwell and flows to the suction of the condensate pumps. The inside of the tubes have water from the Circulating Water System passing through them for heat rejection. The Circulating Water System has divided water boxes, each provided with inlet and outlet circulating water valves, permitting individual operation, removal from service of one half shell for maintenance, or backwashing of either half shell. The steam packing exhauster and the steam jet air ejectors are provided to obtain the minimum vacuum that will prevent steam from leaking past the packing and into the Turbine Building.

During abnormal conditions, the Main Condenser System receives, although not simultaneously, flows from the Main Steam System, feedwater heater drains, reactor feed pump turbines exhaust, and relief valve discharges from various steam lines. There are also other intermittent flows into the Main Condenser System, such as condensate and reactor feedwater pumps minimum recirculation flows.

Makeup from the condensate storage tank is evenly divided between the operating elevation of the drain coolers. At each condenser, a line supplies make-up to a spray nozzle at the elevation of the drain coolers. Makeup thus enters the steam space to ensure deaeration before it mixes with condensate in the hotwell.

The condenser shells and turbine casings are protected by relief diaphragms, which will open in the event of failure of a turbine bypass valve to close on loss of condenser vacuum. The steam released from a ruptured diaphragm is discharged to the local area and then to the turbine building stack through the ventilating system.

Hotwell level is monitored and alarms are provided for both low and high level. Local temperature indication is also provided. Condenser vacuum is indicated in the control room. Vacuum pressure monitors provide alarm and trip signals to the main turbine and for the turbine bypass valves for loss of vacuum.

There are generally two types of valve trip events, which can occur at Hope Creek. The first trip will close the main stop valves, reheat stop valves, main control valves, intercept valves, and extraction check valves and opens the bypass valves to provide a flow path of reactor steam through the bypass valve assembly to the Main Condenser System. The second type of valve trip will close the bypass valves on low condenser vacuum, thereby protecting against an over pressurization of the main condenser. Bypass trip oil is used to actuate the bypass valve trip, independent of the turbine trip oil, via the bypass valve relay.

Air can be removed from the Main Condenser System by a mechanical vacuum pump (evaluated with the Main Condenser Air Extraction System), which discharges to the plant south vent. This pump is used for evacuating the condenser during plant startup and for purging the condenser after plant shutdown.

Hope Creek utilizes an alternate source term for design basis radiological consequence analyses under the 10 CFR 50.67 for accidents. The Main Condenser System is credited for radiological holdup for a control rod drop accident.

For more detailed information, See UFSAR section 10.4.1 and 15.4.9.

System Boundary

The boundary of the Main Condenser System begins at the low-pressure turbine exhaust inlets and ends at the condenser hotwell. The boundary includes the main condenser shell, condenser tubes and tubesheets.

Not included in the Main Condenser System are the following interfacing systems, which are separately evaluated as license renewal systems:

Feedwater System
Condensate Storage and Transfer System
Main Steam System

Reason for Scope Determination

The Main Condenser license renewal system does not meet 10 CFR 54.4(a)(1) because it is a nonsafety-related system and is not relied upon to remain functional during or following a design basis event. The Main Condenser System meets the scoping requirements of 10 CFR 54.4(a)(2) because it is relied on for post accident holdup. It does not meet 10 CFR 54.4(a)(3) since it is not relied upon in the safety analyses and 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), ATWS (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

System Intended Functions

1. Provide post accident containment and holdup of activity products. The Main Condenser System provides for post accident holdup. 10 CFR 54.4(a)(2)

UFSAR References

10.4.1.1
15.4.9

License Renewal Boundary Drawings

LR-M-01-1, Sheet 1

Table 2.3.4-3 Main Condenser System
Components Subject to Aging Management Review

Component Type	Intended Function
Main Condenser Shell	Holdup
Main Condenser Tubes	Holdup
Main Condenser Tubesheet	Holdup

The aging management review results for these components are provided in:

Table 3.4.2-3 Main Condenser System
Summary of Aging Management Evaluation

2.3.4.4 Main Steam System

System Purpose

The Main Steam System is a normally pressurized system designed to deliver steam from the reactor to the Main Turbine and Auxiliary System. The system consists of large and small bore piping, pneumatically actuated isolation valves, automatic or manually operated relief valves, and vacuum breaking check valves. The Main Steam System is in scope for license renewal.

The purpose of the Main Steam System is to provide a primary containment and reactor coolant pressure boundary function, serve as a pressure relief system, and serve as a steam distribution system. It accomplishes the primary containment and reactor coolant pressure boundary function by utilizing piping and valves to limit reactor coolant inventory or radioactivity release to within acceptable limits. It accomplishes the pressure relief function for the reactor coolant pressure boundary by way of automatic or manual actuation of safety relief valves (SRVs). It also provides automatic or manual reactor depressurization to support low pressure emergency core cooling system operation. Distribution of steam to the Main Turbine and Auxiliary Systems is accomplished by piping distribution branches in the Turbine Building.

System Operation

The system is comprised of large and small bore piping, pneumatically actuated isolation valves, automatic or manually operated relief valves, and vacuum breaking check valves to accomplish its designed functions. The Main Steam System transports steam generated by the reactor through the reactor pressure vessel nozzle to the main turbine through the main steam isolation valves (MSIVs) in each of the four main steam lines. Four main steam lines, each attached to a reactor vessel nozzle, have branch connections for either three or four safety relief valves. Integral with the piping in the primary containment are flow restrictors inside the piping along with sensing lines to monitor differential pressure. Two isolation valves on each line, one inside and one outside of primary containment, provide primary containment and reactor coolant boundary requirements. Additionally, the A and C lines have branch connections upstream of the inboard main steam isolation valves for Reactor Core Isolation Cooling System and High Pressure Coolant Injection System, respectively. Distribution of steam to the Main Turbine and Auxiliary System is accomplished through branch connections downstream of an equalizing header located in the Turbine Building.

The Main Steam System provides the pressure relief function with the fourteen safety relief valves installed on the main steam lines on the branch connections. When actuated, the safety relief valves discharge steam below the water line in the pressure suppression chamber (evaluated with the Primary Containment Structure) via quenchers. The safety relief valves are spring type safety valves sized and provided with setpoints that maintain reactor vessel pressures within design conditions.

Five of the safety relief valves are designated as Automatic Depressurization System valves. They are automatically actuated by the automatic depressurization logic (evaluated with the Automatic Depressurization System) or manually actuated, depressurizing the reactor vessel to support low pressure emergency core cooling systems in an emergency depressurization function. The Automatic Depressurization System is evaluated separately.

Integral with the main steam line piping are flow restrictors on each steam line inside the drywell. The main steam line flow nozzles provide a differential pressure which is sensed through small diameter piping leading to flow instrumentation, which provide indication and alarm for main steam line flow rate during normal and transient conditions. Actuation of safety signals on high flow is provided to the Containment Isolation System. The flow restrictors limit the maximum possible flow through the steam lines and in conjunction with the MSIVs limit the radiological release outside of the drywell and loss of reactor coolant during a postulated severance of the main steam line outside the containment prior to MSIV closure.

The main steam isolation valves are pneumatic piston actuated valves utilizing instrument air which is evaluated with the Compressed Air System, and Primary Containment Instrument Gas to assist closing the valves when required. The valves are provided automatic isolation signals to close from the Containment Isolation System and manual actuation from the control room. Solenoid valves powered from the Reactor Protection System operate the valves. The main steam isolation valves have position sensing switches as part of the Reactor Protection System to provide a reactor scram on sensed start of closure.

Sensing lines for the main steam low pressure sensors are downstream of the main steam isolation valves to sense a main steam line break and provide a signal for closure of the main steam isolation valves.

The turbine bypass valves provide a reactor pressure control function, turbine steam seals minimize air in leakage to the main condenser, the steam jet air ejector steam supply provides motive force for the air extraction function, the reactor feed pump supply provides motive force for the feed pump turbines, and the recombiner supply provides a preheat function.

Under post accident conditions the piping and components associated with the main flow path between the outboard main steam isolation valves and the turbine stop valves provides containment, holdup and plate out for main steam isolation valve leakage.

Draining of the main steam lines is accomplished by the drain lines routed to either the main condenser, which is evaluated with the Main Condenser System, or the Equipment and Floor Drainage System.

Piping is installed on the reactor vessel head and connected to the main steam lines to provide venting of non-condensable gases from the reactor vessel during normal operation. Another branch connection off the reactor head vent line provides steam to the wide range level indicator condensing chamber within the Nuclear Boiler Instrumentation System. Another branch connection with solenoid operated isolation valves provides a vent path from the reactor vessel to the Equipment and Floor Drainage System.

For more information see UFSAR Sections, 5.2, 5.4, 6.2 and 10.3.

System Boundary

The Main Steam System boundary begins with the four main steam line attachment points to the reactor vessel outlet nozzles, continues through the drywell and drywell penetrations into the turbine building, continues through the main turbine stop and control valves and ends at the connection to the main turbine casing. The reactor vessel outlet nozzles are evaluated for license renewal scoping with the Reactor Pressure Vessel. Each main steam line is equipped with safety relief valves and flow restrictor, followed by a main steam isolation valve inside and outside the primary containment. The boundary includes piping between the reactor pressure vessel and the outboard isolation valve, including the main steam line drain piping. Also included in the Main Steam System boundary is the discharge piping from the safety relief valves, which is routed through the drywell, the pressure suppression chamber (Torus) vent header, and ends at the quencher located in the pressure suppression chamber (Torus). Included in the Main Steam System boundary is the reactor head vent piping beginning at the head vent nozzle pipe-to-nozzle weld and ending at the main steam piping, the head vent piping to the reactor level instrumentation condensing chamber for the wide range level instrument in the Nuclear Boiler Instrumentation System, and the head vent piping to the Equipment and Floor Drainage System. The reactor head vent nozzle is evaluated for license renewal scoping with the Reactor Pressure Vessel. Included in the Main Steam System boundary is the reactor head seal leak detection piping. All associated piping, components, and instrumentation contained within the flow path described above are included in the system evaluation boundary. Included in the license renewal scoping boundary of the Main Steam System are the piping branch connections that start between the outboard main steam isolation valves and the main steam stop valves and end at the main steam line low pressure sensors. Also included is the main steam lead and startup drain piping that starts at a branch connection upstream of the main stop valves and ends at the main condenser.

The Main Steam System supports the containment, hold up, and plate out intended function. This portion of the system includes the nonsafety-related piping in the main flow path starting from the outboard main steam stop valves and continuing to, but not including, the main turbine stop valves. However, not included in the scope of license renewal is the portion of the Main Steam System from branch piping 2.5 inch NPS and smaller that is attached to the nonsafety-related Main Steam System piping in the Turbine Building that does not support the containment, hold up, and plate out function. Components that are not required to support the system's leakage boundary, structural support or containment, hold up, and plate out function are not included in the scope of license renewal.

Also included in the license renewal scoping boundary of the Main Steam System are those portions of nonsafety-related piping and equipment that extend beyond the safety-related/nonsafety-related interface up to the location of the first seismic anchor, or to a point no longer in proximity to equipment performing a safety-related function, whichever extends furthest. This includes the nonsafety-related portions of the system located within the Primary Containment, Reactor Building and Turbine Building. Included in this boundary are pressure-retaining components relied upon to preserve the leakage boundary and structural support intended function of this portion of the system. For more information, refer to the license renewal boundary drawing for identification of this boundary, shown in red.

Not included in the Main Steam System scoping boundary are the following interfacing systems, which are separately evaluated as license renewal systems:

Automatic Depressurization System
Chilled Water System
Compressed Air System
Equipment and Floor Drainage System
Feedwater System
High Pressure Coolant Injection System
Main Condenser Air Extraction System
Main Condenser System
Main Turbine and Auxiliary System

Nuclear Boiler Instrumentation System
Primary Containment Instrument Gas System
Process and Post-Accident Sampling System
Reactor Core Isolation Cooling System
Residual Heat Removal System

Reason for Scope Determination

The Main Steam System meets 10 CFR 54.4(a)(1) because portions of the system are safety-related and relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the system could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it is relied upon in safety analyses and 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), and Station Blackout (10 CFR 50.63). The Main Steam System is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Anticipated Transient Without Scram (10 CFR 50.62).

System Intended Functions

1. Provide reactor coolant pressure boundary. The main steam lines connect directly to the Reactor Vessel. Withstand the maximum pressure difference expected across the flow restrictor following the complete severance of a main steam line. 10 CFR 54.4(a)(1)

2. Provide primary containment boundary. The main steam isolation valves close automatically on isolation signals. 10 CFR 54.4(a)(1)

3. Sense process conditions and generate signals for primary containment and reactor isolation. Main steam high flow and main steam low pressure are input signals to the Primary Containment and reactor isolation logic. 10 CFR 54.4(a)(1)

4. Resist nonsafety-related SSC failure that could prevent satisfactory accomplishment of a safety-related function. Nonsafety-related piping downstream of the main steam stop valves to the turbine stop valves is relied upon to provide a containment, hold up, and plate out function for radioactivity released through main steam isolation valves leakage during post accident conditions. Other nonsafety-related piping located in the Primary Containment and Reactor Building is relied upon to provide a leakage boundary intended function. Nonsafety-related piping downstream of the turbine stop valves is relied upon to provide a structural support intended function. 10 CFR 54.4(a)(2)

5. 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). The safety relief valves are relied upon in the Fire Protection analysis for pressure control. 10 CFR 54.4(a)(3)

6. Relied upon in the safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49). The safety relief valves are expected to operate in a harsh post LOCA environment. 10 CFR 54.4(a)(3)

7. 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). The main steam isolation valves going closed and the safety relief valves being available for pressure control are credited in the SBO analysis. 10 CFR 54.4(a)(3)

UFSAR References

5.2
5.4
6.2
7.3
10.3

License Renewal Boundary Drawings

LR-M-01-1, Sheet 1
LR-M-41-1, Sheet 1
LR-M-41-1, Sheet 2
LR-M-42-1, Sheet 1
LR-M-49-1, Sheet 1
LR-M-51-1, Sheet 1
LR-M-53-1, Sheet 1
LR-M-55-1, Sheet 1
LR-M-87-1, Sheet 2

Table 2.3.4-4 **<u>Main Steam System</u>**
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting	Mechanical Closure
Bolting (Class 1)	Mechanical Closure
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary
Condensing Chamber (Class 1)	Pressure Boundary
Flow Element (Class 1)	Pressure Boundary
Flow Element (Class 1)	Throttle
Piping and Fittings	Leakage Boundary
Piping and Fittings	Pressure Boundary
Piping and Fittings	Structural Support
Piping and Fittings (Class 1)	Pressure Boundary
Piping and Fittings (Head Seal Leak Detection)	Pressure Boundary
Restricting Orifices	Leakage Boundary
Restricting Orifices	Pressure Boundary
Restricting Orifices (Class 1)	Pressure Boundary
Restricting Orifices (Class 1)	Throttle
Sparger (T-quencher)	Pressure Boundary
Strainer Body	Leakage Boundary
Strainer Body	Pressure Boundary
Thermowell	Leakage Boundary
Thermowell	Pressure Boundary
Turbine Casing	Structural Support
Valve Body	Leakage Boundary
Valve Body	Pressure Boundary
Valve Body	Structural Support
Valve Body (Class 1)	Pressure Boundary

The aging management review results for these components are provided in:

Table 3.4.2-4 Main Steam System
Summary of Aging Management Evaluation

2.4 SCOPING AND SCREENING RESULTS: STRUCTURES

The following structural components are addressed in this section:

- Auxiliary Boiler Building (2.4.1)
- Auxiliary Building Control/Diesel Generator Area (2.4.2)
- Auxiliary Building Service/Radwaste Area (2.4.3)
- Component Supports Commodity Group (2.4.4)
- Fire Water Pump House (2.4.5)
- Piping and Component Insulation Commodity Group (2.4.6)
- Primary Containment (2.4.7)
- Reactor Building (2.4.8)
- Service Water Intake Structures (2.4.9)
- Shoreline Protection and Dike (2.4.10)
- Switchyard (2.4.11)
- Turbine Building (2.4.12)
- Yard Structures (2.4.13)

2.4.1 Auxiliary Boiler Building

Structure Purpose

The Auxiliary Boiler Building is a structural steel and concrete masonry unit structure located north of the Reactor Building. The building is single story, with a small penthouse above the roof. It is approximately 131'-6" x 99'-6" in plan dimensions and partitioned into three area: the auxiliary steam boiler area, water treatment room, and a unit substation room. The building foundation consists of a reinforced concrete slab on grade supported on piles. Its roof is composed of precast concrete slabs supported by structural steel and protected with a roofing membrane. Access to the roof and the penthouse is provided from outside the building through a stairway. The building houses the nonsafety-related Auxiliary Steam and Fresh Water Supply System components and switchgear in the yard electrical substation room. The yard electrical substation provides power to the Fire Water Pump House that supports the plant fire protection system. The Auxiliary Boiler Building is located in the yard separated from safety-related systems, structures, and components (SSCs) such that its failure would not impact a safety-related function.

The purpose of the Auxiliary Boiler Building is to provide physical support, shelter, and protection for the nonsafety-related Auxiliary Steam and Fresh Water Supply System components and switchgear for the yard electrical substation. The yard electrical substation provides power to components required for fire protection, as required by 10 CFR 50.48. Other major components housed in the building include two oil fired boilers, a deaerator, three boiler feedwater pumps, fresh water tanks and pumps, ventilation, electrical and supporting equipment.

Included in the boundary of the Auxiliary Boiler Building are concrete anchors, a reinforced concrete foundation slab, structural steel, piles, bolting, doors, conduit, masonry walls, panels and racks, and roofing membrane. Structures and components that do not perform or support an intended function, such as Auxiliary Steam and Fresh Water Supply System equipment foundations and control facilities, stairs and platforms, are not included in the scope of license renewal. Refer to the "Components Subject to Aging Management Review" table below for a complete list of components included in the boundary of the Auxiliary Boiler Building.

Not included in the boundary of the Auxiliary Boiler Building are component supports and fire barriers. Component supports are identified and separately evaluated in the Component Support Commodity Group section. Fire barriers are identified and evaluated with the license renewal Fire Protection System.

For more detailed information, see UFSAR Sections 3.3.2.3 and 9.5.9.2.

Reason for Scope Determination

The Auxiliary Boiler Building is not in scope under 10 CFR 54.4(a)(1) because no portions of the structure are safety-related or relied upon to remain functional during and following design basis events. The Auxiliary Boiler Building is not in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the structure would not prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It meets 10 CFR 54.4(a)(3) because it provides physical support, shelter and protection for systems, structures and components (SSCs) 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). The structure is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

Structure Intended Functions

1. Provides 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). 10 CFR 54.4(a)(3)

UFSAR References

3.3.2.3
3.6.1.2.1.16
9.5.1.2.34
9.5.9.2

License Renewal Boundary Drawings

LR-C-0002-0, Sheet 1

Table 2.4-1 **Auxiliary Boiler Building**
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting (Structural)	Structural Support
Cable Trays	Structural Support
Concrete Anchors	Structural Support
Concrete: Foundation	Shelter, Protection
Concrete: Foundation	Structural Support
Conduit	Shelter, Protection
Conduit	Structural Support
Doors	Shelter, Protection
Masonry walls: Above-grade exterior	Shelter, Protection
Masonry walls: Above-grade exterior	Structural Support
Masonry walls: Interior	Shelter, Protection
Masonry walls: Interior	Structural Support
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Shelter, Protection
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection
Panels, Racks, Cabinets, and Other Enclosures	Structural Support
Piles	Structural Support
Precast Panels	Shelter, Protection
Precast Panels	Structural Support
Roofing membrane	Shelter, Protection
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection
Steel Components: All structural steel	Structural Support

The aging management review results for these components are provided in:

Table 3.5.2-1 Auxiliary Boiler Building
Summary of Aging Management Evaluation

2.4.2 Auxiliary Building Control/Diesel Generator Area

Structure Purpose

The Auxiliary Building Control/Diesel Generator Area is constructed of reinforced concrete and is located adjacent to, and north of the Reactor Building. The building is a multi-story structure; approximately 242 feet by 165 feet in plan area, comprised of reinforced concrete walls, slabs, foundation mat, roof, and structural steel. The roof is reinforced concrete supported by structural steel, protected with built-up roofing material. The building foundation consists of a reinforced concrete mat placed on engineered structural backfill that bears on the dense Vincentown Formation. The foundation and building walls are separated from the abutting buildings by seismic separation joints. Reinforced concrete isolation walls separate the service/radwaste and the control/diesel generator areas. The Auxiliary Building Control/Diesel Generator Area is classified as a seismic Category I structure, designed to maintain its structural integrity during and following postulated design basis accidents and extreme environmental conditions.

The Auxiliary Building Control/Diesel Generator Area is divided into compartments designed to provide physical separation for redundant mechanical and electrical safety-related components. The eastern compartments constitute the control area and the western compartments constitute the diesel generator area. There are no concrete masonry walls in the Control/Diesel Generator Area.

The Diesel Generator Area contains rooms that house the diesel fuel tanks, standby diesel generators, ventilation and electrical equipment and supporting systems. The diesel fuel oil storage tanks are located in four storage tank rooms, one for each diesel generator. Each room is enclosed by 3-hour fire barriers and the diesel generator area is separated from the control area by 3-hour fire barriers. Each diesel generator has separate air intake and exhaust building openings. The air intake opening is located on the upper part of the south wall of the diesel generator area consisting of a fixed louvered cover to protect the intake from weather with a shield provided for missile protection. The air intake and exhaust gas openings are designed to prevent contamination of the intake air by exhaust products. The exhaust stack is located on the building roof and is provided with a missile barrier. Other openings that penetrate the structure used for the safety-related ventilation systems fresh air intakes and exhaust ducts are also provided with missile barriers.

The Control Area contains compartments that house the control room envelope, cable spreading rooms, computer rooms, battery rooms, ventilation and electrical equipment and supporting systems. The control room envelope consists of the main control room, computer room, shift supervisors' office, ready room, instructional viewing area, and supporting facilities. The control room envelope is maintained at least 1/8 inch water gauge positive pressure relative to the control room adjacent areas. The control room envelope construction joints and penetrations for cable, pipe, HVAC duct, HVAC equipment, dampers, and doors are designed specifically for leak tightness. The Unit 2 cancelled control rooms were reconfigured for office space and conference rooms and are separate from the main control room.

The Auxiliary Building Control/Diesel Generator Area also contains unoccupied space, empty rooms or rooms with abandoned equipment from the Unit 2 plant cancelled areas. There are several stairways, two elevators, and a grade level (elevation 102') truck hatch, which allow movement within the building and access to the equipment.

The purpose of the Auxiliary Building Control/Diesel Generator Area is to provide structural support, shelter and protection to safety-related systems, components and structures housed within it during normal plant operation, and during and following postulated design basis accidents and extreme environmental conditions. The building contains the main control room, which is the main operation center for the plant providing a centralized area for control and monitoring of safety-related equipment. The control room in conjunction with control room HVAC system provides a habitable environment for plant operators so that the plant can be safely operated and shutdown under design basis accident conditions required by GDC 19 of 10 CFR 50, Appendix A, and meet 10 CFR 50.67 requirements. Major components within the building also include the standby diesel generators, electrical switchgear, and HVAC equipment. The building's reinforced concrete walls and floors meet both structural and radiation shielding requirements to allow personnel access for operating and maintaining equipment. The control/diesel generator area ventilation systems are evaluated with the Auxiliary Building Ventilation System. The Auxiliary Building Control/Diesel Generator Area also supports and protects nonsafety-related equipment including abandoned equipment and office space from the Unit 2 plant cancelled areas.

Included in the boundary of the Auxiliary Building Control/Diesel Generator Area are concrete elements of the building, concrete embedments and anchors, bolting, cable trays, doors, hatches, compressible joints and seals, conduit, racks, enclosures, steel components, miscellaneous steel, penetration seals, penetration sleeves, roofing membrane, pipe whip restraints, and tube track. The entire building is in scope for license renewal; except for rooms with abandoned equipment from the Unit 2 plant cancelled areas, office partitions and personnel facilities. The abandoned equipment, office partitions and personnel facilities do not perform a license renewal intended function and are not in scope for license renewal. Refer to the "Components Subject to Aging Management Review" table below for a complete list of components included in the boundary of the Auxiliary Building Control/Diesel Generator Area.

Not included in the boundary of the Auxiliary Building Control/Diesel Generator Area are component supports, cranes and hoists, building elevators, fire barriers and piping and component insulation. Component supports are evaluated with the Component Supports Commodity Group, the cranes and hoists are evaluated with the Cranes and Hoists System and fire barriers are evaluated with the Fire Protection System. The building elevators are evaluated with the Elevators and Manlifts, and the piping and component insulation is evaluated with the Piping and Component Insulation Commodity Group.

For more detailed information, see UFSAR Sections 3.8.4.1.2, 6.4, and 9.5.8.

<u>Reason for Scope Determination</u>

The Auxiliary Building Control/Diesel Generator Area meets 10 CFR 54.4(a)(1) because it is a safety-related structure that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because the structure provides physical support, shelter and protection for nonsafety-related systems, structures, and components (SSCs) whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it provides physical support, shelter and protection for systems, structures and components (SSCs) 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), Anticipated Transients Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63). The Auxiliary Building Control/Diesel

Generator Area is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Environmental Qualification (10 CFR 50.49).

Structure Intended Functions

1. Provides physical support, shelter and protection for safety-related systems, structures, and components (SSCs). 10 CFR 54.4(a)(1)

2. Provide centralized area for control and monitoring of nuclear safety-related equipment. 10 CFR 54.4(a)(1)

3. Provides physical support, shelter, and protection for nonsafety-related systems, structures, and components (SSCs) whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4 (a)(1). 10 CFR 54.4(a)(2)

4. Provides 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). 10 CFR 54.4(a)(3)

5. Provides 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 Anticipated Transient without Scram (10 CFR 50.62). 10 CFR 54.4(a)(3)

6. Provides 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). 10 CFR 54.4(a)(3)

UFSAR References

1.2.3
3.1
3.2
3.4
3.6
3.8.4.1
3.8.5.1
6.4
9.5.8

License Renewal Boundary Drawings

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Table 2.4-2 **Auxiliary Building Control/Diesel Generator Area Components Subject to Aging Management Review**

Component Type	Intended Function
Bolting (Structural)	Structural Support
Cable Trays	Structural Support
Compressible Joints and Seals (Seismic Gaps)	Expansion / Separation
Concrete Anchors	Structural Support
Concrete Curbs	Direct Flow
Concrete Embedments	Structural Support
Concrete: Above-grade exterior	Flood Barrier
Concrete: Above-grade exterior	Missile Barrier
Concrete: Above-grade exterior	Shelter, Protection
Concrete: Above-grade exterior	Shielding
Concrete: Above-grade exterior	Structural Support
Concrete: Below-grade exterior	Flood Barrier
Concrete: Below-grade exterior	Missile Barrier
Concrete: Below-grade exterior	Shelter, Protection
Concrete: Below-grade exterior	Structural Support
Concrete: Foundation	Flood Barrier
Concrete: Foundation	Shelter, Protection
Concrete: Foundation	Structural Support
Concrete: Interior	Flood Barrier
Concrete: Interior	HELB/MELB Shielding
Concrete: Interior	Missile Barrier
Concrete: Interior	Shelter, Protection
Concrete: Interior	Shielding
Concrete: Interior	Structural Support
Conduit	Shelter, Protection
Conduit	Structural Support
Doors	Flood Barrier
Doors	HELB/MELB Shielding
Doors	Missile Barrier
Doors	Shelter, Protection
Equipment foundations	Structural Support
Hatches/Plugs	HELB/MELB Shielding
Hatches/Plugs	Missile Barrier

Component Type	Intended Function
Hatches/Plugs	Shelter, Protection
Hatches/Plugs	Structural Support
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection
Panels, Racks, Cabinets, and Other Enclosures	Structural Support
Penetration seals	Flood Barrier
Penetration seals	HELB/MELB Shielding
Penetration seals	Shelter, Protection
Penetration sleeves	Flood Barrier
Penetration sleeves	HELB/MELB Shielding
Penetration sleeves	Structural Support
Pipe Whip Restraints and Jet Impingement Shields	HELB/MELB Shielding
Pipe Whip Restraints and Jet Impingement Shields	Pipe Whip Restraint
Roofing membrane	Shelter, Protection
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Flood Barrier
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection
Steel Components (Curbs)	Direct Flow
Steel Components: All structural steel	Missile Barrier
Steel Components: All structural steel	Structural Support
Tube Track	Structural Support

The aging management review results for these components are provided in:

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area Summary of Aging Management Evaluation

2.4.3 Auxiliary Building Service/Radwaste Area

Structure Purpose

The Auxiliary Building Service/Radwaste Area is constructed of reinforced concrete and structural steel and is located adjacent to, and east of the Reactor Building. The building is a multi-story structure, separated into three sections, with a total length of approximately 550 feet and 88 or 70 feet wide for the different sections. The northern section of the radwaste/service area is structurally continuous with the plant cancelled area (Unit 2 reactor building), the central section with the Auxiliary Building Control/Diesel Generator Area, and the southern section with the Reactor Building. Seismic joints separate the foundation mats and building walls of the structure sections and the abutting Turbine Building.

The structure is comprised of reinforced concrete, structural steel, reinforced concrete panel walls, removable concrete and lead block shielding plugs that are restrained with metal decking, and built-up roofing over the reinforced concrete roof slab. The building foundations consist of a reinforced concrete mats placed on engineered structural backfill that bears on the dense Vincentown Formation. The building roof supports HVAC fan room, the north and the south plant vent stack enclosures, and access hatches. The HVAC fan room and the vent stack enclosures are comprised of structural steel and metal siding. The building is classified as a seismic Category I structure, designed to maintain its structural integrity during and following postulated design basis accidents and extreme environmental conditions. The HVAC fan room, and the north and south vent stack enclosures are classified nonsafety-related, non-seismic structures.

The Auxiliary Building Service/Radwaste Area houses the remote shutdown panel, a section of the main steam line tunnel, cable tray areas, a pipe way, radwaste treatment and storage facilities, chemical lab, heating and ventilation equipment, machine shops, decontamination equipment, and personnel support facilities.

The service/radwaste area of the building is divided into compartments designed to protect safety-related systems and components and provide radiation shielding for vital safety-related components and plant personnel. Reinforced concrete walls separate the service/radwaste area from the control/diesel generator area and the reactor building. There are no concrete masonry walls in the service/radwaste area. The Auxiliary Building Service/Radwaste area includes rooms and compartments, which contain nonsafety-related Radwaste System components designed to collect, process, store, and prepare for disposal of liquid, gaseous and solid waste. Reinforced concrete walls and slabs are sealed to contain liquid radwaste within the building, in the event of system component failure. Storage areas are shielded to protect personnel in accessible portions of the radwaste areas to meet the requirements of 10 CFR 20.

The main steam tunnel section located in the Auxiliary Building Service/Radwaste Area contains the main steam and feedwater lines running between the reactor and turbine buildings. The main steam tunnel design includes blowout panels to protect the structure from overpressurization following a postulated main steam pipe break.

The Auxiliary Building Service/Radwaste Area also contains unoccupied space and empty rooms from the plant cancelled areas. There are several stairways, two elevators, and grade level (elevation 102') truck hatches, which allow movement within the building and access to the equipment and radwaste shipment.

The purpose of the Auxiliary Building Service/Radwaste Area is to provide structural support, shelter and protection to safety-related systems, structures and components (SSCs) housed within it during normal plant operation, and during and following postulated design basis accidents and extreme environmental conditions. The building contains the remote shutdown panel, which is an alternate center for achieving and maintaining plant safe shutdown conditions from outside the main control. The Auxiliary Building Service/Radwaste Area also supports and protects nonsafety-related SSCs whose failure could impact a safety-related function.

The building is sealed to prevent liquid radioactive waste from being released to the environment in the event of a Safe Shutdown Earthquake. The building's reinforced concrete walls and floors meet both structural and radiation shielding requirements to allow personnel access for operating and maintaining equipment. The Auxiliary Building Service/Radwaste Area in conjunction with Auxiliary Building Ventilation System components is designed to maintain the radwaste area at a slight negative pressure to prevent the unmonitored release of radioactivity to the environment.

Included in the boundary of the Auxiliary Building Service/Radwaste Area are concrete and structural steel elements of the building, concrete embedments and anchors, blowout panels, bolting, cable trays, doors, hatches/plugs, compressible joints and seals, conduit, racks, enclosures, steel components, decking, miscellaneous steel, penetration seals, penetration sleeves, roofing membrane, removable shielding plugs, metal components, and tube track. The entire building is in scope for license renewal; except for components that make up the roof mounted HVAC fan room, the north and south plant vent stack enclosures, and office partitions and personnel facilities. The HVAC fan room, the north and south plant vent stack enclosures, and office partitions and personnel facilities do not perform a license renewal intended function and are not in scope for license renewal. Refer to the "Components Subject to Aging Management Review" table below for a complete list of components included in the boundary of the Auxiliary Building Service/Radwaste Area.

Not included in the boundary of the Auxiliary Building Service/Radwaste Area are component supports, cranes and hoists, building elevators, fire barriers, north and south plant vent stacks (HVAC duct), and piping and component insulation. Component supports are evaluated with the Component Supports Commodity Group, the cranes and hoists are evaluated with the Cranes and Hoists System and fire barriers are evaluated with the Fire Protection System. The building elevators are evaluated with the Elevators and Manlifts, the north and south plant vent stacks (HVAC duct) are separately evaluated with Auxiliary Building Ventilation System, and the piping and component insulation is evaluated with the Piping and Component Insulation Commodity Group.

For more detailed information, see UFSAR Sections 3.6.1.2.1.1, 3.8.4.1.3, and 7.4.1.4.

Reason for Scope Determination

The Auxiliary Building Service/Radwaste Area meets 10 CFR 54.4(a)(1) because it is a safety-related structure that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because the structure provides physical support, shelter and protection for nonsafety-related systems, structures, and components (SSCs) whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it provides physical support, shelter and protection for systems, structures and components (SSCs) 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), Anticipated Transients Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63). The Auxiliary Building Service/Radwaste Area is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Environmental Qualification (10 CFR 50.49).

Structure Intended Functions

1. Provides physical support, shelter and protection for safety-related systems, structures, and components. 10 CFR 54.4(a)(1)

2. Provides physical support, shelter, and protection for nonsafety-related systems, structures, and components (SSCs) whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4 (a)(1). 10 CFR 54.4(a)(2)

3. Prevents liquid radioactive waste from being released to the environment in the event of a Safe Shutdown Earthquake (SSE). 10 CFR 54.4(a)(2)

4. Provides 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). 10 CFR 54.4(a)(3)

5. Provides 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 Anticipated Transients without Scram (10 CFR 50.62). 10 CFR 54.4(a)(3)

6. Provides 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). 10 CFR 54.4(a)(3)

UFSAR References

1.2.3
Table 3.2-1
3.4
3.6
3.8
7.4
11.2
11.3

License Renewal Boundary Drawings

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Table 2.4-3 **Auxiliary Building Service/Radwaste Area**
Components Subject to Aging Management Review

Component Type	Intended Function
Blowout Panel	Missile Barrier
Blowout Panel	Pressure Relief
Blowout Panel	Shelter, Protection
Bolting (Structural)	Structural Support
Cable Trays	Structural Support
Compressible Joints and Seals (Seismic Gaps)	Expansion / Separation
Concrete Anchors	Structural Support
Concrete Curbs	Direct Flow
Concrete Embedments	Structural Support
Concrete: Above-grade exterior	Flood Barrier
Concrete: Above-grade exterior	Missile Barrier
Concrete: Above-grade exterior	Shelter, Protection
Concrete: Above-grade exterior	Shielding
Concrete: Above-grade exterior	Structural Support
Concrete: Above-grade exterior	Water retaining boundary
Concrete: Below-grade exterior	Flood Barrier
Concrete: Below-grade exterior	Missile Barrier
Concrete: Below-grade exterior	Shelter, Protection
Concrete: Below-grade exterior	Structural Support
Concrete: Below-grade exterior	Water retaining boundary
Concrete: Foundation	Flood Barrier
Concrete: Foundation	Shelter, Protection
Concrete: Foundation	Structural Support
Concrete: Foundation	Water retaining boundary
Concrete: Interior	Flood Barrier
Concrete: Interior	HELB/MELB Shielding
Concrete: Interior	Missile Barrier
Concrete: Interior	Shelter, Protection
Concrete: Interior	Shielding
Concrete: Interior	Structural Support
Concrete: Interior	Water retaining boundary
Conduit	Shelter, Protection
Conduit	Structural Support
Doors	Flood Barrier
Doors	HELB/MELB Shielding

Component Type	Intended Function
Doors	Missile Barrier
Doors	Shelter, Protection
Doors	Water retaining boundary
Equipment foundations	Structural Support
Hatches/Plugs	HELB/MELB Shielding
Hatches/Plugs	Missile Barrier
Hatches/Plugs	Shelter, Protection
Hatches/Plugs	Shielding
Hatches/Plugs	Structural Support
Metal components: Steel curb	Direct Flow
Metal decking	Structural Support
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Shelter, Protection
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection
Panels, Racks, Cabinets, and Other Enclosures	Structural Support
Penetration seals	Flood Barrier
Penetration seals	HELB/MELB Shielding
Penetration seals	Shelter, Protection
Penetration sleeves	Flood Barrier
Penetration sleeves	HELB/MELB Shielding
Penetration sleeves	Structural Support
Roofing membrane	Shelter, Protection
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Flood Barrier
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection
Spray Shields	Shelter, Protection
Steel Components: All structural steel	Missile Barrier
Steel Components: All structural steel	Structural Support
Tube Track	Structural Support

The aging management review results for these components are provided in:

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area
Summary of Aging Management Evaluation

2.4.4 Component Supports Commodity Group

Structure Purpose

The Component Supports Commodity Group consists of structural elements and specialty components designed to transfer the load applied from a system, structure, or component (SSC) to the building structural element or directly to the building foundation. Supports include seismic anchors or restraints, support frames, constant and variable spring hangers, rod hangers, sway struts, guides, stops, design clearances, straps, and clamps. Specialty components include snubbers, sliding surfaces, and vibration isolators. The commodity group is comprised of the following supports:

- Supports for ASME Class 1, 2 and 3 piping and components, including reactor vessel to biological shield wall stabilizer, reactor vessel skirt support anchorage, reactor vessel support ring girder and anchorage, control rod drive (CRD) housing supports and service water pumps.

- Supports for ASME Class MC components, including suppression chamber seismic restraints, suppression chamber support saddles and columns, and vent system supports.

- Supports for cable trays, conduit, HVAC ducts, tube track, instrument tubing and non-ASME piping and components.

- Supports for racks, panels, cabinets and enclosures for electrical equipment and instrumentation.

- Supports for emergency diesel generator (EDG), HVAC system components, and other miscellaneous mechanical equipment.

- Supports for platforms, pipe whip restraints, jet impingement shields, and other miscellaneous structures.

The purpose of a support is to transfer gravity, thermal, seismic, and other lateral loads imposed on or by the system, structure, or component to the supporting building structural element or foundation. Sliding surfaces when incorporated into the support design permit release of lateral forces but are relied upon to carry vertical load. Specialty supports such as snubbers only resist seismic forces. Vibration isolators are incorporated in the design of some vibrating equipment to minimize the impact of vibration. Other support types such as guides and position stops allow displacement in a specified direction or preclude unacceptable movements and interactions.

The Component Supports Commodity Group includes supports for mechanical, electrical and instrumentation systems, components, and structures that are in the scope of license renewal. The group also includes supports for SSCs, which are not in the scope of license renewal, but their supports are required to restrain or prevent physical interaction with safety-related SSCs (e.g. seismic II/I). The supports include support members, welded and bolted connections, Lubrite plates, vibration isolators, concrete anchors, concrete embedments, and grout.

Included in the boundary of the Component Supports Commodity Group for each of the supports indicated above are building concrete at locations of expansion and grouted anchors, grout pads for support base plates; high strength bolting for component supports; constant and variable load spring hangers, guides, stops; sliding surfaces; support members, welds, bolted connections, support anchorage to building structure; and vibration isolation elements. Snubbers are also included in the boundary of this commodity group however, they are considered active components and are not subject to aging management review except for the end connections, which perform a passive function for structural support. Refer to the "Components Subject to Aging Management Review" table below for a complete list of components included in the boundary of the Component Supports Commodity Group.

Not included in the boundary of the Component Supports Commodity Group are equipment foundations, concrete embedments, and concrete anchors used for components other than supports listed herein. These commodities are evaluated separately with the license renewal structure that contains them.

For more detailed information, see UFSAR Sections 1.2.4.2.4, 3.6.2 and 6.6.

Reason for Scope Determination

The Component Supports Commodity Group meets 10 CFR 54.4(a)(1) because it has safety-related supports that are relied upon to remain functional during and following design basis events. The Component Supports Commodity Group meets 10 CFR 54.4(a)(2) because failure of nonsafety-related supports could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It meets 10 CFR 54.4(a)(3) because it provides physical support for systems, structures and components (SSCs) relied upon in the safety analyses and 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), Anticipated Transients Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63).

Structure Intended Functions

1. Provides structural support or restraint to SSCs in the scope of license renewal. 10 CFR 54.4 (a)(1), (a)(2), (a)(3)

2. Provides structural support or restraint to SSCs not in the scope of license renewal to prevent interaction with safety-related SSCs. 10 CFR 54.4 (a)(2)

UFSAR References

1.2.4.2.4
1.8.1
3.6.2
3.6.2.6
3.8.3.1
5.3.3.1.4
6.6

License Renewal Boundary Drawings

Not Required

Table 2.4-4 Component Supports Commodity Group
Components Subject to Aging Management Review

Component Type	Intended Function
Supports for ASME Class 1 Piping and Components (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support
Supports for ASME Class 1 Piping and Components (Constant and variable load spring hangers; guides; stops)	Structural Support
Supports for ASME Class 1 Piping and Components (High strength bolting for NSSS component supports)	Structural Support
Supports for ASME Class 1 Piping and Components (Sliding surfaces)	Structural Support
Supports for ASME Class 1 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support
Supports for ASME Class 2 and 3 Piping and Components (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support
Supports for ASME Class 2 and 3 Piping and Components (Constant and variable load spring hangers; guides; stops)	Structural Support
Supports for ASME Class 2 and 3 Piping and Components (Sliding surfaces)	Structural Support
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support
Supports for ASME Class MC Components (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support
Supports for ASME Class MC Components (Constant and variable load spring hangers; guides; stops)	Structural Support
Supports for ASME Class MC Components (Sliding surfaces)	Structural Support

Component Type	Intended Function
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Vibration isolation elements)	Structural Support
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Vibration isolation elements)	Vibration Isolation
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support

Component Type	Intended Function
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support

The aging management review results for these components are provided in:

Table 3.5.2-4 Component Supports Commodity Group Summary of Aging Management Evaluation

2.4.5 Fire Water Pump House

Structure Purpose

The Fire Water Pump House is a single story above grade concrete structure, approximately 22 feet by 63 feet in plan. The building is located north of the Reactor Building in the yard, separated from safety-related systems, structures, and components (SSCs) such that its failure would not impact a safety-related function. The exterior walls are constructed of concrete masonry block with reinforcement steel. The interior of the building has been partitioned with concrete masonry block walls that provide a fire barrier intended function and provide separate areas for the different types of pumps housed by the structure. The building houses the diesel driven fire pump, motor driven fire pump and jockey pump that support the plant fire protection system. The fuel supply for the diesel driven fire pump is located outside the building on a concrete pad, located on the west side of the building. The building also houses pumps that were used during plant construction and have been abandoned in place. The building foundation consists of a reinforced concrete slab on piles. The roof is constructed of metal decking on structural steel framing, supported on pilasters integral with the exterior walls, which is protected with a roofing membrane.

The purpose of the Fire Water Pump House is to provide structural support, shelter and protection for components required for fire protection, as required by 10 CFR 50.48. Major components housed in the building include the diesel driven fire pump, motor driven fire pump and jockey pump, associated piping and piping components, controls and instrumentation, and electrical panels and enclosures.

Included in the boundary of the Fire Water Pump House are concrete anchors and blocks, a reinforced concrete foundation slab, structural steel, piles, bolting, doors, conduit, panels and racks, penetration seals, penetration sleeves, and roofing membrane. Structures and components that do not perform or support an intended function, such as abandoned equipment foundations and controls, are not included in the scope of license renewal. Refer to the "Components Subject to Aging Management Review" table below for a complete list of components included in the boundary of the Fire Water Pump House.

Not included in the boundary of the Fire Water Pump House are component supports and fire barriers, as well as the adjacent water storage tank foundations. Component Supports are identified and separately evaluated in the Component Supports Commodity Group section. Fire barriers are identified and evaluated with the Fire Protection System. The adjacent water storage tank foundations are separately evaluated with Yard Structures.

For more detailed information, see UFSAR Section 9.5.1.2.3.2.

Reason for Scope Determination

The Fire Water Pump House is not in scope under 10 CFR 54.4(a)(1) because no portion of the structure is safety-related or relied upon to remain functional during and following design basis events. The Fire Water Pump House is not in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the structure would not prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It meets 10 CFR 54.4(a)(3) because it provides physical support, shelter and protection for systems, structures and components (SSCs) 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). The structure is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

Structure Intended Functions

1. Provides 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). 10 CFR 54.4(a)(3)

UFSAR References

9.5.1.2.3.2

License Renewal Boundary Drawings

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Table 2.4-5 Fire Water Pump House
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting (Structural)	Structural Support
Concrete Anchors	Structural Support
Concrete: Foundation	Shelter, Protection
Concrete: Foundation	Structural Support
Conduit	Shelter, Protection
Conduit	Structural Support
Doors	Shelter, Protection
Equipment foundations	Structural Support
Masonry walls: Above-grade exterior	Shelter, Protection
Masonry walls: Above-grade exterior	Structural Support
Masonry walls: Interior	Shelter, Protection
Masonry walls: Interior	Structural Support
Metal decking	Shelter, Protection
Metal decking	Structural Support
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Shelter, Protection
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection
Panels, Racks, Cabinets, and Other Enclosures	Structural Support
Penetration seals	Shelter, Protection
Penetration sleeves	Structural Support
Piles	Structural Support
Roofing membrane	Shelter, Protection
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection
Steel components: All structural steel	Structural Support
Tube Track	Structural Support

The aging management review results for these components are provided in:

Table 3.5.2-5 Fire Water Pump House
Summary of Aging Management Evaluation

2.4.6 Piping and Component Insulation Commodity Group

Structure Purpose

The Piping and Component Insulation Commodity Group is comprised of pre-fabricated blankets, modules, or panels engineered as integrated assemblies to fit the surface to be insulated and to fit easily against the piping and components. The insulation group includes metallic and nonmetallic materials.

Metallic insulation or reflective mirror insulation is fabricated from stainless steel material. Nonmetallic insulation consists of calcium silicate, fiberglass and fiberglass molded insulation, cellular glass, ceramic fiber, Nukon insulation, and "Min-K" insulation. Anti-sweat insulation used on chilled water systems consists of fiberglass insulation material jacketed with stainless steel or aluminum jacketing. The fiberglass and calcium silicate insulation is covered with stainless steel or aluminum protective jackets held in-place by stainless steel tie wire, straps or clips. In some cases, stainless steel wire mesh is used to cover the insulation instead of the protective jacket. The Piping and Component Insulation Commodity Group is not classified as a safety-related commodity.

The purpose of piping and component insulation is to improve thermal efficiency, minimize heat loads on the HVAC systems, provide for personnel protection, or prevent freezing of heat traced piping, and protect against sweating of cold piping and components. Insulation located in areas with safety-related equipment is designed to protect nearby safety-related SSC equipment from overheating and maintain its structural integrity during postulated design basis seismic events. Insulation within Primary Containment has been evaluated to ensure that it will not affect the Emergency Core Cooling Systems (ECCS) suction strainers.

Included in the boundary of the Piping and Component Insulation Commodity Group is insulation for all piping and components. Piping and component insulation inside safety-related structures, and in scope piping and components located in the outdoor environment are in the scope of license renewal. The insulation, insulation jacking (includes wire mesh, tie wires, straps, clips) perform an intended function and are in the scope of license renewal under 10 CFR 54.4(a)(2). Insulation for the not in scope piping and components located in nonsafety-related structures is not in the scope of license renewal. Refer to the "Components Subject to Aging Management Review" table below for a complete list of components included in the boundary of the Piping and Component Insulation Commodity Group.

For more detailed information, see UFSAR Sections 5.3.3.1.4.4, 5.4.1.3, and 6.2.2.2.2.

Reason for Scope Determination

The Piping and Component Insulation Commodity Group is not in scope under 10 CFR 54.4(a)(1) because no portions of the insulation are safety-related or relied on to remain functional during and following design basis events. The Piping and Component Insulation Commodity Group is in scope under 10 CFR 54.4(a)(2) because failure of the nonsafety-related commodity could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The insulation group is not in scope under 10 CFR 54.4(a)(3) because it is not 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), Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62), or Station Blackout (10 CFR 50.63).

Structure Intended Functions

1. Provides physical support, shelter, and protection for nonsafety-related systems, structures, and components (SSCs) whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). 10 CFR 54.4(a)(2)

UFSAR References

1.12.3.6
5.2.3.2.4
5.3.3.1.4.4
5.4.1.3
6.1
6.2.2.2.2
6.2.4.3.2.1
9.5.1.1.7
10.3.6

License Renewal Boundary Drawings

Not Required

Table 2.4-6 **Piping and Component Insulation Commodity Group**
Components Subject to Aging Management Review

Component Type	Intended Function
Insulation	Thermal Insulation
Insulation jacketing (includes wire mesh, tie wires, straps, clips)	Shelter, Protection
Insulation jacketing (includes wire mesh, tie wires, straps, clips)	Structural Support

The aging management review results for these components are provided in:

Table 3.5.2-6 Piping and Component Insulation Commodity Group
Summary of Aging Management Evaluation

2.4.7 Primary Containment

Structure Purpose

The Primary Containment is comprised of the primary containment structure, primary containment penetrations, and internal structures of the primary containment structure. The Primary Containment is completely enclosed by the Reactor Building. The Reactor Building provides the secondary containment pressure boundary, structural support, shielding, shelter and protection for Primary Containment and the components housed within, against external design basis events.

The Primary Containment is a General Electric Mark I design and consists of a drywell, a pressure suppression chamber, and a vent system connecting the drywell and the pressure suppression chamber. It is designed, fabricated, inspected, and tested in accordance with the requirements of Subsection NE, Requirements for MC Components, of the ASME Boiler and Pressure Vessel Code, Section III. The Primary Containment is safety-related and classified as a seismic Category I structure.

The drywell is a steel pressure vessel, in the shape of an inverted light bulb, with a spherical lower section, a cylindrical upper section, and a removable, flanged, hemi-ellipsoidal top head. Inner and outer steel cylindrical skirts, that are encased in concrete and anchored to a concrete pedestal, support the drywell. The concrete pedestal that supports the drywell is founded on the foundation slab of the Reactor Building. The outer skirt is designed to transfer the drywell loads at the bottom of the drywell into the foundation. The inner skirt extends into the drywell and transfers reactor pressure vessel (RPV) pedestal loads into the foundation. Above the foundation transition zone of the drywell shell and concrete is an air gap of nominally 2 inches that separates the drywell vessel from the concrete drywell shield wall. The air gap permits displacement of the vessel but the size of the gap is limited to allow transfer of postulated jet impingement forces into the drywell shield wall without rupturing the vessel. At the foundation transition zone of the drywell shell and concrete are four drains equally spaced around the perimeter of the drywell shell that will drain potential water intrusion from the air gap. There is no sand bed region or sand in the foundation transition zone of the drywell shell and concrete and the air gap. The outside surface of the drywell shell is coated with inorganic zinc. The drywell head is bolted to the drywell flange and is sealed with a double seal arrangement.

Access into the drywell is through a personnel airlock/equipment hatch, with two mechanically interlocked doors, and the other equipment access hatch. The drywell houses the reactor pressure vessel, the reactor coolant recirculation system, safety relief valves, branch connections of the reactor primary system, a drywell spray header, and internal structures discussed below.

The pressure suppression chamber is a toroidal shaped, steel pressure vessel encircling the base of drywell. The pressure suppression chamber, commonly called the torus, is partially filled with demineralized water and includes internal steel framing, and access hatches. The pressure suppression chamber is mounted on support structures that transmit loads to the Reactor Building foundation. Major components inside the pressure suppression chamber include Emergency Core Cooling Systems (ECCS) suction strainers, pressure suppression chamber (torus) spray header, vent line header and downcomers, and T-quenchers.

The vent system consists of eight circular vent lines, which form a connection between the drywell and the pressure suppression chamber. The lines enter the pressure suppression chamber through penetrations provided with expansion bellows (inboard and outboard) and join into a common header contained within the air space of the pressure suppression chamber. The header discharge is through downcomer pipes, which terminate below the water level in the pressure suppression chamber. The header and the downcomer pipes are supported from the pressure suppression chamber shell.

The Primary Containment is provided with a vacuum breaker system to equalize the pressure between the drywell and the pressure suppression chamber, and between the pressure suppression chamber and the Reactor Building. The vacuum breaker system assures that the design pressure limits are not exceeded for the two steel pressure vessels, the drywell and pressure suppression chamber.

The Primary Containment is penetrated at multiple locations by piping, instrument lines, and electrical raceways. The penetrations consist of sleeves welded to the drywell shell or pressure suppression chamber. Two general types of process pipe penetrations are provided: those that must accommodate thermal movement and those that experience insignificant thermal stress. Penetrations required to accommodate thermal movements are provided with expansion bellows.

Internal structures consist of a fill slab, reactor pedestal, biological shield wall and its lateral support structural steel, and miscellaneous steel.

The fill slab is reinforced concrete placed to an elevation approximately 9 feet from the bottom of the drywell to provide a working base for supporting the reactor pedestal, and other structures and components inside the drywell.

The reactor pedestal is a reinforced concrete cylinder with an outside diameter of approximately 30 feet. The inside surface of the cylindrical pedestal is lined with carbon steel plate. The reactor pedestal provides structural support to the reactor pressure vessel, the biological shield wall, and floor framing. The biological shield wall extends above the reactor pedestal and is a composite steel plate and concrete cylindrical shell with an inside diameter of approximately 26 feet. The wall is filled partly with normal density concrete and partly with high-density concrete or grout. The top of the wall is capped with a steel plate and laterally braced to the drywell vessel.

Structural steel includes the floor framing steel for the various platforms inside the drywell, the RPV head insulation support frame, and a catwalk inside the pressure suppression chamber. Miscellaneous steel includes steel components such as grating, ladders, and handrails, inside primary containment.

The purpose of the Primary Containment is to accommodate, with a minimum of leakage, the pressures and temperatures resulting from the break of any enclosed process pipe, and thereby, to limit the release of radioactive fission products to values which will ensure offsite dose rates well below 10 CFR 50.67 guideline limits. It also provides a source of water for ECCS and for pressure suppression in the event of a loss-of-coolant accident. The Primary Containment and internal structures also provide structural support to the reactor pressure vessel, the reactor coolant systems, and other safety and nonsafety-related systems, structures, and components housed within the Primary Containment. The biological shield wall provides the added function of radiation shielding to maintain drywell environment within equipment qualification parameters.

Included in the boundary of the Primary Containment are the drywell, drywell head, pressure suppression chamber, vent lines, downcomers, drywell and pressure suppression chamber penetrations, vent line bellows, drywell penetration bellows, personnel air lock/equipment and other hatches, pressure retaining bolting, thermowells, and internal structures mentioned above. Refer to the "Components Subject to Aging Management Review" table below for a complete list of components included in the boundary of the Primary Containment.

Not included in the boundary of the Primary Containment are safety relief valves and discharge lines, T-quenchers, pressure suppression chamber (torus) supports, drywell and torus spray headers, vacuum breakers, ECCS suction strainers, downcomer bracing, other component supports, fire barriers, and piping and component insulation. These components are separately evaluated with their respective license renewal systems. That is, safety relief valves and discharge lines, and T-quenchers are evaluated with the Main Steam System. Drywell and torus spray headers are evaluated with the Residual Heat Removal System and ECCS suction strainers are evaluated with the Reactor Core Isolation Cooling System, Core Spray System and Residual Heat Removal System. Vacuum breakers are evaluated with the Vacuum Relief Valve System. Fire barriers are evaluated with the Fire Protection System. Piping and component insulation is evaluated with the Piping and Component Insulation Commodity Group. Downcomer bracing, pressure suppression chamber supports, and other component supports are evaluated with the Component Supports Commodity Group.

For more detailed information, see UFSAR Sections 3.8 and 6.2.

Reason for Scope Determination

The Primary Containment meets 10 CFR 54.4(a)(1) because it is a safety-related structure that is relied upon to remain functional during and following design basis events. The Primary Containment meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the structure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it provides physical support, shelter and protection for systems, structures and components (SSCs) 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), Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63).

Structure Intended Functions

1. Provides physical support, shelter, and protection for safety-related systems, structures, and components (SSCs). 10 CFR 54.4(a)(1)

2. Controls the potential release of fission products to the external environment so that offsite consequences of design basis events are within acceptable limits. 10 CFR 54.4(a)(1)

3. Provides sufficient air and water volumes to absorb the energy released to the containment in the event of design basis events so that the pressure is within acceptable limits. 10 CFR 54.4(a)(1)

4. Provides a source of water for emergency core cooling systems. 10 CFR 54.4(a)(1)

5. Provides physical support, shelter, and protection for nonsafety-related systems, structures, and components (SSCs) whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4 (a)(1). 10 CFR 54.4(a)(2)

6. Provides 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). 10 CFR 54.4(a)(3)

7. Provides 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 Environmental Qualification (10 CFR 50.49). 10 CFR 54.4(a)(3)

8. Provides 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 Anticipated Transients Without Scram (10 CFR 50.62). 10 CFR 54.4(a)(3)

9. Provides 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). 10 CFR 54.4(a)(3)

<u>UFSAR References</u>

1.1
1.2.4.2.9.1
3.5.1.2
3.8.2
3.8.3
6.2.1
6.2.2
6.2.3
6.5.2
6.5.3

<u>License Renewal Boundary Drawings</u>

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Table 2.4-7 Primary Containment
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting (Containment Closure)	Pressure Boundary
Bolting (Containment Closure)	Structural Support
Bolting (Structural)	Structural Support
Cable Trays	Structural Support
Coatings	Maintain Adhesion
Concrete anchors	Structural Support
Concrete embedments	Structural Support
Concrete: Interior	Structural Support
Concrete: Interior (Biological shield)	Shielding
Concrete: Interior (Biological shield)	Structural Support
Concrete: Interior (RPV Pedestal)	Structural Support
Conduit	Shelter, Protection
Conduit	Structural Support
Doors	Shielding
Hatches/Plugs	Pressure Boundary
Hatches/Plugs	Shelter, Protection
Miscellaneous steel (catwalks, stairs, handrails, ladders, platforms, etc.)	Structural Support
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection
Panels, Racks, Cabinets, and Other Enclosures	Structural Support
Penetration bellows	Expansion / Separation
Penetration bellows	Pressure Boundary
Penetration seals (End Caps)	Pressure Boundary
Penetration sleeves	Pressure Boundary
Penetration sleeves	Shelter, Protection
Penetration sleeves	Structural Support
Personnel airlock, equipment hatch, CRD hatch	Pressure Boundary
Personnel airlock, equipment hatch, CRD hatch	Shelter, Protection
Personnel airlock, equipment hatch, CRD hatch: Locks, hinges, and closure mechanisms	Pressure Boundary

Component Type	Intended Function
Personnel airlock, equipment hatch, CRD hatch: Locks, hinges, and closure mechanisms	Structural Support
Pipe Whip Restraints and Jet Impingement Shields	HELB/MELB Shielding
Pipe Whip Restraints and Jet Impingement Shields	Pipe Whip Restraint
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Pressure Boundary
Steel Components: All structural steel	Structural Support
Steel Components: Biological shield lateral truss	Structural Support
Steel Components: Biological shield liner plates	Shielding
Steel Components: Biological shield liner plates	Structural Support
Steel Components: Radial beam seats in BWR Drywell	Structural Support
Steel Components: Sump Liners	Structural Support
Steel Components: Sump Liners	Water retaining boundary
Steel Elements: Drywell head; Downcomers	Pressure Boundary
Steel Elements: Drywell; Torus; Drywell Head; Embedded shell; Drywell support skirt; Torus ring girder; Downcomers	Pressure Boundary
Steel Elements: Drywell; Torus; Drywell Head; Embedded shell; Drywell support skirt; Torus ring girder; Downcomers	Structural Support
Steel Elements: Torus; Vent line; Vent header; Vent line bellows; Downcomers	Expansion / Separation
Steel Elements: Torus; Vent line; Vent header; Vent line bellows; Downcomers	Pressure Boundary
Thermowell	Pressure Boundary
Tube Track	Structural Support

The aging management review results for these components are provided in:

Table 3.5.2-7 Primary Containment
Summary of Aging Management Evaluation

2.4.8 Reactor Building

Structure Purpose

The Reactor Building is comprised of the unit 1 reactor building (herein referred to as reactor building) and the plant cancelled area, formerly the unit 2 reactor building.

Reactor building:

The reactor building is a reinforced concrete enclosure that consists of a cylindrical containment structure topped by a toroid spherical dome, with a rectangular lower section enclosing the base of the cylinder. The cylindrical portion completely encloses both the reactor and the pressure suppression primary containment system. The reactor building also houses the spent fuel storage pool, the steam dryer/moisture separator storage pool, the new fuel storage vault, reactor cavity, spent fuel storage pool skimmer surge tanks, reactor auxiliary equipment, refueling equipment, reactor vessel servicing equipment and engineered safety features (ESFs). The reactor building is a seismic Category I reinforced concrete structure designed to maintain its structural integrity during and following postulated design basis accidents and extreme environmental conditions.

The building has essentially seven floor levels, with the refueling floor and operating floor on the top floor, and the pressure suppression chamber (torus) and Emergency Core Cooling System (ECCS) pump rooms in the basement. The rectangular reinforced concrete foundation mat is 14 feet thick with the bottom of the mat approximately 61 feet below plant grade and founded on engineered structural backfill that bears on the dense Vincentown Formation. The mat also supports the southern portion of Auxiliary Building Service/Radwaste Area. The foundation is structurally independent of the other foundations, separated by a seismic joint. Above the base mat, the reactor building is approximately 250 feet high, consisting of a cylinder with a toroid spherical dome that has a steel liner plate on the underside, surrounded by a rectangular structure approximately 78 feet high. The cylinder section is a reinforced concrete shell 2.5 to 3.0 feet thick, with an inside diameter of 165 feet. The reinforced concrete floors are generally supported by structural steel framing systems that are in turn supported by reinforced concrete walls. Radial framing is used within the cylindrical portion, while framing in the rectangular area is laid out on east-west and north-south lines. The cylindrical wall above the refuel floor supports a 150-ton capacity, polar crane. All reinforced concrete walls and floors are designed to meet both structural and radiation shielding requirements. There are no concrete masonry unit walls used in the reactor building.

The purpose of the Reactor Building is to provide secondary containment when the primary containment is in service and to provide primary containment during reactor refueling and maintenance operations when the primary containment system is open. The primary objective of the building is to minimize ground level release of airborne radioactive fission products to values which will ensure offsite dose rates well below 10 CFR 50.67 guideline limits, and to provide for controlled, elevated release through the ventilation stack of the building's atmosphere under accident conditions. The Reactor Building also provides structural support, shelter, and protection to systems, structures, and components housed within, during normal plant operation, and during and following postulated design basis accidents and extreme environmental conditions.

During normal plant operation, the reactor building pressure is maintained at a negative pressure by the Reactor Building Ventilation System (RBVS), which also maintains airflow from areas of lesser contamination, to areas of greater potential contamination. Following a LOCA, the RBVS is automatically shut down, and the Filtration, Recirculation, and Ventilation System (FRVS) is actuated. The FRVS ventilation system discharges the air through filters to the outdoors via a vent at the top of the reactor building. The FRVS is designed to maintain a negative building differential pressure to reduce ground leakage of fission products from the reactor building subsequent to these design basis accidents.

The secondary containment function of the Reactor Building is achieved through design and construction of low leakage of air through the access control doors, pipe and electrical penetration seals and the building walls. Personnel access openings to the building are provided with interlocked double door, air lock system to minimize reactor building leakage. The door design has been considered within the capability of the RBVS and FRVS to maintain reactor building leakage within the required limits. Passage through any of the double door entrances to the reactor building can occur without loss of secondary containment integrity.

Safety-related systems and components are protected against the effects of pipe whip, which might result from piping failures of high energy lines. This protection is provided by either spatial separation (compartmentation) or pipe whip restraints. Each of the ECCS pumps and its associated components are located in individual compartments within the reactor building to provide physical separation. Protection against overpressurization of the various essential equipment compartments in the reactor building as a result of line breaks in these areas is provided by interconnecting steam venting paths between the various compartments and by blowout panels leading to the outside atmosphere.

Plant cancelled area:

The plant cancelled area is a three story reinforced concrete and structural steel enclosure that is rectangular in shape and is located in the northwest quadrant of the power complex, adjacent to the Auxiliary Building Control/Diesel Generator Area. The rectangular reinforced concrete foundation mat is 14 feet thick with the bottom of the mat approximately 61 feet below plant grade and founded on engineered structural backfill that bears on the dense Vincentown Formation. The mat also supports the northern portion of Auxiliary Building Service/Radwaste Area. The foundation is structurally independent of the other foundations, separated by a seismic joint. Above the base mat, the plant cancelled area is approximately 78 feet high consisting of a cylinder area surrounded by a rectangular structure. Radial framing is used within the cylindrical portion, while framing in the rectangular area is laid out on east-west and north-south lines. The central portion of the roof consists of cellular metal decking and built-up roofing material and the remaining roof is reinforced concrete. The building does not house any safety-related equipment.

The plant cancelled area is classified as a seismic Category I structure. However, since the plant cancelled area does not house any safety-related systems or components, the structure does not perform a 10 CFR 54.4(a)(1) intended function. The structure is required to maintain its structural integrity to prevent a failure which could impact a safety-related function of the adjacent safety-related systems, structures, and components. The plant cancelled area is thus in the scope of license renewal for 10 CFR 54.4 (a)(2) only.

Included in the boundary of the Reactor Building are blow out panels, bolting, cable trays, compressible joints and seals, concrete elements of the building, concrete anchors and embedments, conduit, doors, equipment foundations, hatches and plugs, inflatable seals, metal panels, miscellaneous steel, panels, racks, and other enclosures, penetration bellows, penetration seals, penetration sleeves, pipe whip restraints, roofing membrane, refueling bellows, seals and gaskets, spray shields, steel components, and tube track. Also included in the boundary of the Reactor Building is the spent fuel storage pool liner, cask loading pit liner, reactor cavity liner, steam dryer/moisture separator storage pool liner, and spent fuel storage pool skimmer surge tank liner. The components in the boundary of the building are in the scope of license renewal and subject to aging management review. Refer to the "Components Subject to Aging Management Review" table below for a complete list of components included in the boundary of the Reactor Building.

Not included in the boundary of the Reactor Building is the reactor building ventilation system components, the filtration, recirculation, and ventilation system components, other mechanical and electrical systems and components housed within the building, fire barriers, the refueling platform, new fuel storage racks and spent fuel storage racks, miscellaneous cranes, including reactor building polar crane and hoists, building elevators, component supports, and piping and component insulation. These components are separately evaluated with their respective license renewal systems. That is, the reactor building ventilation system components are evaluated with the Reactor Building Ventilation System, the filtration, recirculation, and ventilation system components with the Filtration, Recirculation, and Ventilation System and other mechanical and electrical systems and components housed inside the structure are separately evaluated with their respective mechanical systems, electrical systems, or commodities. Fire barriers are evaluated with the Fire Protection System and the refueling platform, new fuel storage racks, and spent fuel storage racks are evaluated with the Fuel Handling and Storage System. The miscellaneous cranes and hoists are evaluated with the Cranes and Hoists System, and the building elevators are evaluated with Elevators and Manlifts, and component supports are evaluated with the Component Supports Commodity Group. Piping and component insulation is evaluated with the Piping and Component Insulation Commodity Group.

For more detailed information, see UFSAR Sections 1.2.2.1, 3.8.4.1.1, 3.8.5.1, and 6.2.3.2.1.

Reason for Scope Determination

The Reactor Building meets 10 CFR 54.4(a)(1) because it is a safety-related structure that is relied upon to remain functional during and following design basis events. The Reactor Building meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the structure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it provides physical support, shelter and protection for systems, structures and components (SSCs) 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), Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63).

Structure Intended Functions

1. Provides physical support, shelter, and protection for safety-related systems, structures, and components (SSCs). 10 CFR 54.4(a)(1)

2. Controls the potential release of fission products to the external environment so that offsite consequences of design basis events are within acceptable limits. 10 CFR 54.4(a)(1)

3. Provides for the discharge of treated gaseous waste to meet the requirements of 10 CFR 50.67. 10 CFR 54.4(a)(1)

4. Provides protection for safe storage of new and spent fuel. 10 CFR 54.4 (a)(1)

5. Provides physical support, shelter, and protection for nonsafety-related systems, structures, and components (SSCs) whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4 (a)(1). 10 CFR 54.4(a)(2)

6. Provides 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). 10 CFR 54.4(a)(3)

7. Provides 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 Environmental Qualification (10 CFR 50.49). 10 CFR 54.4(a)(3)

8. Provides 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 Anticipated Transients Without Scram (10 CFR 50.62). 10 CFR 54.4(a)(3)

9. Provides 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). 10 CFR 54.4(a)(3)

UFSAR References

1.1
1.2.2.1
1.2.3
1.2.4.2.9.1
2.5.4.10.1
3.4.1
3.5.2
3.6.1
3.8.4.1.1
3.8.5.1
6.2.3.2.1
Table 6.2-14
Table 6.2-14a
Table 6.2-26
6.3.1.1.3
6.5.3.2
6.8
10.3
12.2.1

License Renewal Boundary Drawings

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Table 2.4-8 **Reactor Building**
Components Subject to Aging Management Review

Component Type	Intended Function
Blowout Panel	Pressure Relief
Blowout Panel	Shelter, Protection
Bolting (Structural)	Structural Support
Cable Trays	Structural Support
Compressible Joints and Seals (Inflatable Pool Seals)	Water retaining boundary
Compressible Joints and Seals (Seismic Gaps)	Expansion / Separation
Concrete Anchors	Structural Support
Concrete Curbs	Direct Flow
Concrete Embedments	Structural Support
Concrete: Above-grade exterior	Flood Barrier
Concrete: Above-grade exterior	Missile Barrier
Concrete: Above-grade exterior	Shelter, Protection
Concrete: Above-grade exterior	Shielding
Concrete: Above-grade exterior	Structural Pressure Boundary
Concrete: Above-grade exterior	Structural Support
Concrete: Below-grade exterior	Flood Barrier
Concrete: Below-grade exterior	Missile Barrier
Concrete: Below-grade exterior	Shelter, Protection
Concrete: Below-grade exterior	Structural Pressure Boundary
Concrete: Below-grade exterior	Structural Support
Concrete: Foundation	Flood Barrier
Concrete: Foundation	Shelter, Protection
Concrete: Foundation	Structural Pressure Boundary
Concrete: Foundation	Structural Support
Concrete: Interior	Flood Barrier
Concrete: Interior	HELB/MELB Shielding
Concrete: Interior	Missile Barrier
Concrete: Interior	Shelter, Protection
Concrete: Interior	Shielding
Concrete: Interior	Structural Pressure Boundary
Concrete: Interior	Structural Support
Conduit	Shelter, Protection
Conduit	Structural Support

Component Type	Intended Function
Doors	Flood Barrier
Doors	HELB/MELB Shielding
Doors	Missile Barrier
Doors	Shelter, Protection
Doors	Structural Pressure Boundary
Equipment foundations	Structural Support
Hatches/Plugs	HELB/MELB Shielding
Hatches/Plugs	Missile Barrier
Hatches/Plugs	Shelter, Protection
Hatches/Plugs	Shielding
Hatches/Plugs	Structural Support
Metal decking	Structural Support
Metal panels	HELB/MELB Shielding
Metal panels	Shelter, Protection
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection
Panels, Racks, Cabinets, and Other Enclosures	Structural Support
Penetration bellows (HELB/MELB Shielding)	Flood Barrier
Penetration bellows (HELB/MELB Shielding)	HELB/MELB Shielding
Penetration bellows (HELB/MELB Shielding)	Shelter, Protection
Penetration bellows (HELB/MELB Shielding)	Structural Pressure Boundary
Penetration seals	Flood Barrier
Penetration seals	HELB/MELB Shielding
Penetration seals	Shelter, Protection
Penetration seals	Structural Pressure Boundary
Penetration sleeves	Flood Barrier
Penetration sleeves	HELB/MELB Shielding
Penetration sleeves	Structural Pressure Boundary
Penetration sleeves	Structural Support
Pipe Whip Restraints and Jet Impingement Shields	HELB/MELB Shielding

Component Type	Intended Function
Pipe Whip Restraints and Jet Impingement Shields	Pipe Whip Restraint
Roofing membrane	Shelter, Protection
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Flood Barrier
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	HELB/MELB Shielding
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection
Spent fuel pool gates	Water retaining boundary
Spray Shields	Shelter, Protection
Steel Components: All structural steel	Missile Barrier
Steel Components: All structural steel	Structural Support
Steel Components: Fuel pool liners	Water retaining boundary
Steel Components: Reactor Building dome liner	Structural Pressure Boundary
Steel Components: Reactor Building dome liner	Structural Support
Steel Components: Reactor Well, Dryer and Separator Pool and Cask Loading Pit liners	Water retaining boundary
Steel Components: Refueling bellows (RPV to Drywell and Drywell to Reactor Well)	Water retaining boundary
Steel Components: Skimmer Surge Tank liner	Water retaining boundary
Steel Components: Skimmer Surge Tank screen	Filter
Steel Components: Sump Liners	Structural Support
Steel Components: Sump Liners	Water retaining boundary
Tube Track	Structural Support

The aging management review results for these components are provided in:

Table 3.5.2-8 Reactor Building
Summary of Aging Management Evaluation

2.4.9 Service Water Intake Structures

Structure Purpose

The Service Water Intake Structures include the service water intake structure, service water chemical control building, hypochlorite storage tank dike and foundation, and service water sampling shed.

Service water intake structure:

The service water intake structure is a reinforced concrete and steel structure located west of the Reactor Building, along the western shoreline of the facility and on the east bank of the Delaware River. The service water intake structure is a multi-story structure; approximately 100 feet by 120 feet in plan area, comprised of reinforced concrete foundation mat, slabs, walls and structural steel. The reinforced concrete foundation mat of the structure is founded on lean concrete bearing on dense Vincentown Formation. The roof for the structure is reinforced concrete. The service water intake structure is designed to protect the enclosed Service Water System, Service Water Intake Ventilation System and related vital components under postulated environmental and design basis accidents, and is classified as a seismic Category I structure.

The service water intake structure is divided into four sections. The western portions of these sections are divided into two chambers or pump bays for the service water pumps. Two of the four sections house the service water pumps utilized to draw water out of the river for plant operation. The other two sections of the structure were intended to be utilized for the second unit of the facility, which was not completed and contain no service water pumps. The service water intake structure has trash racks and traveling water screens located on the western side of the structure that filter debris from the incoming flow. The sectional arrangement of the screens and pumps allows the use of steel bulkheads to permit maintenance of equipment without interruption of service water flow to operable equipment.

Ice barriers are provided for the service water intake structure to prevent ice blockage. The ice barriers are positioned in front of the trash racks and consist of structural steel members and treated wood. Their design incorporates marine dock type bumpers to reduce impact load on the structure in the event that barges or ships drift into the vicinity of the intake structure. The collisions of a barge or ship with the intake structure do not have to be considered as a design basis event, therefore the bumpers do not perform a license renewal intended function.

An outdoor gantry crane services the service water intake structure. The crane is supported from the building reinforced concrete within the building envelope and from structural steel frames outside the building boundary. Foundation for the frames consists of reinforced concrete slab on piles. Removal of equipment and materials from the structure is through reinforced concrete hatches on the roof.

The service water intake structure and the Service Water System supply cooling water drawn from the Delaware River for reactor safeguard and auxiliary equipment under all credible design basis events and accidents. The Delaware River is the ultimate heat sink (UHS), required to provide cooling water for emergency shutdown, as well as during normal plant operation.

The purpose of the service water intake structure is to provide river water to dissipate waste heat from the plant during normal, shutdown and accident conditions. The intake structure also provides structural support for pumps and components, which convey the river water to the plant. In addition, the intake structure provides structural support and access to electrical, mechanical, and structural components required to support the function and operation of the Service Water System, Service Water Intake Ventilation System, including the deicing system, steel bulkheads, trash racks, traveling water screens, access platforms, ladders, and stairs.

Service water chemical control building and hypochlorite storage tank dike and foundation:

The service water chemical control building and hypochlorite storage tank dike and foundation are structures located east of the service water intake structure. The service water chemical control building and hypochlorite storage tank dike and foundation are founded on a common reinforced concrete slab on grade. The water chemical control building is a metal prefabricated commercial grade building, approximately 12 feet by 20 feet in plan and houses the equipment used to inject hypochlorite into the Service Water System. The hypochlorite storage tank dike and foundation is a combination reinforced concrete slab and short perimeter walls that provide structural support for the storage tanks that contain the hypochlorite chemical and functions as a fluid retaining basin in case of storage tank leakage or failure. These structures are classified as nonsafety-related and do not perform an intended function for license renewal. The structures are located west of the Reactor Building in the yard, separated from safety-related systems, structures, and components (SSCs) such that their failure would not impact a safety-related function.

Service water sampling shed:

The service water sampling shed is a small structure located in the yard northwest of the Reactor Building. The shed is a metal prefabricated commercial grade building founded on a reinforced concrete slab on grade and is approximately 7 feet by 7 feet in plan. The structure houses the equipment used to sample chemicals in the Service Water System. The structure is classified as nonsafety-related and does not perform an intended function for license renewal. The structure is located in the yard, separated from safety-related systems, structures, and components such that its failure would not impact a safety-related function.

Included in the boundary of the Service Water Intake Structures are components of the service water intake structure, the service water chemical control building and hypochlorite storage tank dike and foundation, and service water sampling shed. Components evaluated in the boundary of the structures include reinforced concrete slabs, walls, foundation, cable trays, concrete anchors, conduit, doors, dikes, hatches/plugs, structural steel, miscellaneous steel, metal siding, metal decking, panels and enclosures, penetration seals and sleeves, piles, tube track, and trash racks.

Components that make up the service water intake structure are in the scope of license renewal except miscellaneous steel (ladders, stairs) on the outside of the structure, and the pump bay steel bulkheads. The miscellaneous steel and the bulkheads are provided for personnel access and to facilitate maintenance of the pumps. The components are not safety-related and their failure would not impact a safety-related function. Thus, the components do not perform an intended function and are not in the scope of license renewal. Refer to the "Components Subject to Aging Management Review" table below for a complete list of components included in the boundary of the Service Water Intake Structures.

Components that make up the service water chemical control building and hypochlorite storage tank dike and foundation, and service water sampling shed are not in the scope of license renewal. The two structures and components in their boundary do not perform a license renewal intended function.

Not included in the boundary of the Service Water Intake Structures are component supports, cranes and hoists and fire barriers. Component supports are separately evaluated with the Component Supports Commodity Group. The cranes and hoists are separately evaluated with Cranes and Hoists and fire barriers are separately evaluated with the Fire Protection System.

Also not included in the boundary of the Service Water Intake Structures are components of the Service Water System, including the traveling water screens, components of the Service Water Intake Ventilation System, and deicing system components. Components for these systems are separately evaluated with the license renewal Service Water System, Service Water Intake Ventilation System, and Circulating Water System.

For more detailed information, see UFSAR Sections 3.1, 3.2, 3.8, and 9.2.1.

Reason for Scope Determination

The Service Water Intake Structures meet 10 CFR 54.4(a)(1) because it is a safety-related structure that is relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the structure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it provides physical support, shelter and protection for systems, structures and components (SSCs) 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). The Service Water Intake Structures are not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49) and Anticipated Transients Without Scram (10 CFR 50.62).

Structure Intended Functions

1. Provides physical support, shelter and protection for safety-related systems, structures, and components. 10 CFR 54.4(a)(1)

2. Provides a source of cooling water for plant safe shutdown. 10 CFR 54.4(a)(1)

3. Provides Ultimate Heat Sink during design basis events. 10 CFR 54.4(a)(1)

4. Provides physical support, shelter and protection for nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4 (a)(1). 10 CFR 54.4(a)(2)

5. Provides 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). 10 CFR 54.4(a)(3)

6. Provides 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). 10 CFR 54.4(a)(3)

UFSAR References

2.4
2.5
3.1
3.2
3.8
9.2

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Table 2.4-9 **Service Water Intake Structures**
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting (Structural)	Structural Support
Cable Trays	Structural Support
Concrete anchors	Structural Support
Concrete embedments (including Traveling Water Screens support)	Structural Support
Concrete: Above-grade exterior	Flood Barrier
Concrete: Above-grade exterior	Missile Barrier
Concrete: Above-grade exterior	Shelter, Protection
Concrete: Above-grade exterior	Structural Support
Concrete: Below-grade exterior	Flood Barrier
Concrete: Below-grade exterior	Missile Barrier
Concrete: Below-grade exterior	Shelter, Protection
Concrete: Below-grade exterior	Structural Support
Concrete: Foundation	Flood Barrier
Concrete: Foundation	Shelter, Protection
Concrete: Foundation	Structural Support
Concrete: Interior	Direct Flow
Concrete: Interior	Flood Barrier
Concrete: Interior	Missile Barrier
Concrete: Interior	Shelter, Protection
Concrete: Interior	Structural Support
Conduit	Shelter, Protection
Conduit	Structural Support
Doors	Flood Barrier
Doors	Missile Barrier
Doors	Shelter, Protection
Equipment foundations	Structural Support
Hatches/Plugs	Flood Barrier
Hatches/Plugs	Missile Barrier
Hatches/Plugs	Shelter, Protection
Hatches/Plugs	Structural Support
Ice Barrier	Shelter, Protection
Metal decking	Structural Support

Component Type	Intended Function
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection
Panels, Racks, Cabinets, and Other Enclosures	Structural Support
Penetration seals	Flood Barrier
Penetration seals	Shelter, Protection
Penetration sleeves	Flood Barrier
Penetration sleeves	Structural Support
Piles	Structural Support
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Flood Barrier
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection
Steel components: All structural steel (including trash racks)	Filter
Steel components: All structural steel (including trash racks)	Structural Support
Tube Track	Structural Support

The aging management review results for these components are provided in:

Table 3.5.2-9 Service Water Intake Structures
Summary of Aging Management Evaluation

2.4.10 Shoreline Protection and Dike

Structure Purpose

The Shoreline Protection and Dike, which is also known as the "shoreline protective dike" is a shoreline protective structural feature comprised of cofferdams, steel sheet piles, and rock located at the service water intake structure along the Delaware River shoreline. The original earthen shoreline dike west of the Reactor Building was replaced with sheet pile retaining walls and rock fill construction, extending 100 feet on both sides of the service water intake structure. This section of the Shoreline Protection and Dike is classified nonsafety-related, and seismic Category II/I, to provide protection against shoreline recession during probable maximum hurricane (PMH) surge. An earthen dike continues north of the intake structure sheet pile retaining walls to the barge slip and south to the Salem Generating Station Units 1 and 2 structures.

The shore protection dike includes four 44-foot diameter sheet pile cellular cofferdams, two on each side of the service water intake structure. The cofferdams are filled with course aggregate with the lower part of the backfill pressure grouted.

The purpose of the Shoreline Protection and Dike is to provide protection against shoreline recession for the Service Water System structures and components during and following design seismic and flood (PMH) events. The shoreline protection dike is provided in the vicinity of the service water intake structure to assure surge flooding and wave action will not cause blockage to the water intake or scour of the engineered backfill over the underground service water pipes.

Included in the boundary of the Shoreline Protection and Dike are elements of the dike, sheet piles, rock, and embankments adjacent to the service water intake structure. That portion of the Shoreline Protection and Dike that extends 100 feet on both sides of the service water intake structure performs an intended function and is in the scope of license renewal. The shoreline protection dike sections outside of this boundary do not perform an intended function for license renewal and are not in the scope of license renewal. Refer to the "Components Subject to Aging Management Review" table below for a complete list of components included in the boundary of the Shoreline Protection and Dike.

Not included in the boundary of the Shoreline Protection and Dike are the outer walls of the service water intake structure, which are evaluated with the Service Water Intake Structures.

For more detailed information, see UFSAR Sections 2.4.5, and 2.4.10.

Reason for Scope Determination

The Shoreline Protection and Dike is not in scope under 10 CFR 54.4(a)(1) because no portions of the structure are safety-related or relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because the structure provides physical support, shelter, and protection for nonsafety-related systems, structures, and components (SSCs) whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). The Shoreline Protection and Dike is not in scope under 10 CFR 54.4(a)(3) because it is not 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), Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62) or Station Blackout (10 CFR 50.63).

Structure Intended Functions

1. Provides physical support, shelter, and protection for nonsafety-related systems, structures, and components (SSCs) whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4 (a)(1). 10 CFR 54.4(a)(2)

UFSAR References

2.4.1.1
2.4.5
2.4.10
2.5.1.2.1

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Table 2.4-10 Shoreline Protection and Dike
Components Subject to Aging Management Review

Component Type	Intended Function
Earthen water-control structures: Embankments (dikes)	Shelter, Protection
Piles (Sheet Piles)	Shelter, Protection

The aging management review results for these components are provided in:

Table 3.5.2-10 Shoreline Protection and Dike
Summary of Aging Management Evaluation

2.4.11 Switchyard

Structure Purpose

The Switchyard is located in a fenced area east of the Reactor Building. It is comprised of the 500-kV switchyard and a control house. The Switchyard foundation consists of reinforced concrete walls, grade beams, and isolated footings bearing on steel piles. The control house is a single story masonry wall structure, approximately 54' x 37' in plan dimensions. Its foundation is reinforced concrete slab on steel piles. Its roof is comprised of a precast prestressed concrete hollow slab covered with insulation and built-up roofing. A reinforced concrete cable underground vault runs under the northern and the eastern sides of the control house. The piles for the Switchyard are composed of steel pipe filled with concrete and protected with a cathodic protection system. The Switchyard is classified nonsafety-related structure and its failure would not impact a safety-related function.

The purpose of the Switchyard is to provide structural support, shelter, and protection for the 13.8 KV Station Power System, and the Offsite 500 KVAC System components and commodities. The Offsite 500 KVAC Power System receives offsite power from three (3) different independent sources and feeds it to the plant through the 13.8 KV Station Power System. The Offsite 500 KVAC Power System also receives power generated by the station and transmits it over three transmission lines to the Public Service Electric & Gas electric transmission network. The 13.8 KV Station Power System and the Offsite 500 KVAC Power System are relied upon to provide offsite power during Station Blackout (SBO) event restoration.

Included in the boundary of the Switchyard are reinforced concrete, and masonry wall components of the structure. Also included in its evaluation boundary are concrete anchors, conduits, embedments, equipment foundations, doors, electrical panels and enclosures, manholes, handholes, and duct banks, metal components, miscellaneous steel, structural bolting, piles, roofing membrane, structural sealants, and transmission towers. Structures and components that provide structural support, shelter, and protection to the in scope 13.8 KV Station Power System, and the Offsite 500 KVAC Power System are in scope of license renewal. Other components and structures in the Switchyard that are not required to support the Station Blackout intended function are not in the scope of license renewal. Refer to the "Components Subject to Aging Management Review" table below for a complete list of components in the boundary of the Switchyard.

Not included in the boundary of the Switchyard are electrical components and commodities. These components and commodities are separately evaluated with the 13.8 KV Station Power System and the Offsite 500 KVAC Power System. Additionally, component supports in the Switchyard are separately evaluated with the Component Supports Commodity Group.

For more detailed information, see UFSAR Sections 1.2.3, 8.1, and 8.2.

Reason for Scope Determination

The Switchyard is not in scope under 10 CFR 54.4(a)(1) because no portions of the structure are safety-related or relied on to remain functional during and following design basis events. It is not in scope under 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the structure will not prevent satisfactory accomplishment of function(s) identified for 10 CFR

54.4(a)(1). The Switchyard meets 10 CFR 54.4(a)(3) because it is relied upon in the 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 Switchyard is not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for Fire Protection (10 CFR 50.48), Environmental Qualification (10 CFR 50.49), or Anticipated Transients Without Scram (ATWS) (10 CFR 50.62)

Structure Intended Functions

1. Provides 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). 10 CFR 54.4(a)(3).

UFSAR References

1.2.3
1.2.4.4
3.1.2.2.8
8.1
8.2

License Renewal Boundary Drawings

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Table 2.4-11 **Switchyard**
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting (Structural)	Structural Support
Concrete anchors	Structural Support
Concrete embedments	Structural Support
Concrete: Above-grade exterior	Shelter, Protection
Concrete: Above-grade exterior	Structural Support
Concrete: Below-grade exterior	Shelter, Protection
Concrete: Below-grade exterior	Structural Support
Concrete: Foundation	Shelter, Protection
Concrete: Foundation	Structural Support
Conduit	Shelter, Protection
Conduit	Structural Support
Doors	Shelter, Protection
Equipment foundations	Structural Support
Manholes, Handholes & Duct Banks	Shelter, Protection
Manholes, Handholes & Duct Banks	Structural Support
Masonry walls: Above-grade exterior	Shelter, Protection
Masonry walls: Above-grade exterior	Structural Support
Metal components: Covers	Shelter, Protection
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Shelter, Protection
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection
Panels, Racks, Cabinets, and Other Enclosures	Structural Support
Piles	Structural Support
Roofing membrane	Shelter, Protection
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection
Transmission towers	Structural Support
Tunnel (Cable Vault)	Shelter, Protection
Tunnel (Cable Vault)	Structural Support

The aging management review results for these components are provided in:

Table 3.5.2-11 Switchyard
Summary of Aging Management Evaluation

2.4.12 Turbine Building

Structure Purpose

The structures included in the boundary of the Turbine Building are the turbine building and the administration facility. The administration facility, formerly the Unit 2 turbine building, is located adjacent to the turbine building and was reconfigured for office and warehouse space. The Turbine Building is a reinforced concrete and steel structure located adjacent to the Auxiliary Building Service/Radwaste Area, and east of the Reactor Building. The building is a multi-story structure; approximately 630 feet by 195 feet in plan area, comprised of reinforced concrete walls, slabs, foundation mats, and structural steel. The above ground exterior walls are pre-cast concrete panels and insulated metal siding. The roof is cellular metal deck, insulation board and built-up roofing material supported by structural steel. The building foundation consists of reinforced concrete mats placed on engineered structural backfill that bears on the dense Vincentown Formation. Seismic joints separate the foundation mats and building walls of the turbine building, the administration facility and the abutting Auxiliary Building Service/Radwaste Area. The Turbine Building is classified nonsafety-related, non-seismic Category I, designed not to collapse and adversely impact the structural integrity of any seismic Category I structures.

Turbine building:

The turbine building encloses the steam and power conversion system and turbine auxiliary systems, reactor protection system components, and supporting systems. Major components within the building include the main turbine generator, main condensers, air ejectors, moisture separators, feedwater heaters, feed and condensate pumps, condensate demineralizers, main steam control and stop valves, and their associated piping. Radioactive components are enclosed within heavy concrete walls with labyrinth entrances for shielding purposes. Some interior walls, required for separation, radiation shielding, or fire protection, are constructed of fully grouted, reinforced concrete masonry units. The building also houses other nonsafety-related electrical and mechanical equipment and components such as the, motor generator sets for reactor recirculation pumps, condensate storage and transfer pumps, the demineralizer system, HVAC equipment, electrical equipment and components, instrumentation and their enclosures as applicable. Two 220 ton overhead cranes are provided above the turbine generator operating floor to service the turbine generator unit. The turbine generator operating floor has a large lay down area that was originally intended for the Unit 2 turbine, and the cranes travel along common rails into the administration facility storage area. The turbine generator is supported by a free standing, reinforced concrete pedestal founded on a reinforced concrete mat foundation and the pedestal extends to the operating floor. The operating floor framing is supported on slide bearings that are in turn supported by the pedestal. Separation joints are provided between the pedestal and walls and other turbine building floors to prevent transfer of turbine vibration to the building.

Administration facility:

The administration facility contains office, warehouse, and unoccupied space, or empty rooms from the Unit 2 plant cancelled areas. The old Unit 2 turbine generator operating floor and lay down area is a common storage area with the turbine building generator-operating floor. The administration facility first (grade level) and second floors were reconfigured for office space, conference rooms, a cafeteria and supporting facilities that have no safety-related function.

There are several stairways, two elevators, and grade level truck rollup doors, which allow movement within the Turbine Building and access to the equipment and storage areas.

Reactor Protection System (RPS) sensors are mounted on the turbine to monitor first stage pressure, main control valve fast closure, and stop valve closure and on the main condenser to measure condenser vacuum. This safety-related equipment is located in the Turbine Building. The sensors are safety-related, however, they are physically mounted on equipment that is not seismic Category I, and are located in the Turbine Building, which is not a seismic Category I structure. The RPS is a failsafe design, with other diverse safety-related reactor scram signals such that no single failure or credible natural disaster can prevent a reactor scram. Therefore, failure of the turbine components or structure will not result in a failure of the RPS to attain its failsafe state and scram the reactor. This system is evaluated with the Reactor Protection System.

The purpose of the Turbine Building is to provide structural support, shelter, and protection for systems, components and structures classified as safety and nonsafety-related. The safety-related components housed within the Turbine Building are fail-safe by design and failure of nonsafety-related systems, structures, and components cannot prevent the accomplishment of the safety-related intended function. The building is designed not to collapse and adversely impact the structural integrity of adjacent seismic Category I structures. Structural support, shelter, and protection are provided to systems and components necessary to support fire protection, station blackout, environmental qualification, and anticipated transients without scram. The Turbine Building houses the Main Condenser System to provide for post accident containment and holdup. The Turbine Building also provides shielding from radiation exposure to allow personnel access for operating and maintaining equipment. The turbine building design features provide a ventilation system to maintain the building at a slight negative pressure and prevent the unmonitored release of radioactivity. The turbine building ventilation system is evaluated with the Miscellaneous Ventilation Systems.

Included in the boundary of the Turbine Building are concrete elements of the building, concrete embedments and anchors, bolting, cable trays, doors, hatches, compressible joints and seals, conduit, racks, enclosures, steel components, metal decking and siding, miscellaneous steel, penetration seals, penetration sleeves, roofing membrane, and tube track. Structural elements of the building essential for structural support, shelter, and protection for components credited for fire protection, station blackout, environmental qualification, and anticipated transients without scram are also included in the scope of license renewal. Internal structures that do not perform or support intended functions, such as slide bearings, office facilities, partitions, stairs and platforms, are not included in the scope of license renewal. Refer to the "Components Subject to Aging Management Review" table below for a complete list of components included in the boundary of the Turbine Building.

Not included in the boundary of the Turbine Building are component supports, cranes, elevators, piping and component insulation and fire barriers. Component supports are separately evaluated with the Component Supports Commodity Group, the cranes are evaluated with the Cranes and Hoists and fire barriers are evaluated with the Fire Protection license renewal systems. The building elevators are evaluated with the Elevators and Manlifts and piping and component insulation are evaluated separately with the Piping and Component Insulation Commodity Group.

For more detailed information, see UFSAR Sections 3.8.4.1.7, and 7.2.

Reason for Scope Determination

The Turbine Building is not in scope under 10 CFR 54.4(a)(1) because no portions of the structure are safety-related or relied upon to remain functional during and following design basis events. It meets 10 CFR 54.4(a)(2) because the structure provides physical support, shelter, and protection for nonsafety-related systems, structures, and components (SSCs) whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). It also meets 10 CFR 54.4(a)(3) because it provides physical support, shelter and protection for systems, structures and components (SSCs) 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), Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62) and Station Blackout (10 CFR 50.63).

Structure Intended Functions

1. Provides physical support, shelter, and protection for nonsafety-related systems, structures, and components (SSCs) whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4 (a)(1). 10 CFR 54.4(a)(2)

2. Provides 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). 10 CFR 54.4(a)(3)

3. Provides 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 Environmental Qualification (10 CFR 50.49). 10 CFR 54.4(a)(3)

4. Provides 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 Anticipated Transient without Scram (10 CFR 50.62). 10 CFR 54.4(a)(3)

5. Provides 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). 10 CFR 54.4(a)(3)

UFSAR References

1.2.3
3.2
3.8
7.2
10.4

License Renewal Boundary Drawings

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Table 2.4-12 Turbine Building
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting (Structural)	Structural Support
Cable Trays	Structural Support
Compressible Joints and Seals (Seismic Gaps)	Expansion / Separation
Concrete anchors	Structural Support
Concrete embedments	Structural Support
Concrete: Above-grade exterior	Shelter, Protection
Concrete: Above-grade exterior	Structural Support
Concrete: Below-grade exterior	Shelter, Protection
Concrete: Below-grade exterior	Structural Support
Concrete: Foundation	Shelter, Protection
Concrete: Foundation	Structural Support
Concrete: Interior	Shelter, Protection
Concrete: Interior	Shielding
Concrete: Interior	Structural Support
Conduit	Shelter, Protection
Conduit	Structural Support
Doors	Shelter, Protection
Equipment foundations	Structural Support
Hatches/Plugs	Shelter, Protection
Hatches/Plugs	Shielding
Hatches/Plugs	Structural Support
Masonry walls: Interior	Shelter, Protection
Masonry walls: Interior	Shielding
Masonry walls: Interior	Structural Support
Metal decking	Shelter, Protection
Metal decking	Structural Support
Metal siding	Shelter, Protection
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection
Panels, Racks, Cabinets, and Other Enclosures	Structural Support

Component Type	Intended Function
Penetration seals	Shelter, Protection
Penetration sleeves	Structural Support
Precast Panels	Shelter, Protection
Precast Panels	Structural Support
Roofing membrane	Shelter, Protection
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection
Steel components: All structural steel	Structural Support
Tube Track	Structural Support

The aging management review results for these components are provided in:

Table 3.5.2-12 Turbine Building
Summary of Aging Management Evaluation

2.4.13 Yard Structures

Structure Purpose

The Yard Structures include the compressed gas storage areas, concrete box valve pits, condensate storage tank dike and foundation, fire water tank foundations, light poles, manholes, handholes and duct banks, miscellaneous yard structures, transformer foundations, transmission towers and foundations, trenches, and yard drainage catch basins and ditch.

Compressed gas storage areas:

Compressed gas storage areas are comprised of the carbon dioxide storage facility, hydrogen storage facility, liquid oxygen storage facility, and nitrogen storage facility. The compressed gas storage areas are reinforced concrete slab foundations on grade facilities that are enclosed with a chain link fence or concrete barriers, and located in the yard area. The compressed gas storage areas are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The compressed gas storage areas do not perform an intended function and are not in scope for license renewal.

Concrete box valve pits:

The concrete box valve pits are located in the yard area and are buried below plant grade with a removable concrete panel on top. There are access opening in the concrete panels with covers to allow personnel access into the valve pits. The valve pits contain nonsafety-related piping and valves for not in scope plant water systems, including the Circulating Water System and the not in scope portion of Service Water System. The concrete valve pits are located at grade level and below. They are separated from safety-related systems, structures, and components, except for valve pits 4 and 5, such that their failure would not impact a safety-related function. Valve pits 4 and 5 are located adjacent to the west wall of the unit 1 Reactor Building and failure of these valve pits and enclosed components would not affect the license renewal intended functions of the Reactor Building or enclosed mechanical piping system. The reinforced concrete box valve pits do not perform an intended function and are not in scope for license renewal.

Condensate storage tank dike and foundation:

The condensate storage tank dike and foundation is a reinforced concrete structure located south of the Reactor Building. The structure has a 2 feet thick rectangular reinforced concrete foundation slab with the top of the slab approximately 9 feet below plant grade. The reinforced concrete foundation slab of the structure is founded on lean concrete bearing on dense Vincentown Formation. An octagonal reinforced concrete slab, approximately 2 feet thick, is cast on the foundation slab and functions as the foundation pedestal for the condensate storage tank. There are 2 feet thick reinforced concrete walls, approximately 20 feet in height, along the edge of the foundation slab that forms an open top box structure. The structure has been sized to contain any spillage due to failure of the condensate storage tank. A reinforced concrete valve pit is located on the east side of the condensate storage tank dike. This valve pit is a rectangular open top box structure similar to the condensate storage tank dike, with the perimeter walls extending approximately one foot above plant grade and with grating over the open top. The condensate storage tank dike and foundation is classified as a seismic

Category I structure. The condensate storage tank dike and foundation perform license renewal intended functions and is in scope for license renewal.

Fire water tank foundations:

The fire water tank foundations are two octagonal reinforced concrete slabs on grade and are approximately 3 feet thick. The tank foundations are located north of the Reactor Building in the yard, separated from safety-related systems, structures, and components (SSCs) such that their failure would not impact a safety-related function. There is a reinforced concrete valve pit located on the south end of each tank foundation and they extend approximately 6 feet under the tank foundation. The valve pit is a rectangular box structure with perimeter walls extending approximately one foot above plant grade and a foundation slab approximately 10 feet below plant grade. There is a reinforced concrete slab that serves as a roof over the valve pit, with an opening with a manhole cover for personnel access. The valve pit foundation consists of a reinforced concrete slab with piles under the perimeter walls. The fire water tank foundations perform an intended function and are in scope for license renewal.

Light Poles:

Light poles are metal poles that are mounted on concrete pier foundations located in the yard area. The light poles provide area lighting for safe movement of personnel and for security surveillance and are classified as nonsafety-related. Light poles do not perform an intended function and are not in scope for license renewal.

Manholes, handholes and duct banks:

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 cover to allow plant personnel access to electrical cables routed in duct banks. Manholes and handholes serve as intermediate connection point(s) of duct banks routed in the yard area. There are safety-related and nonsafety-related manholes located in the yard area. Manhole covers are provided at the openings for shelter and protection.

Duct banks are comprised of the placement of multiple raceways in an excavated trench in the yard that are encased in concrete and then backfilled with soil or engineered compacted backfill. The duct banks are used to route nonsafety-related and safety-related cables between structures and in the switchyard area. 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 perform an intended function and are in scope for license renewal.

Miscellaneous yard structures:

Miscellaneous yard structures are comprised of civil features located in the yard area that are not uniquely tied to a group of common structures in the yard. These miscellaneous yard structures include roadways, sidewalks, fences, bollards, lift stations, reinforced concrete foundation slabs for buildings that have been removed from the site, concrete pads for commercial grade HVAC units for office buildings, abandoned concrete equipment foundations, plant security shooting range and facility complex, and miscellaneous yard sheds and foundations. The miscellaneous yard structures are nonsafety-related and separated from safety-related systems, structures, and components such that their failure would not impact a safety-related function. The miscellaneous yard structures do not perform an intended function and are not in scope for license renewal.

Transformer foundations:

Transformer foundations are reinforced concrete slabs that provide structural support for station transformers located in the yard area. The foundations can be concrete slabs on grade, concrete slabs that are cast on a subgrade foundation several feet below grade or on piles with perimeter walls with a pedestal type concrete equipment pad on the foundation slab that provides the structural support for the transformer. Transformer foundations are classified as nonsafety-related and do not perform a safety-related function. There are transformers that are required to support Station Blackout restoration and therefore those foundations are in scope for license renewal.

Transmission towers and foundations:

Transmission towers and foundations are tall steel tower structures that are supported on reinforced concrete pier foundations located in the yard area. The transmission towers are located between the Hope Creek Generating Station (HCGS) Switchyard and the Salem Generating Station (SGS) Switchyard. These transmission towers support the 500 kV power lines that are routed between the HCGS and SGS switchyards. Transmission towers and foundations are classified as nonsafety-related and do not perform a safety-related function. These transmission towers are required to support the Station Blackout restoration function and therefore are in scope for license renewal.

Trenches:

Trenches are reinforced concrete rectangular box structures with open tops that are buried in excavated trenches in the yard area, with either metal grating or metal plate covering the open tops. The trenches are used to route piping and components for not in scope plant systems. The top of the trenches are located at approximately 6 inches above plant grade with the remaining portion of the trenches below grade such that their failure would not impact a safety-related function. The trenches do not perform an intended function and are not in scope for license renewal.

Yard drainage catch basins and ditch:

Yard drainage catch basins are reinforced concrete box structures that are buried in the yard, with an open top with slotted grating. The yard ditch is an open channel earthen feature located along the north boundary of the station's property. These features are provided to drain the station's yard area during normal and severe rainstorms. The yard drainage catch basins and ditch do not perform an intended function and are not in scope for license renewal.

The purpose of the Yard Structures is to provide structural support, shelter, and protection for safety-related and nonsafety-related components and commodities, including components credited for station blackout (SBO) and fire protection (FP). In addition, the condensate storage tank dike and foundation protects against uncontrolled release of condensate water to the environment. Other functions of the Yard Structures include drainage of the yard area, lighting, and personnel and vehicular access throughout the yard area.

Included the boundary of the Yard Structures are components that makeup compressed gas storage areas, concrete box valve pits, condensate storage tank dike and foundation, fire water tank foundations, light poles, manholes, handholes and duct banks, miscellaneous yard structures, transformer foundations, transmission towers and foundations, trenches, and yard drainage catch basins and ditch. Components of the condensate storage tank dike and foundation, fire water tank foundations, manholes, handholes and duct banks that contain electrical commodities in the scope of license renewal, SBO transformer foundations, and SBO transmission towers and foundations are in scope for license renewal. The components include bolting, bus ducts, cable trays, conduits, reinforced concrete, concrete anchors, concrete embedments, equipment foundations, hatches/plugs, miscellaneous steel, racks, panels and enclosures, manholes, handholes and duct banks, penetration sleeves, seals and bellows, seals and gaskets, and transmission towers. Refer to the "Components Subject to Aging Management Review" table below for a complete list of components included in the boundary of Yard Structures.

Not included in the boundary of the Yard Structures are component supports, piping and component insulation and Switchyard components. Component supports are separately evaluated with the Component Supports Commodity Group. The piping and component insulation is evaluated with the Piping and Component Insulation Commodity Group. The components in the Switchyard are evaluated with the Switchyard Structures.

For more detailed information, see UFSAR Sections 3.4.1.1 and 3.8.4.

Reason for Scope Determination

The Yard Structures meet 10 CFR 54.4(a)(1) because there are safety-related structures that are relied upon to remain functional during and following design basis events. They meet 10 CFR 54.4(a)(2) because failure of nonsafety-related portions of the structures could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). They also meet 10 CFR 54.4(a)(3) because the structures provide physical support, shelter and protection for systems, structures and components (SSCs) 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). The Yard Structures are not relied upon in any safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for Environmental Qualification (10 CFR 50.49) and Anticipated Transients Without Scram (10 CFR 50.62).

Structure Intended Functions

1. Provides physical support, shelter and protection for safety-related systems, structures, and components (SSCs). 10 CFR 54.4(a)(1)

2. Prevent liquid radioactive waste from being released to the environment in the event of a Safe Shutdown Earthquake (SSE). 10 CFR 54.4(a)(1)

3. Provides physical support, shelter and protection for nonsafety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4 (a)(1). 10 CFR 54.4(a)(2)

4. Provides 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). 10 CFR 54.4(a)(3)

5. Provides 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). 10 CFR 54.4(a)(3)

UFSAR References

1.2.4.3.10
2.4.2.3
2.4.13.3
2.5.4.10.2
3.4.1.1
Table 3.4-4
3.8.4
3.8.4.1.6
9.2.6
9.5.1.2.34
9.5.9.2

License Renewal Boundary Drawings

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Table 2.4-13 **Yard Structures**
Components Subject to Aging Management Review

Component Type	Intended Function
Bolting (Structural)	Structural Support
Cable Trays	Structural Support
Concrete Anchors	Structural Support
Concrete Embedments	Structural Support
Concrete: Above-grade exterior	Shelter, Protection
Concrete: Above-grade exterior	Structural Support
Concrete: Above-grade exterior	Water retaining boundary
Concrete: Below-grade exterior	Missile Barrier
Concrete: Below-grade exterior	Shelter, Protection
Concrete: Below-grade exterior	Structural Support
Concrete: Below-grade exterior	Water retaining boundary
Concrete: Foundation	Shelter, Protection
Concrete: Foundation	Structural Support
Concrete: Foundation	Water retaining boundary
Conduit	Shelter, Protection
Conduit	Structural Support
Equipment foundations	Structural Support
Hatches/Plugs (Manhole and Handhole covers)	Missile Barrier
Hatches/Plugs (Manhole and Handhole covers)	Shelter, Protection
Manholes, Handholes & Duct banks	Missile Barrier
Manholes, Handholes & Duct banks	Shelter, Protection
Manholes, Handholes & Duct banks	Structural Support
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection
Penetration bellows (Condensate Storage Tank Dike)	Shelter, Protection
Penetration bellows (Condensate Storage Tank Dike)	Water retaining boundary
Penetration seals	Shelter, Protection
Penetration seals	Water retaining boundary
Penetration sleeves	Shelter, Protection

Component Type	Intended Function
Piles	Structural Support
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection
Steel Components: Bus Duct	Shelter, Protection
Steel Components: Bus Duct	Structural Support
Transmission towers	Structural Support

The aging management review results for these components are provided in:

Table 3.5.2-13 Yard Structures
Summary of Aging Management Evaluation

2.5 SCOPING AND SCREENING RESULTS: ELECTRICAL AND INSTRUMENTATION AND CONTROLS (I&C) SYSTEMS

The determination of electrical systems that fall within the scope of license renewal is made through the application of the process described in Section 2.1. The results of the electrical systems scoping review are contained in Section 2.2.

Subsection 2.1.6.1 provides the screening methodology for determining which component/commodity groups within the scope of 10 CFR 54.4 meet the requirements contained in 10 CFR 54.21(a)(1). The component/commodity groups that meet those screening requirements are identified in this section. These identified component/commodity groups consequently require an aging management review.

As described in Subsection 2.1.6.1, the screening for electrical and I&C components was performed on a commodity group basis for the in-scope electrical and I&C systems as well as the electrical and I&C component types associated with in-scope mechanical systems listed in Table 2.2-1.

Components which support or interface with electrical and I&C components, for example, cable trays, conduits, instrument racks, panels and enclosures, are assessed as part of the Structural Component Support Commodity Group in Section 2.4.4.

2.5.1 ELECTRICAL/I&C COMPONENT COMMODITY GROUPS

After identifying passive commodity groups in accordance with the guidance of NEI 95-10, commodity groups that are subject to periodic replacement were also screened out. Commodity groups were then evaluated to identify whether specific commodity groups perform a license renewal intended function, thus determining whether they are subject to aging management review.

UFSAR References

Additional system details are included in the UFSAR Sections 7 and 8.

Evaluation Boundaries

In addition to the plant electrical and I&C components, certain Switchyard components required to restore offsite power following a station blackout (SBO) were included within the scope of license renewal. The evaluation boundaries of the offsite power system are described below.

The purpose of the offsite power system and Switchyard is to provide the electrical interconnection between Hope Creek and the offsite transmission network. Restoration is defined as the re-powering of the plant AC distribution system from offsite sources and/or on site emergency AC sources. For Hope Creek, this includes the portion of the plant electrical system used to connect the in-scope AC distribution system equipment to offsite power and by definition recover from an SBO event. For Hope Creek, the boundary between the offsite transmission network and the plant electrical distribution system has been defined at six 500 kV switchyard circuit breakers: breakers 30X and 31X (Salem), 50X and 51X (New Freedom), and 60X and 61X (Red Lion). Long-lived passive electrical commodities included in the scope of license renewal on the plant side of this boundary are: switchyard bus and connections, transmission conductors and connections, high voltage insulators, substation structures and supports, inaccessible medium voltage cables, metal enclosed bus, insulated cables and connections, and cable connections (metallic parts).

A simplified diagram of the SBO recovery path and the key plant electrical distribution systems is shown in Figure 2.1-2.

2.5.2 ELECTRICAL COMPONENT COMMODITY GROUPS

2.5.2.1 Identification of Electrical Component Commodity Groups

The first step of the screening process for electrical component commodity groups is to use plant documentation to identify the electrical components within the electrical, I&C and mechanical systems based on plant design documentation, drawings, and the Component Data Module (SAP CDM), as well as by interfacing with the parallel mechanical and civil screening efforts. The electrical component commodity groups identified at Hope Creek are listed below. This list includes electrical commodity groups identified in NEI 95-10 Appendix B in addition to commodity groups added per NUREG-1800 Table 2.1-5, the EPRI License Renewal Electrical Handbook or unique to Hope Creek.

Electrical Component Commodity Groups for In-Scope Systems:

- Alarm Units
- Analyzers
- Annunciators
- Batteries
- Cable Connections – Metallic Parts
- Cable Tie-Wraps
- Chargers
- Circuit Breakers
- Communication Equipment
- Connection Contacts
- Converters
- Electric Heaters
- Electrical Controls and Panel Internal Assemblies
- Electrical Penetrations
- Elements, RTDs, Sensors, Themocouples, Transducers
- Fuse Holders
- Fuses
- Generators, Motors
- Heat Trace
- High Voltage Insulators
- Indicators
- Insulated Cables and Connections
- Inverters
- Isolators
- Light Bulbs
- Loop Controllers
- Metal Enclosed Bus
- Meters
- Motor Generator Sets
- Power Supplies
- Radiation Monitors
- Recorders
- Regulators
- Relays (and Bistables)
- Signal Conditioners

- Solenoid Operators
- Solid State Devices
- Splices
- Surge Arresters
- Switches
- Switchgear, Load Centers, Motor Control Centers, Distribution Panel Internal Component Assemblies
- Switchyard Bus and Connections
- Terminal Blocks
- Transformers
- Transmission Conductors and Connections
- Transmitters
- Uninsulated Ground Conductors

2.5.2.2 Application of Screening Criterion 10 CFR 54.21 (a)(1)(i) to the Electrical Component Commodity Groups

Following the identification of the electrical commodity groups, the criteria of 10 CFR 54.21 (a)(1)(i) were applied to identify commodity groups that perform their functions without moving parts or without a change in configuration or properties. The following electrical commodity groups were determined to meet the screening criteria of 10 CFR 54.21 (a)(1)(i):

- Cable Connections - Metallic Parts
- Cable Tie-Wraps
- Electrical Equipment Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Electrical Penetrations
- Fuse Holders
- High Voltage Insulators
- Insulated Cables and Connections
- Metal Enclosed Bus
- Splices
- Switchyard Bus and Connections
- Terminal Blocks
- Transmission Conductors and Connections
- Uninsulated Ground Conductors

2.5.2.3 Elimination of Electrical Component Commodity Groups With No License Renewal Intended Functions

The following electrical commodity group was determined to not have a license renewal intended function:

<u>Cable Tie-Wraps</u>

Tie-wraps are used in cable installations as cable ties. Cable ties hold groups of cables together for restraint and ease of maintenance. Cable ties are used to bundle wires and cables together to keep the wire and cable runs neat and orderly. Cable ties are used to restrain wires and cables within raceways to facilitate cable installation. There are no current license basis requirements for

Hope Creek that tie-wraps remain functional during and following design basis events. Cable ties are not credited for maintaining cable ampacity, ensuring maintenance of cable minimum bending radius, or maintaining cables within vertical raceways at Hope Creek. The seismic qualification of cable trays does not credit the use of cable ties. Tie-wraps are not credited in the Hope Creek design basis in terms of any 10 CFR 54.4 intended function. Therefore, cable tie-wraps are not within the scope of license renewal and are not subject to aging management review.

Uninsulated Ground Conductors

The Uninsulated Ground Conductors commodity group is comprised of grounding cable and associated connectors. Ground conductors are provided for equipment and personnel protection. They do not perform an intended function for license renewal. Therefore, Uninsulated Ground Conductors are not subject to aging management review.

2.5.2.4 Application of Screening Criterion 10 CFR 54.21 (a)(1)(ii) to Electrical Component Commodity Groups

The 10 CFR 54.21 (a)(1)(ii) screening criterion was applied to the specific commodity groups that remained following application of the 10 CFR 54.21 (a)(1)(i) criterion. 10 CFR 54.21 (a)(1)(ii) allows the exclusion of those commodity groups that are subject to replacement based on a qualified life or specified time period. The only electrical commodity groups identified for exclusion by the criteria of 10 CFR 54.21 (a)(1)(ii) are electrical and I&C components included in the Hope Creek Environmental Qualification (EQ) Program. This is because electrical and I&C components included in the EQ Program have defined qualified lives and are replaced prior to the expiration of their qualified lives. No electrical and I&C components within the Hope Creek EQ Program are subject to aging management review in accordance with the screening criteria of 10 CFR 54.21 (a)(1)(ii). See Section 4.4 for the TLAA evaluation of the Hope Creek EQ Program. The remaining commodity groups, all or part of which are not in the EQ Program, require aging management review and are discussed below.

2.5.2.5 Electrical Component Commodity Groups Subject to Aging Management Review

The electrical component commodity groups subject to aging management review are identified in Table 2.5.2-1, along with the associated intended functions. These electrical component commodity groups are further described below.

2.5.2.5.1 Cable Connections - Metallic Parts

The Cable Connectors (Metallic Parts) commodity group includes metallic portions of cable connections that are not included in the EQ Program. The metallic connections evaluated include splices, threaded connectors, compression type termination lugs, and terminal blocks. Therefore, Cable

Connections (Metallic Parts) meet the screening criterion of 10 CFR 54.21(a)(1)(ii) and are subject to aging management review.

2.5.2.5.2 Electrical Penetrations

Environmentally qualified electrical penetrations are managed under the Environmental Qualification Program, which is evaluated as a time-limited aging analysis. The electrical continuity of the non-environmentally qualified electrical penetrations is managed under the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. The pressure boundary function of electrical penetrations is included in Section 2.4.7, Primary Containment.

2.5.2.5.3 Fuse Holders

The Fuse Holder commodity group includes fuse holders that are not part of a larger active assembly and are not included in the EQ Program. Both metallic and non-metallic portions of fuse holders that are not part of a larger active assembly and are not included in the EQ Program meet the screening criterion of 10 CFR 54.21(a)(1)(ii) and are subject to aging management review. Insulating portions of fuse holders are evaluated with insulated cables and connections (Section 2.5.2.5.1).

2.5.2.5.4 High Voltage Insulators

The High Voltage Insulators commodity group supports a portion of the circuits that supply power from the electric utility transmission system and Switchyard to plant buses, to power in-scope license renewal components used for recovery from a station blackout event. High Voltage Insulators are not included in the EQ program. Therefore, High Voltage Insulators meet the screening criterion of 10 CFR 54.21(a)(1)(ii) and are subject to an aging management review.

2.5.2.5.5 Insulated Cables and Connections

The insulated cables and connections commodity group was separated for aging management review into subcategories based on their treatment in NUREG-1801:

- Insulated Cables and Connections
- Insulated Cables and Connections Used in Instrumentation Circuits
- Insulated Inaccessible Medium-Voltage Cables

Insulated cables and connections included in this review are:

- Electrical Penetration Pigtails
- Splices
- Terminal Blocks
- Insulating Portions of Fuse Holders

Numerous insulated cables and connections are included in the EQ Program and, therefore, are not subject to an aging management review in accordance with the screening criteria of 10 CFR 54.21 (a)(1)(ii). Insulated cables and connections not included in the EQ Program meet the criterion of 10 CFR 54.21(a)(1)(ii) and are subject to an aging management review.

Insulated cables and connections inside the enclosure of an active device (e.g., motor leads and connections, cables and connections internal to relays, chargers, switchgear, transformers, power supplies) are maintained along with the other subcomponents inside the enclosure and are not subject to an aging management review.

2.5.2.5.6 Metal Enclosed Bus

The Metal Enclosed Bus commodity group distributes 4.16 kV power from the Station Service Transformers 1AX501 and 1BX501 to the 4.16 kV Class 1E switchgear utilizing non-segregated bus work. These portions of the power distribution system are in the scope of license renewal and supply electrical power from the switchyard to plant buses to power in-scope license renewal components for recovery from a station blackout event. Therefore, metal enclosed bus meets the screening criterion of 10 CFR 54.21(a)(1)(ii) and is subject to aging management review.

2.5.2.5.7 Switchyard Bus and Connections, Transmission Conductors and Connections

The Switchyard Bus and Connections commodity group forms a portion of the circuits that supply power from the electrical utility grid to plant buses to power in scope license renewal components used for recovery from a station blackout. The Switchyard Bus and Connections are not included in the EQ program. Therefore, Switchyard Bus and Connections meet the screening criterion of 10 CFR 54.21(a)(1)(ii) and are subject to an aging management review.

The Transmission Conductors and Connections commodity group forms a portion of the circuits that supply power from the electric utility grid to plant buses to power in-scope license renewal components used for recovery from a station blackout. The Transmission Conductors and Connections are not included in the EQ program. Therefore, Transmission Conductors and Connections meet the screening criterion of 10 CFR 54.21(a)(1)(ii) and are subject to an aging management review.

Table 2.5.2-1 <u>Electrical Component Commodity Groups Subject to Aging Management Review</u>

Component Type	Intended Functions
Cable Connections - Metallic Parts	Electrical Continuity
Fuse Holders	Electrical Continuity
High Voltage Insulators	Insulation - Electrical
Insulated Cables and Connections	Electrical Continuity
Metal Enclosed Bus	Electrical Continuity
	Insulation - Electrical
	Shelter, Protection
Switchyard Bus and Connections	Electrical Continuity
Transmission Conductors and Connections	Electrical Continuity

The aging management review results for these components are provided in Table 3.6.2-1, Electrical Commodity Groups – Summary of Aging Management Evaluation.

3.0 AGING MANAGEMENT REVIEW RESULTS

This section provides the results of the aging management review for those structures and components identified in Section 2.0 as being subject to aging management review.

Descriptions of the internal and external service environments that were used in the aging management review to determine aging effects requiring management are included in Table 3.0-1, Hope Creek Internal Service Environments and Table 3.0-2, Hope Creek External Service Environments. The environments used in the aging management reviews are listed in the Environment column. The third column identifies one or more of the NUREG-1801 Volume 2 environments that were used when comparing the Hope Creek Aging Management Review results to the NUREG-1801 results.

Most of the Aging Management Review (AMR) results information in Section 3 is presented in the following two tables:

- **Table 3.x.1** - where '3' indicates the LRA section number, 'x' indicates the subsection number from NUREG 1801, Volume 1, and '1' indicates that this is the first table type in Section 3. For example, in the Reactor Vessel, Internals, and Reactor Coolant System subsection, this table would be number 3.1.1, in the Engineered Safety Features subsection, this table would be 3.2.1, and so on. For ease of discussion, this table will hereafter be referred to in this Section as "Table 1."

- **Table 3.x.2-y** - where '3' indicates the LRA section number, 'x' indicates the subsection number from NUREG-1801, Volume 1, and '2' indicates that this is the second table type in Section 3; and 'y' indicates the table number for a specific system. For example, for the Reactor Pressure Vessel, within the Reactor Vessel, Internals, and Reactor Coolant System subsection, this table would be 3.1.2-3 and for the Reactor Recirculation System, it would be table 3.1.2-4. For the Containment Hydrogen Recombiner System, within the Engineered Safety Features (ESF) subsection, this table would be 3.2.2-1. For the next system within the ESF subsection, it would be table 3.2.2-2. For ease of discussion, this table will hereafter be referred to in this section as "Table 2."

TABLE DESCRIPTION

NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," contains the generic evaluation of existing plant programs. It documents the technical basis for determining where existing programs are adequate without modification, and where existing programs should be augmented for the extended period of operation. The evaluation results documented in the report indicate that many of the existing programs are adequate to manage the aging effects for particular structures or components, within the scope of license renewal, without change. The report also contains recommendations on specific areas for which existing programs should be augmented for license renewal. In order to take full advantage of NUREG-1801, a comparison between the AMR results and the tables of NUREG-1801 has been made. The results of that comparison are provided in the two tables.

Table 1

The purpose of Table 1 is to provide a summary comparison of how the facility aligns with the corresponding tables of NUREG-1801, Volume 1. The table is essentially the same as Tables 3.1.1 through 3.6.1 provided in NUREG-1801, Volume 1, except that the “ID” and “Type” columns have been replaced by an “Item Number” column and the “Related Generic Item” and “Unique Item” columns have been replaced by a “Discussion” column.

The “Item Number” column provides the reviewer with a means to cross-reference from Table 2 to Table 1.

The “Discussion” column is used to provide clarifying or amplifying information. The following are examples of information that might be contained within this column:

- “Further Evaluation Recommended” information or reference to where that information is located
- The name of a plant specific aging management program being used
- Exceptions to the NUREG-1801 assumptions
- A discussion of how the line is consistent with the corresponding line item in NUREG-1801, Volume 1, when that may not be intuitively obvious
- A discussion of how the item is different than the corresponding line item in NUREG-1801, Volume 1, when it may appear to be consistent (e.g., when there is exception taken to an aging management program that is listed in NUREG-1801, Volume 1)

The format of Table 1 provides the reviewer with a means of aligning a specific Table 1 row with the corresponding NUREG-1801, Volume 1 table row, thereby allowing for the ease of checking consistency.

Table 2

Table 2 provides the detailed results of the aging management reviews for those components identified in LRA Section 2 as being subject to aging management review. There will be a Table 2 for each of the systems within a Chapter 3 Section grouping. For example, for Hope Creek, the Engineered Safety Features System Group contains tables specific to the Automatic Depressurization System, Containment Hydrogen Recombiner System, Core Spray System, Filtration, Recirculation, and Ventilation System, High Pressure Coolant Injection (HPCI) System, Hydrogen and Oxygen Analyzer System, Reactor Core Isolation Cooling (RCIC) System, Residual Heat Removal (RHR) System and Vacuum Relief Valve System.

Table 2 consists of the following nine columns:

- Component Type
- Intended Function
- Material

- Environment
- Aging Effect Requiring Management
- Aging Management Programs
- NUREG-1801 Volume 2 Item
- Table 1 Item
- Notes

Component Type – The first column identifies all of the component types from Section 2 of the LRA that are subject to aging management review. They are listed in alphabetical order.

Intended Function – The second column contains the license renewal intended functions for the listed component types. Definitions of intended functions are contained in Table 2.1-1.

Material – The third column lists the particular materials of construction for the component type.

Environment – The fourth column lists the environment to which the component types are exposed. Internal and external service environments are indicated and a list of these environments is provided in Tables 3.0-1 and 3.0-2, respectively.

Aging Effect Requiring Management – As part of the aging management review process, the aging effects/mechanisms required to maintain the intended function of the component type are identified for the material and environment combination. These aging effects/mechanisms requiring management are listed in the fifth column.

Aging Management Programs – The aging management programs used to manage the aging effects requiring management are listed in the sixth column of Table 2. Aging management programs are described in Appendix B.

NUREG-1801, Vol. 2 Item – Each combination of component type, material, environment, aging effect/mechanism requiring management, and aging management program that is listed in Table 2, is compared to NUREG-1801, Volume 2 with consideration given to the standard notes, to identify consistency. Consistency is documented by noting the appropriate NUREG-1801, Volume 2 item number in the seventh column of Table 2. If there is no corresponding item number in NUREG-1801, Volume 2, this row is left blank. Thus, a reviewer can readily identify the correlation between the plant-specific tables and the NUREG-1801, Volume 2 tables.

Table 1 Item – Each combination of component, material, environment, aging effect/mechanism requiring management, and aging management program that has an identified NUREG-1801, Volume 2 item number must also have a Table 3.x.1 line item reference number. The corresponding line item from Table 1 is listed in the eighth column of Table 2. If there is no corresponding item in NUREG-1801, Volume 1, this row in column eight is left blank. The Table 1 Item allows the information from the two tables can be correlated.

Notes – The notes provided in each Table 2 describe how the information in the table aligns with the information in NUREG-1801. Each Table 2 contains both standard lettered notes and plant-specific numbered notes.

The standard lettered notes, e.g., A, B, C, etc., provide standard information regarding comparison of the Hope Creek aging management review results with the NUREG-1801, Volume 2 Aging Management Table line item identified in the seventh column. In addition to the standard lettered notes, numbered plant-specific notes provide additional clarifying information when appropriate.

TABLE USAGE

Table 1

The reviewer evaluates each row in Table 1 by moving from left to right across the table. Since the Component, Aging Effect, Aging Management Programs and Further Evaluation Recommended information is taken directly from NUREG-1801, Volume 1, no further analysis of those columns is required. The information intended to help the reviewer the most in this table is contained within the Discussion column. Here the reviewer will be given information necessary to determine, in summary, how the Hope Creek evaluations and programs align with NUREG-1801, Volume 1. This may be in the form of descriptive information within the Discussion column or the reviewer may be referred to other locations within the LRA for further information.

Table 2

Table 2 contains all of the Aging Management Review information for the plant, whether or not it aligns with NUREG-1801. For a given row within the table, the reviewer is able to see the intended function, material, environment, aging effect/mechanism requiring management and aging management program combination for a particular component type within a system. In addition, if there is a correlation between the combination in Table 2 and a combination in NUREG-1801, Volume 2, this will be identified by a referenced item number in column seven, NUREG-1801, Volume 2 Item. The reviewer can refer to the item number in NUREG-1801, Volume 2, if desired, to verify the correlation. If the column is blank, no corresponding combination in NUREG-1801, Volume 2 was found. As the reviewer continues across the table from left to right, within a given row, the next column is labeled Table 1 Item. If there is a reference number in this column, the reviewer is able to use that reference number to locate the corresponding row in Table 1 and see how the aging management program for this particular combination aligns with NUREG-1801.

Table 2 provides the reviewer with a means to navigate from the components subject to Aging Management Review (AMR) in LRA Section 2 all the way through the evaluation of the programs that will be used to manage the effects of aging of those components.

A listing of the abbreviations used in this section is provided in Section 1.6.

Cumulative Fatigue Damage and TLAAs in Table 2

A Fatigue analysis is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). For those components subject to cumulative fatigue usage, the impact on existing TLAAs was evaluated and is addressed in Section 4.3.

Where specified by NUREG-1801, Volume 2, the following rules were used when applying TLAA to the aging effects associated with cumulative fatigue for a component:

1. For all pressure retaining components in a system that are subject to the aging effects of cumulative fatigue, a TLAA is applied for component types, including piping and fittings, and valves.

2. The use of TLAA in the following tables indicates that the current licensing basis was reviewed for TLAAs and the fatigue analysis was evaluated where one exists for that component. However, not every component has an explicit fatigue analysis. In these instances, as stated in Section 4.3, piping and components were designed to codes and standards that require application of stress range reduction factors to account for cyclic thermal conditions. Maintaining plant thermal cycles within the code design limit ensures components such as piping, piping components, and bolting are within fatigue limits.

Table 3.0-1 – Hope Creek Internal Service Environments

Hope Creek AMR Environment	Description	NUREG-1801 Environments Used For AMR Comparison
Air/Gas-Dry	Air/Gas-Dry includes air with a very limited percentage of moisture present that has been treated to reduce the dew point well below the system operating temperature. This includes air downstream of dryers in air systems and includes the air inside systems with temperatures higher than the dew point that have surfaces that are normally dry. It also includes commercial grade gases (such as nitrogen, Freon, etc.) that are provided as a high quality product with little if any external contaminants.	Gas Dried air
Air/Gas-Wetted	Air/Gas-Wetted includes air/gas environments containing significant amounts of moisture where condensation or water pooling may occur. This environment includes air with enough moisture to facilitate loss of material in steel caused by general, pitting, and crevice corrosion. Any internal air environment that does not meet the definition of Air/Gas – Dry is categorized as Air/Gas – Wetted, which includes outdoor air drawn inside ventilation systems.	Condensation Condensation (Internal) Moist air or condensation (internal)
Closed Cycle Cooling Water	Closed Cycle Cooling Water includes treated water subject to the Closed-Cycle Cooling Water System Program, which is Aging Management Program XI.M21 in NUREG-1801. The Closed-Cycle Cooling Water System Program relies on maintenance of system corrosion inhibitor concentrations within specified limits of Electric Power Research Institute TR-107396 to minimize corrosion. Demineralized water is treated with corrosion inhibitors, pH control agents, or biocides, as needed.	Closed cycle cooling water
Closed Cycle Cooling Water >140°F	Closed Cycle Cooling Water >140 °F is Closed Cycle Cooling Water that has a temperature greater than 140 °F. This environment is identified when applicable for stainless steel components subject to cracking. Refer to the Closed Cycle Cooling Water environment definition for further details.	Closed cycle cooling water >140 °F (For cracking of stainless steel components) Closed cycle cooling water (all other applicable aging effects)

Hope Creek AMR Environment	Description	NUREG-1801 Environments Used For AMR Comparison
Diesel Exhaust	Diesel Exhaust represents the exhaust from diesel engines. It is considered to have the potential to concentrate contaminants and be subject to wetting through condensation.	Diesel exhaust
Fuel Oil	Fuel Oil includes fuel oil for the emergency diesel generators and diesel-driven fire pumps. Water contamination of fuel oil is assumed.	Fuel oil
Lubricating Oil	Lubricating Oils are low to medium viscosity hydrocarbons used for bearing, gear, and engine lubrication. Water contamination of lubricating oil is assumed.	Lubricating oil
Raw Water	The Delaware River and ground water from wells provide the sources of raw water utilized by HCGS. Raw water is also rain or ground water. Raw water is water that has not been demineralized or chemically treated to any significant extent. For use in systems, the water has been rough filtered to remove large particles and may contain a biocide additive for control of micro- and macro-organisms. Raw water may contain contaminants. Drainage systems may be exposed to a variety of contaminated or untreated water that is thus classified as raw water for the determination of aging effects.	Raw water Water – standing Water – flowing
Reactor Coolant	Reactor Coolant is demineralized water used within the Reactor Coolant System. The Reactor Coolant environment also includes steam inside the reactor vessel. The temperature of the Reactor Coolant environment is assumed to be >482 °F. The Reactor Coolant environment is used only for Reactor Pressure Vessel and Reactor Internals components. Components in other systems that form a portion of the reactor coolant pressure boundary use the Treated Water environment. See the definition for Treated Water.	Reactor coolant
Reactor Coolant and Neutron Flux	The Reactor Coolant and Neutron Flux environment consists of the Reactor Coolant environment (defined above) in addition to component exposure to neutron fluence projected to exceed 1.0 x 10^{17} n/cm^2 within 60 years.	Reactor coolant Reactor coolant and neutron flux Reactor coolant >482°F and neutron flux

Hope Creek AMR Environment	Description	NUREG-1801 Environments Used For AMR Comparison
Sodium Pentaborate	Sodium Pentaborate solution is the liquid poison used in the Standby Liquid Control System.	Sodium pentaborate solution
Steam	The Steam environment consists of steam that is subject to chemistry controls set by the Water Chemistry Program.	Reactor coolant Steam Steam or treated water Treated water Treated water >140 °F
Treated Water	Treated water is demineralized water or chemically purified water and is the base water for all clean systems. Depending on the system, treated water may require further processing. Treated water may be deaerated and may include additives to protect reactor vessel internal and other reactor system components, and may include wet steam environments.	Reactor coolant Treated water Air – indoor uncontrolled or treated water
Treated Water >140°F	Treated Water >140 °F is Treated Water that has a temperature greater than 140 °F. This environment is identified when applicable for stainless steel components subject to cracking. Refer to the Treated Water environment definition for further details.	Air with reactor coolant leakage (Internal) or Reactor coolant Reactor coolant Treated water Treated water >140 °F (For cracking of stainless steel components) Steam
Treated Water >482°F	Treated Water >482 °F is Treated Water that has a temperature greater than 482 °F, and may include wet steam environments. This environment is selected for systems operating at temperatures >482°F and that contain Cast Austenitic Stainless Steel (CASS) components. Refer to the Treated Water environment definition for further details.	Reactor coolant Reactor coolant >482 °F Treated water >482 °F

Table 3.0-2 – Hope Creek External Service Environments

Hope Creek AMR Environment	Description	NUREG-1801 Environments Used For AMR Comparison
Adverse Local Environment	The Adverse Local Environment represents conditions with excessive heat, radiation, moisture, or voltage, sometimes in the presence of oxygen. The environmental conditions can be locally concentrated or applicable to a general plant area. This environment is used for electrical commodities.	Adverse localized environment
Air – Indoor (External)	Air - Indoor (External) consists of air environments that are in indoor locations and are sheltered/protected from weather. Humidity levels up to 100 percent are assumed and the surfaces of components in this environment might be wet. Additionally, this environment might 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 with steam or water leakage Air with reactor coolant leakage System temperature up to 550°F (applies to closure bolting) Soil (applies to structural cracking due to settlement) Various
Air – Outdoor (External)	Air – Outdoor (External) is atmospheric air with a temperature °F range of –34 °F to 110 °F and a relative humidity range of 10% to 100%. This environment is subject to periodic wetting and wind.	Air – outdoor Soil (applies to structural cracking due to settlement) Various System temperature up to 550°F (applies to closure bolting)
Concrete	Concrete is used for components that are embedded in concrete.	Concrete

Hope Creek AMR Environment	Description	NUREG-1801 Environments Used For AMR Comparison
Groundwater/soil	Groundwater is the water beneath the surface that can be collected with wells, tunnels, or drainage galleries, or that flows naturally to the earth's surface via seeps or springs. Soil is a mixture of inorganic materials produced by the weathering of rocks and clays, and organic material produced by the decomposition of vegetation. Voids containing air and moisture occupy ~50% of the soil volume. Concrete subjected to a groundwater/soil environment can be vulnerable to Increase in porosity and permeability, cracking, loss of material (spalling, scaling)/ aggressive chemical attack.	Groundwater/soil Soil Various
Soil	Soil is used for components that are buried in soil.	Soil
Water-flowing	Water that is refreshed, thus having larger impact on leaching; this can be rainwater, raw water, groundwater, or flowing water under a foundation.	Water-flowing Soil (applies to structural cracking due to settlement)
Water-standing	Water that is stagnant and unrefreshed, thus possibly resulting in an increased ionic strength of solution up to saturation.	Groundwater/soil Soil (applies to structural cracking due to settlement)

3.1 AGING MANAGEMENT OF REACTOR VESSEL, INTERNALS, AND REACTOR COOLANT SYSTEM

3.1.1 INTRODUCTION

This section provides the results of the aging management review for those components identified in Section 2.3.1, Reactor Vessel, Internals, and Reactor Coolant System, as being subject to aging management review. The systems, or portions of systems, which are addressed in this section are described in the indicated sections.

- Nuclear Boiler Instrumentation (2.3.1.3)
- Reactor Internals (2.3.1.4)
- Reactor Pressure Vessel (2.3.1.5)
- Reactor Recirculation System (2.3.1.6)

3.1.2 RESULTS

The following tables summarize the results of the aging management review for Reactor Vessel, Internals and Reactor Coolant System:

Table 3.1.2-1 Summary of Aging Management Evaluation – Nuclear Boiler Instrumentation

Table 3.1.2-2 Summary of Aging Management Evaluation – Reactor Internals

Table 3.1.2-3 Summary of Aging Management Evaluation – Reactor Pressure Vessel

Table 3.1.2-4 Summary of Aging Management Evaluation – Reactor Recirculation System

3.1.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

3.1.2.1.1 Nuclear Boiler Instrumentation

Materials

The materials of construction for the Nuclear Boiler Instrumentation components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel

Environments

The Nuclear Boiler Instrumentation components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Wetted
- Steam

- Treated Water
- Treated Water > 140 F

Aging Effects Requiring Management

The following aging effects associated with the Nuclear Boiler Instrumentation components require management:

- Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading
- Cumulative Fatigue Damage/Fatigue
- Loss of Material/General, Pitting, Crevice Corrosion, and Galvanic Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the the Nuclear Boiler Instrumentation components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1.1)
- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Small-Bore Class 1 Piping Inspection (B.2.2.6)
- TLAA
- Water Chemistry (B.2.1.2)

Table 3.1.2-1, Summary of Aging Management Evaluation – Nuclear Boiler Instrumentation summarizes the results of the aging management review for the Nuclear Boiler Instrumentation.

3.1.2.1.2 Reactor Internals

Materials

The materials of construction for the Reactor Internals components are:

- Cast Austenitic Stainless Steel (CASS)
- Nickel Alloy
- Stainless Steel
- Stainless Steel with Stellite Cladding

Environments

The Reactor Internals components are exposed to the following environments:

- Air - Indoor
- Reactor Coolant
- Reactor Coolant and Neutron Flux

Aging Effects Requiring Management

The following aging effects associated with the Reactor Internals components require management:

- Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, Irradiation-Assisted Stress Corrosion Cracking, and Flow-Induced Vibration
- Cumulative Fatigue Damage/Fatigue
- Loss of Fracture Toughness/Thermal Aging Embrittlement and Neutron Irradiation Embrittlement
- Loss of Preload/Stress Relaxation
- Loss of Material/Pitting and Crevice Corrosion

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Internals components:

- BWR Vessel Internals (B.2.1.9)
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) (B.2.1.10)
- TLAA
- Water Chemistry (B.2.1.2)

Table 3.1.2-2, Summary of Aging Management Evaluation – Reactor Internals summarizes the results of the aging management review for the Reactor Internals.

3.1.2.1.3 Reactor Pressure Vessel

Materials

The materials of construction for the Reactor Pressure Vessel components are:

- Carbon or Low Alloy Steel with Stainless Steel Cladding
- Carbon Steel
- Carbon and Low Alloy Steel Bolting

- High Strength Low Alloy Steel Bolting with Yield Strength of 150 ksi or Greater
- Low Alloy Steel
- Nickel Alloy
- Stainless Steel

Environments

The Reactor Pressure Vessel components are exposed to the following environments:

- Air-Indoor
- Reactor Coolant
- Reactor Coolant and Neutron Flux

Aging Effects Requiring Management

The following aging effects associated with the Reactor Pressure Vessel components require management:

- Cracking/Stress Corrosion Cracking and Cyclic Loading
- Cumulative Fatigue Damage/Fatigue
- Loss of Fracture Toughness/Neutron Irradiation Embrittlement
- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Pressure Vessel components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1.1)
- Bolting Integrity (B.2.1.12)
- BWR Control Rod Drive Return Line Nozzle (B.2.1.6)
- BWR Feedwater Nozzle (B.2.1.5)
- BWR Penetrations (B.2.1.8)
- BWR Stress Corrosion Cracking (B.2.1.7)
- BWR Vessel ID Attachment Welds (B.2.1.4)
- BWR Vessel Internals (B.2.1.9)
- External Surfaces Monitoring (B.2.1.25)
- One-Time Inspection (B.2.1.22)

- Reactor Head Closure Studs (B.2.1.3)
- Reactor Vessel Surveillance (B.2.1.21)
- TLAA
- Water Chemistry (B.2.1.2)

Table 3.1.2-3, Summary of Aging Management Evaluation – Reactor Pressure Vessel summarizes the results of the aging management review for the Reactor Pressure Vessel.

3.1.2.1.4 Reactor Recirculation System

Materials

The materials of construction for the Reactor Recirculation System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Cast Austenitic Stainless Steel (CASS)
- Glass
- Stainless Steel

Environments

The Reactor Recirculation System components are exposed to the following environments:

- Air - Indoor
- Treated Water
- Treated Water > 140 F
- Treated Water > 482 F

Aging Effects Requiring Management

The following aging effects associated with the Reactor Recirculation System components require management:

- Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading
- Cumulative Fatigue Damage/Fatigue
- Loss of Fracture Toughness/Thermal Aging Embrittlement
- Loss of Material/General, Pitting, Crevice Corrosion, and Galvanic Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Recirculation System components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1.1)
- Bolting Integrity (B.2.1.12)
- BWR Stress Corrosion Cracking (B.2.1.7)
- External Surfaces Monitoring (B.2.1.25)
- One-Time Inspection (B.2.1.22)
- Small-Bore Class 1 Piping Inspection (B.2.2.6)
- TLAA
- Water Chemistry (B.2.1.2)

Table 3.1.2-4, Summary of Aging Management Evaluation – Reactor Recirculation System summarizes the results of the aging management review for the Reactor Recirculation System.

3.1.2.2 AMR Results for Which Further Evaluation is Recommended by the GALL Report

NUREG-1801 provides the basis for identifying those programs that warrant further evaluation by the reviewer in the license renewal application. For the Reactor Vessel, Internals, and Reactor Coolant System, those programs are addressed in the following subsections.

3.1.2.2.1 Cumulative Fatigue Damage

Fatigue is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of metal fatigue as a TLAA for the Core Spray, Feedwater, High Pressure Coolant Injection, Main Steam, Nuclear Boiler Instrumentation, Reactor Core Isolation Cooling, Reactor Internals, Reactor Pressure Vessel, Reactor Recirculation, Reactor Water Cleanup, and Residual Heat Removal Systems is discussed in Section 4.3.

Item Numbers 3.1.1-6, 3.1.1-7, 3.1.1-8, 3.1.1-9, and 3.1.1-10 are applicable to PWRs only and are not used for Hope Creek.

3.1.2.2.2 Loss of Material due to General, Pitting, and Crevice Corrosion

1. *Loss of material due to general, pitting, and crevice corrosion could occur in the steel PWR steam generator shell assembly exposed to secondary feedwater and steam. Loss of material due to general, pitting, and crevice corrosion could also occur for the steel top head enclosure (without cladding) top head nozzles [vent, top head spray or reactor core isolation cooling (RCIC), and spare] exposed to reactor coolant. The existing program relies on control of reactor water chemistry to*

mitigate corrosion. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to general, pitting and crevice corrosion of the carbon and low alloy steel for reactor vessel nozzles (head spray, head vent, spare, bottom head drain, feedwater, instrumentation, low pressure coolant injection, main steam, seal leak detection), nozzle safe ends and welds (core spray, feedwater, head spray, low pressure coolant injection, seal leak detection), reactor vessel internal attachments, reactor vessel top head and flange and reactor coolant pressure boundary components exposed to reactor coolant in the Reactor Pressure Vessel. The One-Time Inspection and Water Chemistry programs are described in Appendix B.

Item Number 3.1.1-12 is applicable to PWRs only and is not used for Hope Creek.

2. *Loss of material due to pitting and crevice corrosion could occur in stainless steel BWR isolation condenser components exposed to reactor coolant. Loss of material due to general, pitting, and crevice corrosion could occur in steel BWR isolation condenser components. The existing program relies on control of reactor water chemistry to mitigate corrosion. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.*

   Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to general, pitting and crevice corrosion of the carbon steel piping and fittings exposed to treated water and steam in the Core Spray, Feedwater, High Pressure Coolant Injection, Main Steam, Nuclear Boiler Instrumentation, Reactor Core Isolation Cooling, Reactor Recirculation, Reactor Water Cleanup, and Residual Heat Removal Systems. Hope Creek does not have Isolation Condensers. The One-Time Inspection and Water Chemistry programs are described in Appendix B.

3. *Loss of material due to pitting and crevice corrosion could occur for stainless steel, nickel alloy, and steel with stainless steel or nickel alloy cladding flanges, nozzles,*

penetrations, pressure housings, safe ends, and vessel shells, heads and welds exposed to reactor coolant. The existing program relies on control of reactor water chemistry to mitigate corrosion. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to pitting and crevice corrosion of the stainless steel, cast austenitic stainless steel, nickel-alloy, and steel with stainless steel cladding for reactor vessel flange, nozzles, penetrations, safe ends, thermal sleeves, vessel shells, heads, welds, and reactor coolant pressure boundary components including piping, piping elements and piping components exposed to treated water and steam in the Core Spray, High Pressure Coolant Injection, Main Steam, Nuclear Boiler Instrumentation, Process and Post-Accident Sampling, Reactor Core Isolation Cooling, Reactor Pressure Vessel, Reactor Recirculation, Reactor Water Cleanup, Residual Heat Removal, and Standby Liquid Control Systems. The One-Time Inspection and Water Chemistry programs are described in Appendix B.

4. Item Number 3.1.1-16 is applicable to PWRs only and is not used for Hope Creek.

3.1.2.2.3 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement

1. *Neutron irradiation embrittlement is a TLAA to be evaluated for the period of extended operation for all ferritic materials that have a neutron fluence greater than 10^{17} n/cm2 (E >1 MeV) at the end of the license renewal term. Certain aspects of neutron irradiation embrittlement are TLAAs as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). This TLAA is addressed separately in Section 4.2, "Reactor Vessel Neutron Embrittlement Analysis," of this SRP-LR.*

   Neutron irradiation embrittlement is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of neutron irradiation embrittlement as a TLAA for the Reactor Pressure Vessel is discussed in Section 4.2.

2. *Loss of fracture toughness due to neutron irradiation embrittlement could occur in BWR and PWR reactor vessel beltline shell, nozzle, and welds exposed to reactor coolant and neutron flux. A reactor vessel materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. Reactor vessel surveillance program is plant-specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In*

accordance with 10 CFR Part 50, Appendix H, an applicant is required to submit its proposed withdrawal schedule for approval prior to implementation. Untested capsules placed in storage must be maintained for future insertion. Thus, further staff evaluation is required for license renewal. Specific recommendations for an acceptable AMP are provided in Chapter XI, Section M31 of the GALL Report.

Hope Creek will use the Reactor Vessel Surveillance program, B.2.1.21, to manage the loss of fracture toughness due to neutron irradiation embrittlement of the steel with stainless steel cladding for the reactor vessel shell exposed to reactor coolant and neutron flux. The Hope Creek Reactor Vessel Surveillance program relies on the BWR Integrated Surveillance Program (ISP) and satisfies the requirements of 10 CFR 50, Appendix H. The Reactor Vessel Surveillance aging management program includes periodic testing of metallurgical surveillance samples to monitor the progress of neutron embrittlement of the reactor pressure vessel as a function of neutron fluence, in accordance with Regulatory Guide (RG) 1.99, "Radiation Embrittlement of Reactor Vessel Materials," Revision 2. BWRVIP-116 identifies and schedules additional capsules to be withdrawn and tested during the license renewal period. Hope Creek will continue using the Integrated Surveillance Program during the period of extended operation by implementing the requirements of BWRVIP-116. The Reactor Vessel Surveillance program will adequately identify, evaluate, and manage the effects of loss of fracture toughness due to neutron irradiation embrittlement of the steel with stainless steel cladding of the reactor vessel to ensure there is no loss of intended function during the period of extended operation. The Reactor Vessel Surveillance program is described in Appendix B.

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 could occur in the stainless steel and nickel alloy BWR top head enclosure vessel flange leak detection lines. The GALL Report recommends that a plant-specific AMP be evaluated because existing programs may not be capable of mitigating or detecting cracking due to SCC and IGSCC. Acceptance criteria are described in Branch Technical Position RLSB-1.*

   Hope Creek will use ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program, B.2.1.1, and Water Chemistry, B.2.1.2, to manage the effects of stress corrosion cracking in the stainless steel vessel flange leak detection line exposed to treated water. The head seal leak detection line is evaluated in the Main Steam System under the Steam and Power Conversion Systems grouping. The Hope Creek ISI Program, as discusssed in an approved relief request, utilizes a VT-2 visual examination on the line prior to reactor cavity drain down during each refueling outage. The Water Chemistry program activities provide for monitoring and controlling of water chemistry in accordance with EPRI BWR Vessel and Internals Project BWR Water Chemistry Guidelines. The Water Chemistry program activities prevent or mitigate loss of material, reduction of heat transfer and cracking aging effects to ensure there is no loss of component intended function. The ISI examinations together with the Water Chemistry program will adequately identify, evaluate, and manage the effects of stress corrosion cracking in the stainless steel vessel flange leak detection line to ensure there is no loss of intended function during the period of extended operation. The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and Water Chemistry programs are described in Appendix B.

2. *Cracking due to SCC and IGSCC could occur in stainless steel BWR isolation condenser components exposed to reactor coolant. The existing program relies on control of reactor water chemistry to mitigate SCC and on ASME Section XI ISI. However, the existing program should be augmented to detect cracking due to SCC and IGSCC. The GALL Report recommends an augmented program to include temperature and radioactivity monitoring of the shell-side water, and eddy current testing of tubes to ensure that the component's intended function will be maintained during the period of extended operation. Acceptance criteria are described in Branch Technical Position RLSB-1.*

   Item Number 3.1.1-20 is not applicable to Hope Creek. The item applies only to Isolation Condenser components. Hope Creek does not have Isolation Condensers.

3.1.2.2.5 Crack Growth due to Cyclic Loading

Item Number 3.1.1-21 is applicable to PWRs only and is not used for Hope Creek.

3.1.2.2.6 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement and Void Swelling

Item Number 3.1.1-22 is applicable to PWRs only and is not used for Hope Creek.

3.1.2.2.7 Cracking due to Stress Corrosion Cracking

1. Item Number 3.1.1-23 is applicable to PWRs only and is not used for Hope Creek.

2. Item Number 3.1.1-24 is applicable to PWRs only and is not used for Hope Creek.

3.1.2.2.8 Cracking due to Cyclic Loading

1. *Cracking due to cyclic loading could occur in the stainless steel BWR jet pump sensing lines. The GALL Report recommends that a plant specific AMP be evaluated to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.*

   Item Number 3.1.1-25 is not applicable to Hope Creek. The stainless steel jet pump sensing lines internal to the reactor vessel are not required to support intended functions and are not included within the scope of license renewal. A safety assessment for these components has been performed and reported in BWRVIP-06. The evaluation concluded that these components do not perform a safety related function. This report also concluded that failure of these components will not result in consequential failure of any safety related equipment. The lines outside of the vessel are not subjected to flow-induced vibration, but are part of the reactor coolant pressure boundary and are subject to aging managment review. Cracking due to stress corrosion cracking and thermal and mechanical loading of the stainless steel lines external to the reactor vessel is addressed by item 3.1.1-48 of Table 3.1.1.

2. *Cracking due to cyclic loading could occur in steel and stainless steel BWR isolation condenser components exposed to reactor coolant. The existing program relies on ASME Section XI ISI. However, the existing program should be augmented to detect cracking due to cyclic loading. The GALL Report recommends an augmented program to include temperature and radioactivity monitoring of the shell-side water, and eddy current testing of tubes to ensure that the component's intended function will be maintained during the period of extended operation. Acceptance criteria are described in Branch Technical Position RLSB-1.*

   Item Number 3.1.1-26 is not applicable to Hope Creek. The item applies only to Isolation Condenser components. Hope Creek does not have Isolation Condensers.

3.1.2.2.9 Loss of Preload due to Stress Relaxation

Item Number 3.1.1-27 is applicable to PWRs only and is not used for Hope Creek.

3.1.2.2.10 Loss of Material due to Erosion

Item Number 3.1.1-28 is applicable to PWRs only and is not used for Hope Creek.

3.1.2.2.11 Cracking due to Flow-Induced Vibration

Cracking due to flow-induced vibration could occur for the BWR stainless steel steam dryers exposed to reactor coolant. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

Hope Creek will use the BWR Vessel Internals program, B.2.1.9, to manage the effects of cracking due to flow-induced vibration of the cast austenitic stainless steel and stainless steel for the steam dryers exposed to reactor coolant in the Reactor Internals. The BWR Vessel Internals program inspects, evaluates, and repairs flaws, in accordance with the guidelines provided in BWRVIP-139, BWR Vessel and Internals Project Steam Dryer Inspection and Flaw Evaluation. Following the guidelines in BWRVIP-139 will adequately identify, evaluate, and manage the effects of cracking due to flow-induced vibration of the cast austenitic stainless steel and stainless steel for the steam dryers to ensure there is no loss of intended function during the period of extended operation. The BWR Vessel Internals program is described in Appendix B.

3.1.2.2.12 Cracking due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking (IASCC)

Item Number 3.1.1-30 is applicable to PWRs only and is not used for Hope Creek.

3.1.2.2.13 Cracking due to Primary Water Stress Corrosion Cracking (PWSCC)

Item Number 3.1.1-31 is applicable to PWRs only and is not used for Hope Creek.

3.1.2.2.14 Wall Thinning due to Flow-Accelerated Corrosion

Item Number 3.1.1-32 is applicable to PWRs only and is not used for Hope Creek.

3.1.2.2.15 Changes in Dimensions due to Void Swelling

Item Number 3.1.1-33 is applicable to PWRs only and is not used for Hope Creek.

3.1.2.2.16 Cracking due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking

1. Item Numbers 3.1.1-34 and 3.1.1-35 are applicable to PWRs only and are not used for Hope Creek.

2. Item Number 3.1.1-36 is applicable to PWRs only and is not used for Hope Creek.

3.1.2.2.17 Cracking due to Stress Corrosion Cracking, Primary Water Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking

Item Number 3.1.1-37 is applicable to PWRs only and is not used for Hope Creek.

3.1.2.2.18 Quality Assurance for Aging Management of Nonsafety-Related Components

QA provisions applicable to License Renewal are discussed in Section B.1.3.

3.1.2.3 Time-Limited Aging Analysis

The time-limited aging analyses identified below are associated with the Reactor Vessel, Internals, and Reactor Coolant System components:

- Section 4.2, Neutron Embrittlement of the Reactor Vessel and Internals
- Section 4.3, Metal Fatigue of the Reactor Pressure Vessel, Internals, and Reactor Coolant Pressure Boundary Piping and Components

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 54.4. The aging management programs selected to manage aging effects for the Reactor Vessel, Internals, and Reactor Coolant System components are identified in the summaries in Section 3.1.2.1 above.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the conclusions provided in Appendix B, the effects of aging associated with the Reactor Vessel, Internals, and Reactor Coolant System components will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-1	Steel pressure vessel support skirt and attachment welds	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue is a TLAA; further evaluation is documented in Subsection 3.1.2.2.1.
3.1.1-2	Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor vessel components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes, TLAA	Fatigue is a TLAA; further evaluation is documented in Subsection 3.1.2.2.1.
3.1.1-3	Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor coolant pressure boundary piping, piping components, and piping elements exposed to reactor coolant	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes, TLAA	Fatigue is a TLAA; further evaluation is documented in Subsection 3.1.2.2.1.

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-4	Steel pump and valve closure bolting	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) check Code limits for allowable cycles (less than 7000 cycles) of thermal stress range	Yes, TLAA	Fatigue is a TLAA; further evaluation is documented in Subsection 3.1.2.2.1.
3.1.1-5	Stainless steel and nickel alloy reactor vessel internals components	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue is a TLAA; further evaluation is documented in Subsection 3.1.2.2.1.
3.1.1-6	PWR Only				
3.1.1-7	PWR Only				
3.1.1-8	PWR Only				
3.1.1-9	PWR Only				
3.1.1-10	PWR Only				

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-11	Steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and spare) exposed to reactor coolant	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to general, pitting and crevice corrosion of the carbon and low alloy steel for the reactor vessel nozzles, nozzle safe ends and welds, reactor coolant pressure boundary components, reactor vessel internal attachments and reactor vessel top head and flange exposed to reactor coolant. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See subsection 3.1.2.2.2.1.
3.1.1-12	PWR Only				

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-13	Steel and stainless steel isolation condenser components exposed to reactor coolant	Loss of material due to general (steel only), pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to general, pitting and crevice corrosion of the carbon steel piping, piping elements and piping components exposed to treated water and steam. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See subsection 3.1.2.2.2.2.

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-14	Stainless steel, nickel-alloy, and steel with nickel-alloy or stainless steel cladding reactor vessel flanges, nozzles, penetrations, safe ends, vessel shells, heads and welds	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to pitting and crevice corrosion of the stainless steel, nickel-alloy and steel with stainless steel cladding for the reactor vessel flange, nozzles, penetrations, safe ends, thermal sleeves, vessel shells, heads, welds, and reactor coolant pressure boundary components exposed to reactor coolant. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See subsection 3.1.2.2.2.3.

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-15	Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to pitting and crevice corrosion of the stainless steel, and cast austenitic stainless steel for the piping, piping elements and piping components exposed to treated water and steam. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See subsection 3.1.2.2.2.3.
3.1.1-16	PWR Only				

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-17	Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with Appendix G of 10 CFR 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	Loss of fracture toughness due to neutron irradiation embrittlement is a TLAA; further evaluation is documented in Subsection 3.1.2.2.3.1.
3.1.1-18	Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds; safety injection nozzles	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor Vessel Surveillance	Yes, plant specific	The Reactor Vessel Surveillance program, B.2.1.21, will be used to manage the loss of fracture toughness due to neutron irradiation embrittlement of the steel with stainless steel cladding for the reactor vessel shell exposed to reactor coolant and neutron flux. See Subsection 3.1.2.2.3.2.

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-19	Stainless steel and nickel alloy top head enclosure vessel flange leak detection line	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	A plant-specific aging management program is to be evaluated.	Yes, plant specific	The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program, B.2.1.1, and Water Chemistry, B.2.1.2, will be used to manage the effects of stress corrosion cracking of the stainless steel for the vessel flange leak detection line exposed to treated water. See subsection 3.1.2.2.4.1.
3.1.1-20	Stainless steel isolation condenser components exposed to reactor coolant	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and plant-specific verification program	Yes, detection of aging effects is to be evaluated	Not applicable. See subsection 3.1.2.2.4.2
3.1.1-21	PWR Only				
3.1.1-22	PWR Only				
3.1.1-23	PWR Only				
3.1.1-24	PWR Only				

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-25	Stainless steel jet pump sensing line	Cracking due to cyclic loading	A plant-specific aging management program is to be evaluated.	Yes, plant specific	Not applicable. See subsection 3.1.2.2.8.1
3.1.1-26	Steel and stainless steel isolation condenser components exposed to reactor coolant	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD) and plant-specific verification program	Yes, detection of aging effects is to be evaluated	Not applicable. See subsection 3.1.2.2.8.2
3.1.1-27	PWR Only				
3.1.1-28	PWR Only				
3.1.1-29	Stainless steel steam dryers exposed to reactor coolant	Cracking due to flow-induced vibration	A plant-specific aging management program is to be evaluated.	Yes, plant specific	The BWR Vessel Internals program, B.2.1.9, will be used to manage the effects of cracking due to flow-induced vibration of the cast austenitic stainless steel and stainless steel for the steam dryers exposed to reactor coolant. See subsection 3.1.2.2.11.
3.1.1-30	PWR Only				
3.1.1-31	PWR Only				

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-32	PWR Only				
3.1.1-33	PWR Only				
3.1.1-34	PWR Only				
3.1.1-35	PWR Only				
3.1.1-36	PWR Only				
3.1.1-37	PWR Only				
3.1.1-38	Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant	Cracking due to cyclic loading	BWR CR Drive Return Line Nozzle	No	Consistent with NUREG-1801. The BWR Control Rod Drive Return Line Nozzle program, B.2.1.6, will be used to manage cracking due to cyclic loading of the steel with stainless steel cladding control rod drive return line nozzle exposed to reactor coolant in the Reactor Pressure Vessel.
3.1.1-39	Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant	Cracking due to cyclic loading	BWR Feedwater Nozzle	No	Consistent with NUREG-1801. The BWR Feedwater Nozzle program, B.2.1.5, will be used to manage cracking due to cyclic loading of the low alloy steel feedwater nozzles exposed to reactor coolant in the Reactor Pressure Vessel.

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-40	Stainless steel and nickel alloy penetrations for control rod drive stub tubes instrumentation, jet pump instrument, standby liquid control, flux monitor, and drain line exposed to reactor coolant	Cracking due to stress corrosion cracking, Intergranular stress corrosion cracking, cyclic loading	BWR Penetrations and Water Chemistry	No	Consistent with NUREG-1801 with exceptions. The BWR Penetrations, B.2.1.8, and Water Chemistry, B.2.1.2, will be used to manage cracking due to stress corrosion cracking of the nickel alloy welds on nozzles exposed to reactor coolant in the Reactor Pressure Vessel. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation.
3.1.1-41	Stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to 4 NPS; nozzle safe ends and associated welds	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Consistent with NUREG-1801 with exceptions. The BWR Stress Corrosion Cracking program, B.2.1.7, and Water Chemistry, B.2.1.2, will be used to manage cracking due to stress corrosion cracking of the cast austenitic stainless steel, stainless steel, and nickel alloy for the nozzle safe ends and welds, piping, piping elements and piping components, and reactor coolant pressure boundary components exposed to reactor coolant, treated water and steam in the Reactor Pressure Vessel, and Reactor Recirculation System. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. Components in the Reactor Pressure Vessel,

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					and Reactor Recirculation System have been aligned to this item number based on material, environment and aging effect. The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD, B.2.1.1, program will be substituted to manage cracking due to stress corrosion cracking of the steel with stainless steel cladding, stainless steel, and nickel alloy for nozzles (CRD return, core spray, jet pump instrumentation, recirculation inlet and outlet), penetrations (stub tubes, incore housings), and the reactor vessel bottom head, shell and shell flange exposed to reactor coolant. Components in the Main Steam System have been aligned to this item number based on material, environment and aging effect. The Water Chemistry, B.2.1.2, program will be used to manage cracking due to stress corrosion cracking of the cast austenitic stainless steel for the Class 1 flow element exposed to treated water for this system.

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-42	Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Vessel ID Attachment Welds and Water Chemistry	No	Consistent with NUREG-1801 with exceptions. The BWR Vessel ID Attachment Welds, B.2.1.4, and Water Chemistry, B.2.1.2, programs will be used to manage cracking due to stress corrosion cracking of the nickel alloy and stainless steel vessel attachment welds exposed to reactor coolant in the Reactor Pressure Vessel. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation.
3.1.1-43	Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Vessel Internals and Water Chemistry	No	Consistent with NUREG-1801 with exceptions. The BWR Vessel Internals, B.2.1.9, and Water Chemistry, B.2.1.2, will be used to manage cracking due to stress corrosion cracking and intergranular stress corrosion cracking of the cast austenitic stainless steel and stainless steel for the control rod drive housings and control rod guide tubes exposed to a reactor coolant environment in the Reactor Internals. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation.

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-44	Stainless steel and nickel alloy core shroud, core plate, core plate bolts, support structure, top guide, core spray lines, spargers, jet pump assemblies, control rod drive housing, nuclear instrumentation guide tubes	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	BWR Vessel Internals and Water Chemistry	No	Consistent with NUREG-1801 with exceptions. The BWR Vessel Internals, B.2.1.9, and Water Chemistry, B.2.1.2, will be used to manage cracking due to stress corrosion cracking, intergranular stress corrosion cracking and irradiation-assisted stress corrosion cracking of the cast austenitic stainless steel, stainless steel and nickel alloy for the core shroud, core plate, core plate bolts, support structure, top guide, core spray lines, spargers, jet pump assemblies, control rod drive housing, nuclear instrumentation guide tubes, dry tubes monitor housings, orificed fuel supports and steam dryers exposed to reactor coolant and reactor coolant and neutron flux in the Reactor Internals. The combined programs are also credited to manage cracking due to stress corrosion cracking of the stainless steel for the thermal sleeves associated with the core spray, feedwater, low pressure coolant injection, and reactor recirculation inlet nozzles exposed to reactor coolant and reactor coolant and neutron flux in the Reactor Pressure Vessel. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation.

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-45	Steel piping, piping components, and piping elements exposed to reactor coolant	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Consistent with NUREG-1801. The Flow-Accelerated Corrosion program, B.2.1.11, will be used to manage wall thinning due to flow-accelerated corrosion of the carbon steel Class 1 piping, fittings, branch connections and valve bodies exposed to treated water and steam in the Feedwater, Main Steam, and Reactor Water Cleanup Systems.
3.1.1-46	Nickel alloy core shroud and core plate access hole cover (mechanical covers)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not Applicable. The Hope Creek access hole covers are of a welded design, not a mechanical (bolted) design and are addressed under item 3.1.1-49 in this table.
3.1.1-47	Stainless steel and nickel-alloy reactor vessel internals exposed to reactor coolant	Loss of material due to pitting and crevice corrosion	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Consistent with NUREG-1801 with exceptions. The BWR Vessel Internals, B.2.1.9, and Water Chemistry program, B.2.1.2, will be used to manage the loss of material due to pitting and crevice corrosion of the cast austenitic stainless steel, stainless steel and nickel alloy for the reactor vessel internals exposed to reactor coolant and reactor coolant and neutron flux. Exceptions apply to the NUREG-1801

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					recommendations for Water Chemistry program implementation. Components in the Reactor Internals have been aligned to this item number based on material, environment and aging effect. The BWR Vessel Internals, B.2.1.9, program will be substituted to manage the loss of material due to pitting and crevice corrosion of the cast austenitic stainless steel, stainless steel and nickel alloy for the reactor vessel internals exposed to reactor coolant and reactor coolant and neutron flux.
3.1.1-48	Steel and stainless steel Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking (for stainless steel only), and thermal and mechanical loading	Inservice Inspection (IWB, IWC, and IWD), Water chemistry, and One-Time Inspection of ASME Code Class 1 Small-bore Piping	No	Consistent with NUREG-1801 with exceptions. The ASME Section XI Inservice Inspection program, Subsections IWB, IWC, and IWD, B.2.1.1, and Water Chemistry program, B.2.1.2, will be used to manage cracking due to stress corrosion cracking (stainless steel), and thermal and mechanical loading of the steel and stainless steel for the Class 1 piping, fittings, and branch connections < NPS 4" exposed to treated water and steam. These components are in the Core Spray, Feedwater, High Pressure Coolant Injection, Main Steam, Nuclear Boiler Instrumentation, Reactor Core Isolation Cooling, Reactor Recirculation, Reactor Water Cleanup, Residual Heat Removal and Standby Liquid Control

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Systems. Hope Creek has experienced cracking of ASME Code Class 1 small-bore piping resulting from thermal and mechanical cyclic loading. Because of this, the Small-Bore Class 1 Piping Inspection, B.2.2.6, is credited to manage cracking due to thermal and mechanical loading of Class 1 small-bore piping in lieu of the NUREG-1801 program XI.M35, "One Time Inspection of ASME Code Class 1 Small-Bore Piping" Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. Components in the Core Spray, Feedwater, High Pressure Coolant Injection, Main Steam, Nuclear Boiler Instrumentation, Reactor Core Isolation Cooling, Reactor Recirculation, Reactor Water Cleanup, Residual Heat Removal and Standby Liquid Control Systems have been aligned to this item number based on material, environment and aging effect. The ASME Section XI Inservice Inspection program, Subsections IWB, IWC, and IWD, B.2.1.1, the Water Chemistry program, B.2.1.2, will be used and the Small-Bore Class 1 Piping Inspection program B.2.2.6 will be substituted to manage cracking due to stress corrosion

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					cracking (stainless steel), and thermal and mechanical loading of the steel and stainless steel for the Class 1 piping, fittings, and branch connections < NPS 4" exposed to treated water and steam. Components in the Core Spray, High Pressure Coolant Injection, Main Steam, Nuclear Boiler Instrumentation, Reactor Core Isolation Cooling, Reactor Recirculation, Reactor Water Cleanup, Residual Heat Removal and Standby Liquid Control Systems have been aligned to this item number based on material, environment and aging effect. The ASME Section XI Inservice Inspection program, Subsections IWB, IWC, and IWD, B.2.1.1, and the Water Chemistry program, B.2.1.2 will be substituted to manage cracking due to stress corrosion cracking of the stainless steel piping elements and piping components (condensing chambers, flow devices, restricting orifices, thermowells, and valve bodies) exposed to treated water and steam.
3.1.1-49	Nickel alloy core shroud and core plate access hole cover (welded covers)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and, for BWRs with a crevice in the	No	Consistent with NUREG-1801 with exceptions. The BWR Vessel Internals, B.2.1.9, and Water Chemistry, B.2.1.2, programs will be used to manage cracking due to stress corrosion cracking, intergranular stress corrosion cracking,

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
		stress corrosion cracking	access hole covers, augmented inspection using UT or other demonstrated acceptable inspection of the access hole cover welds		irradiation-assisted stress corrosion cracking of the nickel alloy core shroud and core plate access hole cover (welded covers) exposed to reactor coolant in the Reactor Internals. The access hole covers at Hope Creek are of the non-creviced design. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. Components in the Reactor Internals have been aligned to this item number based on material, environment and aging effect. The BWR Vessel Internals program, B.2.1.9, will be substituted to manage cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking of the nickel alloy core shroud and core plate access hole cover (welded covers) exposed to reactor coolant in the Reactor Internals.

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-50	High-strength low alloy steel top head closure studs and nuts exposed to air with reactor coolant leakage	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	Reactor Head Closure Studs	No	Consistent with NUREG-1801. The Reactor Head Closure Studs program, B.2.1.3, will be used to manage cracking due to stress corrosion cracking of the high-strength low alloy steel bolting with yield strength of 150 ksi or greater for the reactor head closure studs exposed to air in the Reactor Pressure Vessel.
3.1.1-51	Cast austenitic stainless steel jet pump assembly castings; orificed fuel support	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of CASS	No	Consistent with NUREG-1801. The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) program, B.2.1.10, will be used to manage loss of fracture toughness due to thermal aging and neutron irradiation embrittlement of the cast austenitic stainless steel for the jet pump assemblies, core spray lines, spray rings, spray nozzles and thermal sleeves, control rod guide tubes, orificed fuel supports, and steam dryers exposed to reactor coolant and reactor coolant and neutron flux in the Reactor Internals.
3.1.1-52	Steel and stainless steel reactor coolant pressure boundary (RCPB) pump and valve closure bolting, manway and holding bolting, flange bolting, and closure bolting in high-	Cracking due to stress corrosion cracking, loss of material due to wear, loss of preload due to thermal effects, gasket	Bolting Integrity	No	Consistent with NUREG-1801 with exceptions. The Bolting Integrity program, B.2.1.7, will be used to manage the loss of preload due to thermal effects, gasket creep, and self-loosening of the carbon and low alloy steel, and stainless steel bolting exposed to air in the Condensate Storage

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	pressure and high-temperature systems	creep, and self-loosening			and Transfer, Core Spray, Feedwater, Fire Protection, Fuel Pool Cooling and Cleanup, High Pressure Coolant Injection, Hydrogen and Oxygen Analyzer, Main Steam, Nuclear Boiler Instrumentation, Process and Post-Accident Sampling, Reactor Core Isolation Cooling, Reactor Pressure Vessel, Reactor Recirculation, Reactor Water Cleanup, Residual Heat Removal, Service Water, Standby Diesel Generators and Auxiliary, and Standby Liquid Control Systems. Exceptions apply to the NUREG-1801 recommendations for the Bolting Integrity program implementation. Components in the Cranes & Hoists and Fuel Handling and Storage Systems have been aligned to this item number based on material, environment and aging effect. The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program, B.2.1.15, will be substituted to manage loss of preload due to self-loosening of the carbon and low alloy steel and stainless steel bolting for these systems and/or structures. Components in the Primary Containment have been aligned to this item number based on material, environment and aging effect. The Structures Monitoring program, B.2.1.32,

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					will be substituted to manage loss of preload due to self-loosening of the stainless steel structural bolting for the Primary Containment.
3.1.1-53	Steel piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to general, pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable. There is no steel piping, piping components, or piping elements exposed to closed cycle cooling water in Nuclear Boiler Instrumentation, Reactor Internals, Reactor Pressure Vessel, and the Reactor Recirculation System.
3.1.1-54	Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable. There are no copper alloy piping, piping components, or piping elements exposed to closed cycle cooling water in Nuclear Boiler Instrumentation, Reactor Internals, Reactor Pressure Vessel, and the Reactor Recirculation System.

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-55	Cast austenitic stainless steel Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant >250°C (>482°F)	Loss of fracture toughness due to thermal aging embrittlement	Inservice inspection (IWB, IWC, and IWD). Thermal aging susceptibility screening is not necessary, inservice inspection requirements are sufficient for managing these aging effects. ASME Code Case N-481 also provides an alternative for pump casings.	No	Consistent with NUREG-1801. The ASME Section XI Inservice Inspection program, Subsections IWB, IWC, and IWD, B.2.1.1, will be used to manage the loss of fracture toughness due to thermal aging embrittlement in cast austenitic stainless steel Class 1 pump casings and valve bodies exposed to treated water >482°F in the Reactor Recirculation System.
3.1.1-56	Copper alloy >15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable. There are no copper alloy >15% Zn piping, piping components, or piping elements exposed to closed cycle cooling water in Nuclear Boiler Instrumentation, Reactor Internals, Reactor Pressure Vessel, and the Reactor Recirculation System.
3.1.1-57	Cast austenitic stainless steel Class 1 piping, piping component, and piping elements and control rod drive pressure housings	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable. With the exception of the Class 1 pump casings and valve bodies, and reactor internals components, there are no other CASS piping, piping components, or piping elements in Nuclear Boiler

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	exposed to reactor coolant >250°C (>482°F)				Instrumentation, Reactor Internals, Reactor Pressure Vessel, and the Reactor Recirculation System exposed to reactor coolant >250°C (>482°F) that require aging management for loss of fracture toughness due to thermal aging embrittlement. The loss of fracture toughness due to thermal aging embrittlement in CASS Class 1 pump casings and valve bodies is addressed by Item number 3.1.1-55. The loss of fracture toughness due to thermal aging and neutron irradiation embrittlement of CASS for the reactor internals components is addressed by Item number 3.1.1-51. The Class 1 CASS flow restrictor nozzles in the Main Steam System are not susceptible thermal embrittlement because the nozzles were cast by a centrifugal casting method using low molybdenum stainless material (SA 351 CF8). In accordance with the guidance provided in the NUREG 1801, Volume 2., Section XI.M12, the centrifugally cast, low molybdenum CASS portion of the flow restrictors is not susceptible to thermal aging embrittlement.
3.1.1-58	PWR Only				

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-59	PWR Only				
3.1.1-60	PWR Only				
3.1.1-61	PWR Only				
3.1.1-62	PWR Only				
3.1.1-63	PWR Only				
3.1.1-64	PWR Only				
3.1.1-65	PWR Only				
3.1.1-66	PWR Only				
3.1.1-67	PWR Only				
3.1.1-68	PWR Only				
3.1.1-69	PWR Only				
3.1.1-70	PWR Only				
3.1.1-71	PWR Only				

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
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	PWR Only				
3.1.1-80	PWR Only				
3.1.1-81	PWR Only				
3.1.1-82	PWR Only				
3.1.1-83	PWR Only				
3.1.1-84	PWR Only				

Table 3.1.1 Summary of Aging Management Evaluations for the Reactor Vessel, Internals, and Reactor Coolant System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.1.1-85	Nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.1.1-86	Stainless steel piping, piping components, and piping elements exposed to air – indoor uncontrolled (External); air with borated water leakage; concrete; gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.1.1-87	Steel piping, piping components, and piping elements in concrete	None	None	NA - No AEM or AMP	Not applicable. There is no steel piping, piping components, and piping elements exposed to concrete in Nuclear Boiler Instrumentation, Reactor Internals, Reactor Pressure Vessel, and the Reactor Recirculation System.

Table 3.1.2-1
Nuclear Boiler Instrumentation
Summary of Aging Management Evaluation

Table 3.1.2-1 Nuclear Boiler Instrumentation

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-11	3.1.1-4	A, 1
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cracking/Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cracking/Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 2

Table 3.1.2-1 Nuclear Boiler Instrumentation (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cracking/Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B

Table 3.1.2-1 Nuclear Boiler Instrumentation (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B

Table 3.1.2-1 Nuclear Boiler Instrumentation (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Table 3.1.2-1 Nuclear Boiler Instrumentation (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C

Table 3.1.2-1 Nuclear Boiler Instrumentation (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 4
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Table 3.1.2-1 Nuclear Boiler Instrumentation (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Valve Body	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Valve Body	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 4
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The TLAA designation in the Aging Management Program column indicates fatigue of this component is evaluated in Section 4.3.

2. The NUREG-1801 "One-Time Inspection of ASME Code Class 1 Small-Bore Piping" aging management program is applicable only to plants that have not experienced cracking of ASME Code Class 1 small-bore piping. Based on previous Hope Creek operating experience with Class 1 small-bore pipe cracking, a new plant-specific periodic inspection program will be used. The "Small-Bore Class 1 Piping Inspection" aging management program is a plant-specific periodic program that will be implemented to manage cracking by periodic volumetric examinations of small-bore Class 1 piping.

3. The Water Chemistry and ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD aging management programs will be used to manage the aging effect of cracking in restricting orifices, condensing chambers, and valve bodies <NPS 4".

4. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.1.2-2
Reactor Internals
Summary of Aging Management Evaluation

Table 3.1.2-2 Reactor Internals

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Core Shroud and Core Plate (Access hole cover-welded covers)	Structural Support to maintain core configuration and flow distribution	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-5	3.1.1-49	E, 1
Core Shroud and Core Plate (Access hole cover-welded covers)	Structural Support to maintain core configuration and flow distribution	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-5	3.1.1-49	B
Core Shroud and Core Plate (Access hole cover-welded covers)	Structural Support to maintain core configuration and flow distribution	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Core Shroud and Core Plate (Access hole cover-welded covers)	Structural Support to maintain core configuration and flow distribution	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Core Shroud and Core Plate (Access hole cover-welded covers)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Core Shroud and Core Plate (Access hole cover-welded covers)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Pressure Boundary	Nickel Alloy	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals			F
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Pressure Boundary	Nickel Alloy	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry			F
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Pressure Boundary	Nickel Alloy	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Pressure Boundary	Nickel Alloy	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Pressure Boundary	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-1	3.1.1-44	A
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Pressure Boundary	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-1	3.1.1-44	B
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Pressure Boundary	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Pressure Boundary	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Structural Support	Nickel Alloy	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals			F
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Structural Support	Nickel Alloy	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry			F
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Structural Support	Nickel Alloy	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Structural Support	Nickel Alloy	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Structural Support	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-1	3.1.1-44	A
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Structural Support	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-1	3.1.1-44	B

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Structural Support	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Core Shroud and Core Plate (Core Shroud-Upper, Central, Lower)	Structural Support	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Core Shroud and Core Plate (Core plate, core plate bolts, peripheral fuel supports)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-6	3.1.1-44	A
Core Shroud and Core Plate (Core plate, core plate bolts, peripheral fuel supports)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-6	3.1.1-44	B
Core Shroud and Core Plate (Core plate, core plate bolts, peripheral fuel supports)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Cumulative Fatigue Damage/Fatigue	TLAA	IV.B1-14	3.1.1-5	A, 2
Core Shroud and Core Plate (Core plate, core plate bolts, peripheral fuel supports)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Core Shroud and Core Plate (Core plate, core plate bolts, peripheral fuel supports)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Core Shroud and Core Plate (Core plate, core plate bolts, peripheral fuel supports)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Preload/Stress Relaxation	TLAA			H, 3
Core Shroud and Core Plate (LPCI coupling)	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-3	3.1.1-44	A
Core Shroud and Core Plate (LPCI coupling)	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-3	3.1.1-44	B
Core Shroud and Core Plate (LPCI coupling)	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Core Shroud and Core Plate (LPCI coupling)	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Core Shroud and Core Plate (LPCI coupling)	Direct Flow	Stainless Steel with Stellite Cladding	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals			F
Core Shroud and Core Plate (LPCI coupling)	Direct Flow	Stainless Steel with Stellite Cladding	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry			F

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Core Shroud and Core Plate (LPCI coupling)	Direct Flow	Stainless Steel with Stellite Cladding	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals			F
Core Shroud and Core Plate (LPCI coupling)	Direct Flow	Stainless Steel with Stellite Cladding	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry			F
Core Shroud and Core Plate (Shroud support cylinder, plate, column)	Pressure Boundary	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-2	3.1.1-44	A
Core Shroud and Core Plate (Shroud support cylinder, plate, column)	Pressure Boundary	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-2	3.1.1-44	B
Core Shroud and Core Plate (Shroud support cylinder, plate, column)	Pressure Boundary	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Core Shroud and Core Plate (Shroud support cylinder, plate, column)	Pressure Boundary	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Core Shroud and Core Plate (Shroud support cylinder, plate, column)	Structural Support to maintain core configuration and flow distribution	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-2	3.1.1-44	A

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Core Shroud and Core Plate (Shroud support cylinder, plate, column)	Structural Support to maintain core configuration and flow distribution	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-2	3.1.1-44	B
Core Shroud and Core Plate (Shroud support cylinder, plate, column)	Structural Support to maintain core configuration and flow distribution	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Core Shroud and Core Plate (Shroud support cylinder, plate, column)	Structural Support to maintain core configuration and flow distribution	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Core Spray Lines and Spargers (Core spray lines (headers), spray rings, spray nozzles, thermal sleeve)	Direct Flow	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-7	3.1.1-44	A
Core Spray Lines and Spargers (Core spray lines (headers), spray rings, spray nozzles, thermal sleeve)	Direct Flow	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-7	3.1.1-44	B
Core Spray Lines and Spargers (Core spray lines (headers), spray rings, spray nozzles, thermal sleeve)	Direct Flow	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Loss of Fracture Toughness/Thermal Aging Embrittlement and Neutron Irradiation Embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	IV.B1-11	3.1.1-51	C

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Core Spray Lines and Spargers (Core spray lines (headers), spray rings, spray nozzles, thermal sleeve)	Direct Flow	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Core Spray Lines and Spargers (Core spray lines (headers), spray rings, spray nozzles, thermal sleeve)	Direct Flow	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Core Spray Lines and Spargers (Core spray lines (headers), spray rings, spray nozzles, thermal sleeve)	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-7	3.1.1-44	A
Core Spray Lines and Spargers (Core spray lines (headers), spray rings, spray nozzles, thermal sleeve)	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-7	3.1.1-44	B
Core Spray Lines and Spargers (Core spray lines (headers), spray rings, spray nozzles, thermal sleeve)	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Core Spray Lines and Spargers (Core spray lines (headers), spray rings, spray nozzles, thermal sleeve)	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Pressure Boundary	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-2	3.1.1-44	C
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Pressure Boundary	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-2	3.1.1-44	D
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Pressure Boundary	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Pressure Boundary	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Pressure Boundary	Stainless Steel	Reactor Coolant	Cracking/Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-8	3.1.1-43	A
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Pressure Boundary	Stainless Steel	Reactor Coolant	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.B1-8	3.1.1-43	B
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Pressure Boundary	Stainless Steel	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Pressure Boundary	Stainless Steel	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Structural Support to maintain core configuration and flow distribution	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-2	3.1.1-44	C
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Structural Support to maintain core configuration and flow distribution	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-2	3.1.1-44	D
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Structural Support to maintain core configuration and flow distribution	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Structural Support to maintain core configuration and flow distribution	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant	Cracking/Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-8	3.1.1-43	A
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.B1-8	3.1.1-43	B
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Fuel Supports and Control Rod Drive Assemblies (Control rod drive housing)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Fuel Supports and Control Rod Drive Assemblies (Control rod guide tube)	Structural Support to maintain core configuration and flow distribution	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant	Cracking/Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-8	3.1.1-43	C

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fuel Supports and Control Rod Drive Assemblies (Control rod guide tube)	Structural Support to maintain core configuration and flow distribution	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.B1-8	3.1.1-43	D
Fuel Supports and Control Rod Drive Assemblies (Control rod guide tube)	Structural Support to maintain core configuration and flow distribution	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant	Loss of Fracture Toughness/Thermal Aging Embrittlement and Neutron Irradiation Embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	IV.B1-9	3.1.1-51	C
Fuel Supports and Control Rod Drive Assemblies (Control rod guide tube)	Structural Support to maintain core configuration and flow distribution	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Fuel Supports and Control Rod Drive Assemblies (Control rod guide tube)	Structural Support to maintain core configuration and flow distribution	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Fuel Supports and Control Rod Drive Assemblies (Control rod guide tube)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-10	3.1.1-44	C
Fuel Supports and Control Rod Drive Assemblies (Control rod guide tube)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-10	3.1.1-44	D
Fuel Supports and Control Rod Drive Assemblies (Control rod guide tube)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fuel Supports and Control Rod Drive Assemblies (Control rod guide tube)	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Fuel Supports and Control Rod Drive Assemblies (Orificed fuel support)	Structural Support to maintain core configuration and flow distribution	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-1	3.1.1-44	C
Fuel Supports and Control Rod Drive Assemblies (Orificed fuel support)	Structural Support to maintain core configuration and flow distribution	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-1	3.1.1-44	D
Fuel Supports and Control Rod Drive Assemblies (Orificed fuel support)	Structural Support to maintain core configuration and flow distribution	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Loss of Fracture Toughness/Thermal Aging Embrittlement and Neutron Irradiation Embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	IV.B1-9	3.1.1-51	A
Fuel Supports and Control Rod Drive Assemblies (Orificed fuel support)	Structural Support to maintain core configuration and flow distribution	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Fuel Supports and Control Rod Drive Assemblies (Orificed fuel support)	Structural Support to maintain core configuration and flow distribution	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Instrumentation (IRM dry tubes, SRM dry tubes)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Instrumentation (IRM dry tubes, SRM dry tubes)	Pressure Boundary	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-10	3.1.1-44	A
Instrumentation (IRM dry tubes, SRM dry tubes)	Pressure Boundary	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-10	3.1.1-44	B
Instrumentation (IRM dry tubes, SRM dry tubes)	Pressure Boundary	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Instrumentation (IRM dry tubes, SRM dry tubes)	Pressure Boundary	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Instrumentation (IRM dry tubes, SRM dry tubes)	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Instrumentation (IRM dry tubes, SRM dry tubes)	Structural Support	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-10	3.1.1-44	A
Instrumentation (IRM dry tubes, SRM dry tubes)	Structural Support	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-10	3.1.1-44	B
Instrumentation (IRM dry tubes, SRM dry tubes)	Structural Support	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Instrumentation (IRM dry tubes, SRM dry tubes)	Structural Support	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Instrumentation (Incore neutron flux monitor guide tubes)	Structural Support	Stainless Steel	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-10	3.1.1-44	A
Instrumentation (Incore neutron flux monitor guide tubes)	Structural Support	Stainless Steel	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-10	3.1.1-44	B
Instrumentation (Incore neutron flux monitor guide tubes)	Structural Support	Stainless Steel	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Instrumentation (Incore neutron flux monitor guide tubes)	Structural Support	Stainless Steel	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Instrumentation (Incore neutron flux monitor housing)	Pressure Boundary	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-2	3.1.1-44	C
Instrumentation (Incore neutron flux monitor housing)	Pressure Boundary	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-2	3.1.1-44	D

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Instrumentation (Incore neutron flux monitor housing)	Pressure Boundary	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Instrumentation (Incore neutron flux monitor housing)	Pressure Boundary	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Instrumentation (Incore neutron flux monitor housing)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Instrumentation (Incore neutron flux monitor housing)	Pressure Boundary	Stainless Steel	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-10	3.1.1-44	C
Instrumentation (Incore neutron flux monitor housing)	Pressure Boundary	Stainless Steel	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-10	3.1.1-44	D
Instrumentation (Incore neutron flux monitor housing)	Pressure Boundary	Stainless Steel	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Instrumentation (Incore neutron flux monitor housing)	Pressure Boundary	Stainless Steel	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Instrumentation (Incore neutron flux monitor housing)	Structural Support	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-2	3.1.1-44	C

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Instrumentation (Incore neutron flux monitor housing)	Structural Support	Nickel Alloy	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-2	3.1.1-44	D
Instrumentation (Incore neutron flux monitor housing)	Structural Support	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Instrumentation (Incore neutron flux monitor housing)	Structural Support	Nickel Alloy	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Instrumentation (Incore neutron flux monitor housing)	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Instrumentation (Incore neutron flux monitor housing)	Structural Support	Stainless Steel	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-10	3.1.1-44	C
Instrumentation (Incore neutron flux monitor housing)	Structural Support	Stainless Steel	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-10	3.1.1-44	D
Instrumentation (Incore neutron flux monitor housing)	Structural Support	Stainless Steel	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Instrumentation (Incore neutron flux monitor housing)	Structural Support	Stainless Steel	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-13	3.1.1-44	A
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-13	3.1.1-44	B
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Loss of Fracture Toughness/Thermal Aging Embrittlement and Neutron Irradiation Embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	IV.B1-11	3.1.1-51	A

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Nickel Alloy	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-13	3.1.1-44	A

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Nickel Alloy	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-13	3.1.1-44	B
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Nickel Alloy	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Nickel Alloy	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-13	3.1.1-44	A
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-13	3.1.1-44	B
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Stainless Steel with Stellite Cladding	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals			F
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Stainless Steel with Stellite Cladding	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry			F

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Stainless Steel with Stellite Cladding	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals			F
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Pressure Boundary	Stainless Steel with Stellite Cladding	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry			F
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-13	3.1.1-44	A

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-13	3.1.1-44	B
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Loss of Fracture Toughness/Thermal Aging Embrittlement and Neutron Irradiation Embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	IV.B1-11	3.1.1-51	A
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Nickel Alloy	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-13	3.1.1-44	A
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Nickel Alloy	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-13	3.1.1-44	B

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Nickel Alloy	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Nickel Alloy	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Nickel Alloy	Reactor Coolant and Neutron Flux	Loss of Preload/Stress Relaxation	TLAA			H, 3

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-13	3.1.1-44	A
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-13	3.1.1-44	B
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Stainless Steel with Stellite Cladding	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals			F
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Stainless Steel with Stellite Cladding	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry			F

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Stainless Steel with Stellite Cladding	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals			F
Jet Pump Assemblies (Riser brace,beam/bolt assembly, riser pipe, inlet, mixer, restrainer bracket, wedge, diffuser and tailpipe, adapter/lower ring, auxiliary spring wedges and slip joint clamps/bolts)	Structural Support	Stainless Steel with Stellite Cladding	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry			F
Steam Dryers	Structural Support	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant	Cracking/Flow-Induced Vibration	BWR Vessel Internals	IV.B1-16	3.1.1-29	E, 4
Steam Dryers	Structural Support	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-1	3.1.1-44	C

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Steam Dryers	Structural Support	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-1	3.1.1-44	D
Steam Dryers	Structural Support	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant	Loss of Fracture Toughness/Thermal Aging Embrittlement and Neutron Irradiation Embrittlement	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	IV.B1-9	3.1.1-51	C
Steam Dryers	Structural Support	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Steam Dryers	Structural Support	Cast Austenitic Stainless Steel (CASS)	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B
Steam Dryers	Structural Support	Stainless Steel	Reactor Coolant	Cracking/Flow-Induced Vibration	BWR Vessel Internals	IV.B1-16	3.1.1-29	E, 4
Steam Dryers	Structural Support	Stainless Steel	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-1	3.1.1-44	C
Steam Dryers	Structural Support	Stainless Steel	Reactor Coolant	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-1	3.1.1-44	D
Steam Dryers	Structural Support	Stainless Steel	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Steam Dryers	Structural Support	Stainless Steel	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B

Table 3.1.2-2 Reactor Internals (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Top Guide	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-17	3.1.1-44	A
Top Guide	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Cracking/Stress Corrosion Cracking, Intergranular Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking	Water Chemistry	IV.B1-17	3.1.1-44	B
Top Guide	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Cumulative Fatigue Damage/Fatigue	TLAA	IV.B1-14	3.1.1-5	A, 2
Top Guide	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	BWR Vessel Internals	IV.B1-15	3.1.1-47	E, 1
Top Guide	Structural Support to maintain core configuration and flow distribution	Stainless Steel	Reactor Coolant and Neutron Flux	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.B1-15	3.1.1-47	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The BWR Vessel Internals program is substituted to manage the aging effect(s) applicable to the component type, material, and environment combination.

2. The TLAA designation in the Aging Management Program column indicates fatigue of the Core Plate and Top Guide are evaluated in Section 4.3.

3. The core plate rim bolts and Jet Pump auxiliary spring wedge and slip joint bolts require a plant specific analysis to demonstrate high fluence does not lead to loss of pre-load and stress relaxation. Further details can be found in sections 4.2.7 and 4.7.3 of the application.

4. NUREG-1801 specifies a plant-specific aging management program. The BWR Vessel Internals Inspection program is used to manage the aging effect applicable to this component type, material, and environment combination.

Table 3.1.2-3
Reactor Pressure Vessel
Summary of Aging Management Evaluation

Table 3.1.2-3 Reactor Pressure Vessel

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (Class 1) Head Spray, Spare Flanges, CRDs, and Incore Neutron Monitors	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-11	3.1.1-4	A, 1
Bolting (Class 1) Head Spray, Spare Flanges, CRDs, and Incore Neutron Monitors	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting (Class 1) Head Spray, Spare Flanges, CRDs, and Incore Neutron Monitors	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Bolting (Class 1) Top Head Studs and Nuts	Mechanical Closure	High Strength Low Alloy Steel Bolting with Yield Strength of 150 ksi or Greater	Air - Indoor (External)	Cracking/Stress Corrosion Cracking	Reactor Head Closure Studs	IV.A1-9	3.1.1-50	A
Bolting (Class 1) Top Head Studs and Nuts	Mechanical Closure	High Strength Low Alloy Steel Bolting with Yield Strength of 150 ksi or Greater	Air - Indoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-11	3.1.1-4	C, 1
Bolting (Class 1) Top Head Studs and Nuts	Mechanical Closure	High Strength Low Alloy Steel Bolting with Yield Strength of 150 ksi or Greater	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Reactor Head Closure Studs			H, 3

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle (Bottom Head Drain)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (Bottom Head Drain)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Bottom Head Drain)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Nozzle (Bottom Head Drain)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D
Nozzle (CRD Return)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (CRD Return)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cracking/Cyclic Loading	BWR Control Rod Drive Return Line Nozzle	IV.A1-2	3.1.1-38	A
Nozzle (CRD Return)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.A1-1	3.1.1-41	E, 2
Nozzle (CRD Return)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	E, 2
Nozzle (CRD Return)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (CRD Return)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle (CRD Return)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Nozzle (Core Spray)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (Core Spray)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.A1-1	3.1.1-41	E, 2
Nozzle (Core Spray)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	E, 2
Nozzle (Core Spray)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Core Spray)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Nozzle (Core Spray)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Nozzle (Feedwater)	Pressure Boundary	Low Alloy Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (Feedwater)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Cracking/Cyclic Loading	BWR Feedwater Nozzle	IV.A1-3	3.1.1-39	A
Nozzle (Feedwater)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle (Feedwater)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Nozzle (Feedwater)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D
Nozzle (Head Spray)	Pressure Boundary	Low Alloy Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (Head Spray)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Head Spray)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	A
Nozzle (Head Spray)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	B
Nozzle (Head Vent)	Pressure Boundary	Low Alloy Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (Head Vent)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Head Vent)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	A
Nozzle (Head Vent)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	B
Nozzle (Instrumentation - Beltline)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (Instrumentation - Beltline)	Pressure Boundary	Carbon Steel	Reactor Coolant and Neutron Flux (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle (Instrumentation - Beltline)	Pressure Boundary	Carbon Steel	Reactor Coolant and Neutron Flux (Internal)	Loss of Fracture Toughness/Neutron Irradiation Embrittlement	TLAA	IV.A1-4	3.1.1-17	C, 1
Nozzle (Instrumentation - Beltline)	Pressure Boundary	Carbon Steel	Reactor Coolant and Neutron Flux (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Nozzle (Instrumentation - Beltline)	Pressure Boundary	Carbon Steel	Reactor Coolant and Neutron Flux (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D
Nozzle (Instrumentation - Beltline)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant and Neutron Flux (Internal)	Cracking/Stress Corrosion Cracking	BWR Penetrations	IV.A1-5	3.1.1-40	A
Nozzle (Instrumentation - Beltline)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant and Neutron Flux (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-5	3.1.1-40	B
Nozzle (Instrumentation - Beltline)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant and Neutron Flux (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Instrumentation - Beltline)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant and Neutron Flux (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Nozzle (Instrumentation - Beltline)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant and Neutron Flux (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Nozzle (Instrumentation)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (Instrumentation)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Instrumentation)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Nozzle (Instrumentation)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle (Instrumentation)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant	Cracking/Stress Corrosion Cracking	BWR Penetrations	IV.A1-5	3.1.1-40	A
Nozzle (Instrumentation)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-5	3.1.1-40	B
Nozzle (Instrumentation)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Instrumentation)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Nozzle (Instrumentation)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Nozzle (Jet Pump Instrumentation)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (Jet Pump Instrumentation)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.A1-1	3.1.1-41	E, 2
Nozzle (Jet Pump Instrumentation)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	E, 2
Nozzle (Jet Pump Instrumentation)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Jet Pump Instrumentation)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Nozzle (Jet Pump Instrumentation)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle (Low Pressure Coolant Injection)	Pressure Boundary	Low Alloy Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (Low Pressure Coolant Injection)	Pressure Boundary	Low Alloy Steel	Reactor Coolant and Neutron Flux (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Low Pressure Coolant Injection)	Pressure Boundary	Low Alloy Steel	Reactor Coolant and Neutron Flux (Internal)	Loss of Fracture Toughness/Neutron Irradiation Embrittlement	TLAA	IV.A1-4	3.1.1-17	A, 1
Nozzle (Low Pressure Coolant Injection)	Pressure Boundary	Low Alloy Steel	Reactor Coolant and Neutron Flux (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Nozzle (Low Pressure Coolant Injection)	Pressure Boundary	Low Alloy Steel	Reactor Coolant and Neutron Flux (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D
Nozzle (Main Steam)	Pressure Boundary	Low Alloy Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (Main Steam)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Main Steam)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Nozzle (Main Steam)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D
Nozzle (Recirculation Inlet & Outlet)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (Recirculation Inlet & Outlet)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.A1-1	3.1.1-41	E, 2

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle (Recirculation Inlet & Outlet)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	E, 2
Nozzle (Recirculation Inlet & Outlet)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Recirculation Inlet & Outlet)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Nozzle (Recirculation Inlet & Outlet)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Nozzle (Seal Leak Detection)	Pressure Boundary	Low Alloy Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (Seal Leak Detection)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Seal Leak Detection)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	A
Nozzle (Seal Leak Detection)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	B
Nozzle (Spare on Head)	Pressure Boundary	Low Alloy Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle (Spare on Head)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Spare on Head)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	A

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle (Spare on Head)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	B
Nozzle (Standby Liquid Control / Core DP)	Pressure Boundary	Nickel Alloy	Air - Indoor (External)	None	None	IV.E-1	3.1.1-85	A
Nozzle (Standby Liquid Control / Core DP)	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.A1-1	3.1.1-41	E, 2
Nozzle (Standby Liquid Control / Core DP)	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	E, 2
Nozzle (Standby Liquid Control / Core DP)	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle (Standby Liquid Control / Core DP)	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Nozzle (Standby Liquid Control / Core DP)	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Nozzle Safe Ends and Welds (Core Spray)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle Safe Ends and Welds (Core Spray)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle Safe Ends and Welds (Core Spray)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Nozzle Safe Ends and Welds (Core Spray)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle Safe Ends and Welds (Core Spray)	Pressure Boundary	Nickel Alloy (Safe End)	Air - Indoor (External)	None	None	IV.E-1	3.1.1-85	A
Nozzle Safe Ends and Welds (Core Spray)	Pressure Boundary	Nickel Alloy (Safe End)	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	BWR Stress Corrosion Cracking	IV.A1-1	3.1.1-41	A
Nozzle Safe Ends and Welds (Core Spray)	Pressure Boundary	Nickel Alloy (Safe End)	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	B
Nozzle Safe Ends and Welds (Core Spray)	Pressure Boundary	Nickel Alloy (Safe End)	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle Safe Ends and Welds (Core Spray)	Pressure Boundary	Nickel Alloy (Safe End)	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Nozzle Safe Ends and Welds (Core Spray)	Pressure Boundary	Nickel Alloy (Safe End)	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Nozzle Safe Ends and Welds (Feedwater)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle Safe Ends and Welds (Feedwater)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle Safe Ends and Welds (Feedwater)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Nozzle Safe Ends and Welds (Feedwater)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D
Nozzle Safe Ends and Welds (Head Spray)	Pressure Boundary	Low Alloy Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle Safe Ends and Welds (Head Spray)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle Safe Ends and Welds (Head Spray)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Nozzle Safe Ends and Welds (Head Spray)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D
Nozzle Safe Ends and Welds (Head Spray)	Pressure Boundary	Nickel Alloy (Weld)	Air - Indoor (External)	None	None	IV.E-1	3.1.1-85	A
Nozzle Safe Ends and Welds (Head Spray)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	BWR Stress Corrosion Cracking	IV.A1-1	3.1.1-41	A
Nozzle Safe Ends and Welds (Head Spray)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	B
Nozzle Safe Ends and Welds (Head Spray)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle Safe Ends and Welds (Head Spray)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Nozzle Safe Ends and Welds (Head Spray)	Pressure Boundary	Nickel Alloy (Weld)	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Nozzle Safe Ends and Welds (Jet Pump Instrumentation)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Nozzle Safe Ends and Welds (Jet Pump Instrumentation)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	BWR Stress Corrosion Cracking	IV.A1-1	3.1.1-41	A

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle Safe Ends and Welds (Jet Pump Instrumentation)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	B
Nozzle Safe Ends and Welds (Jet Pump Instrumentation)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle Safe Ends and Welds (Jet Pump Instrumentation)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Nozzle Safe Ends and Welds (Jet Pump Instrumentation)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Nozzle Safe Ends and Welds (Low Pressure Coolant Injection)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle Safe Ends and Welds (Low Pressure Coolant Injection)	Pressure Boundary	Carbon Steel	Reactor Coolant and Neutron Flux (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle Safe Ends and Welds (Low Pressure Coolant Injection)	Pressure Boundary	Carbon Steel	Reactor Coolant and Neutron Flux (Internal)	Loss of Fracture Toughness/Neutron Irradiation Embrittlement	TLAA	IV.A1-4	3.1.1-17	C, 1
Nozzle Safe Ends and Welds (Low Pressure Coolant Injection)	Pressure Boundary	Carbon Steel	Reactor Coolant and Neutron Flux (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Nozzle Safe Ends and Welds (Low Pressure Coolant Injection)	Pressure Boundary	Carbon Steel	Reactor Coolant and Neutron Flux (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle Safe Ends and Welds (Main Steam)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle Safe Ends and Welds (Main Steam)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle Safe Ends and Welds (Main Steam)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Nozzle Safe Ends and Welds (Main Steam)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D
Nozzle Safe Ends and Welds (Recirculation Inlet and Outlet)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Nozzle Safe Ends and Welds (Recirculation Inlet and Outlet)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	BWR Stress Corrosion Cracking	IV.A1-1	3.1.1-41	A
Nozzle Safe Ends and Welds (Recirculation Inlet and Outlet)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	B
Nozzle Safe Ends and Welds (Recirculation Inlet and Outlet)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle Safe Ends and Welds (Recirculation Inlet and Outlet)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Nozzle Safe Ends and Welds (Recirculation Inlet and Outlet)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle Safe Ends and Welds (Seal Leak Detection, Spare, & Head Vent)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Nozzle Safe Ends and Welds (Seal Leak Detection, Spare, & Head Vent)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle Safe Ends and Welds (Seal Leak Detection, Spare, & Head Vent)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Nozzle Safe Ends and Welds (Seal Leak Detection, Spare, & Head Vent)	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D
Nozzle Safe Ends and Welds (Standby Liquid Control / Core DP)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Nozzle Safe Ends and Welds (Standby Liquid Control / Core DP)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	BWR Stress Corrosion Cracking	IV.A1-1	3.1.1-41	A
Nozzle Safe Ends and Welds (Standby Liquid Control / Core DP)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	B
Nozzle Safe Ends and Welds (Standby Liquid Control / Core DP)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle Safe Ends and Welds (Standby Liquid Control / Core DP)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Nozzle Safe Ends and Welds (Standby Liquid Control / Core DP)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Nozzle Thermal Sleeves (Core Spray)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-7	3.1.1-44	A
Nozzle Thermal Sleeves (Core Spray)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.B1-7	3.1.1-44	B
Nozzle Thermal Sleeves (Core Spray)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle Thermal Sleeves (Core Spray)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	C
Nozzle Thermal Sleeves (Core Spray)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	D
Nozzle Thermal Sleeves (Feedwater)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-7	3.1.1-44	C
Nozzle Thermal Sleeves (Feedwater)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.B1-7	3.1.1-44	D
Nozzle Thermal Sleeves (Feedwater)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	C
Nozzle Thermal Sleeves (Feedwater)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	D

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle Thermal Sleeves (Low Pressure Coolant Injection)	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux (Internal)	Cracking/Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-7	3.1.1-44	C
Nozzle Thermal Sleeves (Low Pressure Coolant Injection)	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.B1-7	3.1.1-44	D
Nozzle Thermal Sleeves (Low Pressure Coolant Injection)	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle Thermal Sleeves (Low Pressure Coolant Injection)	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	C
Nozzle Thermal Sleeves (Low Pressure Coolant Injection)	Direct Flow	Stainless Steel	Reactor Coolant and Neutron Flux (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	D
Nozzle Thermal Sleeves (Recirculation Inlets)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	BWR Vessel Internals	IV.B1-7	3.1.1-44	C
Nozzle Thermal Sleeves (Recirculation Inlets)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.B1-7	3.1.1-44	D
Nozzle Thermal Sleeves (Recirculation Inlets)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Nozzle Thermal Sleeves (Recirculation Inlets)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	C

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Nozzle Thermal Sleeves (Recirculation Inlets)	Direct Flow	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	D
Penetration (CRD Stub Tubes)	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.A1-1	3.1.1-41	E, 2
Penetration (CRD Stub Tubes)	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	E, 2
Penetration (CRD Stub Tubes)	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Penetration (CRD Stub Tubes)	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Penetration (CRD Stub Tubes)	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Penetration (CRD Stub Tubes)	Structural Support	Nickel Alloy	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.A1-1	3.1.1-41	E, 2
Penetration (CRD Stub Tubes)	Structural Support	Nickel Alloy	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	E, 2
Penetration (CRD Stub Tubes)	Structural Support	Nickel Alloy	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Penetration (CRD Stub Tubes)	Structural Support	Nickel Alloy	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Penetration (CRD Stub Tubes)	Structural Support	Nickel Alloy	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Penetration (Incore Housings)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Penetration (Incore Housings)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.A1-1	3.1.1-41	E, 2

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration (Incore Housings)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	E, 2
Penetration (Incore Housings)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Penetration (Incore Housings)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Penetration (Incore Housings)	Pressure Boundary	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Low Alloy Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	C
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	D

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Nickel Alloy	Air - Indoor (External)	None	None	IV.E-1	3.1.1-85	A
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	BWR Stress Corrosion Cracking	IV.A1-1	3.1.1-41	C
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	D
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	C
Reactor Coolant Pressure Boundary Components	Pressure Boundary	Nickel Alloy	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	D
Reactor Vessel (Bottom Head)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Reactor Vessel (Bottom Head)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.A1-1	3.1.1-41	E, 2
Reactor Vessel (Bottom Head)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	E, 2
Reactor Vessel (Bottom Head)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor Vessel (Bottom Head)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Reactor Vessel (Bottom Head)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Reactor Vessel (External Attachments)	Structural Support	Low Alloy Steel	Air - Indoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-6	3.1.1-1	A, 1
Reactor Vessel (External Attachments)	Structural Support	Low Alloy Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Reactor Vessel (Intermediate, Lower Intermediate and Lower Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Reactor Vessel (Intermediate, Lower Intermediate and Lower Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant and Neutron Flux (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.A1-1	3.1.1-41	E, 2
Reactor Vessel (Intermediate, Lower Intermediate and Lower Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant and Neutron Flux (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	E, 2
Reactor Vessel (Intermediate, Lower Intermediate and Lower Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant and Neutron Flux (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor Vessel (Intermediate, Lower Intermediate and Lower Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant and Neutron Flux (Internal)	Loss of Fracture Toughness/Neutron Irradiation Embrittlement	Reactor Vessel Surveillance	IV.A1-14	3.1.1-18	A
Reactor Vessel (Intermediate, Lower Intermediate and Lower Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant and Neutron Flux (Internal)	Loss of Fracture Toughness/Neutron Irradiation Embrittlement	TLAA	IV.A1-13	3.1.1-17	A, 1
Reactor Vessel (Intermediate, Lower Intermediate and Lower Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant and Neutron Flux (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Reactor Vessel (Intermediate, Lower Intermediate and Lower Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant and Neutron Flux (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Reactor Vessel (Internal Attachments)	Structural Support	Carbon Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Reactor Vessel (Internal Attachments)	Structural Support	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	A
Reactor Vessel (Internal Attachments)	Structural Support	Carbon Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	B
Reactor Vessel (Internal Attachments)	Structural Support	Nickel Alloy	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	BWR Vessel ID Attachment Welds	IV.A1-12	3.1.1-42	A
Reactor Vessel (Internal Attachments)	Structural Support	Nickel Alloy	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-12	3.1.1-42	B

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor Vessel (Internal Attachments)	Structural Support	Nickel Alloy	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Reactor Vessel (Internal Attachments)	Structural Support	Nickel Alloy	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Reactor Vessel (Internal Attachments)	Structural Support	Nickel Alloy	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Reactor Vessel (Internal Attachments)	Structural Support	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	BWR Vessel ID Attachment Welds	IV.A1-12	3.1.1-42	A
Reactor Vessel (Internal Attachments)	Structural Support	Stainless Steel	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-12	3.1.1-42	B
Reactor Vessel (Internal Attachments)	Structural Support	Stainless Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Reactor Vessel (Internal Attachments)	Structural Support	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Reactor Vessel (Internal Attachments)	Structural Support	Stainless Steel	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Reactor Vessel (Shell Flange, Upper and Upper Intermediate Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Reactor Vessel (Shell Flange, Upper and Upper Intermediate Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.A1-1	3.1.1-41	E, 2

Table 3.1.2-3 Reactor Pressure Vessel (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Reactor Vessel (Shell Flange, Upper and Upper Intermediate Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-1	3.1.1-41	E, 2
Reactor Vessel (Shell Flange, Upper and Upper Intermediate Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Reactor Vessel (Shell Flange, Upper and Upper Intermediate Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-8	3.1.1-14	A
Reactor Vessel (Shell Flange, Upper and Upper Intermediate Shell Sections)	Pressure Boundary	Carbon or Low Alloy Steel with Stainless Steel Cladding	Reactor Coolant (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.A1-8	3.1.1-14	B
Reactor Vessel (Top Head and Flange)	Pressure Boundary	Low Alloy Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Reactor Vessel (Top Head and Flange)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.A1-7	3.1.1-2	A, 1
Reactor Vessel (Top Head and Flange)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.A1-11	3.1.1-11	A
Reactor Vessel (Top Head and Flange)	Pressure Boundary	Low Alloy Steel	Reactor Coolant (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.A1-11	3.1.1-11	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The TLAA designation in the Aging Management Program column indicates for neutron embrittlement the component is evaluated in section 4.2 and for fatigue the component is evaluated in Section 4.3.

2. The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and Water Chemistry program are substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

3. Reactor Head Closure Studs program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.1.2-4
Reactor Recirculation System
Summary of Aging Management Evaluation

Table 3.1.2-4 Reactor Recirculation System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-11	3.1.1-4	A, 1
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 2

Table 3.1.2-4 Reactor Recirculation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Flow Device	Leakage Boundary	Glass	Air - Indoor (External)	None	None	V.F-6	3.2.1-52	A
Flow Device	Leakage Boundary	Glass	Treated Water (Internal)	None	None	V.F-10	3.2.1-52	A
Flow Device	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Flow Device	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3
Flow Device	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Flow Device	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Flow Device	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Heat Exchanger Components (Motor Air Cooler)	Evaluated with the Chilled Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.1.2-4 Reactor Recirculation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Piping and Fittings (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A

Table 3.1.2-4 Reactor Recirculation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	BWR Stress Corrosion Cracking	IV.C1-9	3.1.1-41	A
Piping and Fittings (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-9	3.1.1-41	B
Piping and Fittings (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Piping and Fittings (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Piping and Fittings (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Pump Casing (Class 1)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Pump Casing (Class 1)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Cracking/Stress Corrosion Cracking	BWR Stress Corrosion Cracking	IV.C1-9	3.1.1-41	A
Pump Casing (Class 1)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-9	3.1.1-41	B
Pump Casing (Class 1)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Loss of Fracture Toughness/Thermal Aging Embrittlement	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-3	3.1.1-55	A
Pump Casing (Class 1)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Pump Casing (Class 1)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A

Table 3.1.2-4 Reactor Recirculation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Thermowell (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Thermowell (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3
Thermowell (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Thermowell (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Thermowell (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Table 3.1.2-4 Reactor Recirculation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Valve Body (Class 1)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Valve Body (Class 1)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Cracking/Stress Corrosion Cracking	BWR Stress Corrosion Cracking	IV.C1-9	3.1.1-41	A

Table 3.1.2-4 Reactor Recirculation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body (Class 1)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-9	3.1.1-41	B
Valve Body (Class 1)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Valve Body (Class 1)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Loss of Fracture Toughness/Thermal Aging Embrittlement	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-3	3.1.1-55	A
Valve Body (Class 1)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body (Class 1)	Pressure Boundary	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The TLAA designation in the Aging Management Program column indicates fatigue of this component is evaluated in Section 4.3.

2. The NUREG-1801 "One-Time Inspection of ASME Code Class 1 Small-Bore Piping" aging management program is applicable only to plants that have not experienced cracking of ASME Code Class 1 small-bore piping. Based on previous Hope Creek operating experience with Class 1 small-bore pipe cracking, a new plant-specific periodic inspection program will be used. The "Small-Bore Class 1 Piping Inspection" aging management program is a plant-specific periodic program that will be implemented to manage cracking by periodic volumetric examinations of small-bore Class 1 piping.

3. The Water Chemistry and ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD aging management programs will be used to manage the aging effect of cracking in restricting orifices, flow devices, thermowells and valve bodies <NPS 4".

3.2 AGING MANAGEMENT OF ENGINEERED SAFETY FEATURES

3.2.1 INTRODUCTION

This section provides the results of the aging management review for those components identified in Section 2.3.2, Engineered Safety Features, as being subject to aging management review. The systems, or portions of systems, which are addressed in this section are described in the indicated sections.

- Containment Hydrogen Recombiner System (2.3.2.2)
- Core Spray System (2.3.2.3)
- Filtration, Recirculation, and Ventilation System (2.3.2.4)
- High Pressure Coolant Injection (HPCI) System (2.3.2.5)
- Hydrogen and Oxygen Analyzer System (2.3.2.6)
- Reactor Core Isolation Cooling (RCIC) System (2.3.2.7)
- Residual Heat Removal (RHR) System (2.3.2.8)
- Vacuum Relief Valve System (2.3.2.9)

3.2.2 RESULTS

The following tables summarize the results of the aging management review for Engineered Safety Features.

Table 3.2.2-1 Summary of Aging Management Evaluation – Containment Hydrogen Recombiner System

Table 3.2.2-2 Summary of Aging Management Evaluation – Core Spray System

Table 3.2.2-3 Summary of Aging Management Evaluation – Filtration, Recirculation, and Ventilation System

Table 3.2.2-4 Summary of Aging Management Evaluation – High Pressure Coolant Injection (HPCI) System

Table 3.2.2-5 Summary of Aging Management Evaluation – Hydrogen and Oxygen Analyzer System

Table 3.2.2-6 Summary of Aging Management Evaluation – Reactor Core Isolation Cooling (RCIC) System

Table 3.2.2-7 Summary of Aging Management Evaluation – Residual Heat Removal (RHR) System

Table 3.2.2-8 Summary of Aging Management Evaluation – Vacuum Relief Valve System

3.2.2.1 Materials, Environments, Aging Effects Requiring Management And Aging Managements Programs

3.2.2.1.1 Containment Hydrogen Recombiner System

Materials

The materials of construction for the Containment Hydrogen Recombiner System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel

Environments

The Containment Hydrogen Recombiner System components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Wetted
- Treated Water

Aging Effects Requiring Management

The following aging effects associated with the Containment Hydrogen Recombiner System components require management:

- Loss of Material/Galvanic Corrosion
- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Containment Hydrogen Recombiner System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Water Chemistry (B.2.1.2)

Table 3.2.2-1, Summary of Aging Management Evaluation – Containment Hydrogen Recombiner System summarizes the results of the aging management review for the Containment Hydrogen Recombiner System.

3.2.2.1.2 Core Spray System

Materials

The materials of construction for the Core Spray System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Gray Cast Iron
- Stainless Steel Bolting
- Stainless Steel

Environments

The Core Spray System components are exposed to the following environments:

- Air - Indoor
- Treated Water
- Treated Water > 140 ^{o}F

Aging Effects Requiring Management

The following aging effects associated with Core Spray System components require management:

- Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading
- Cumulative Fatigue Damage/Fatigue
- Loss of Material/Galvanic Corrosion
- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Material/Selective Leaching
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Core Spray System components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1.1)
- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)

- One-Time Inspection (B.2.1.22)
- Selective Leaching of Materials (B.2.1.23)
- Small-Bore Class 1 Piping Inspection (B.2.2.6)
- TLAA
- Water Chemistry (B.2.1.2)

Table 3.2.2-2, Summary of Aging Management Evaluation – Core Spray System summarizes the results of the aging management review for the Core Spray System.

3.2.2.1.3 Filtration, Recirculation, and Ventilation System

Materials

The materials of construction for the Filtration, Recirculation, and Ventilation System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy with 15% Zinc or More
- Copper Alloy with less than 15% Zinc
- Elastomer
- Galvanized Steel
- Polymer
- Stainless Steel
- Stainless Steel Bolting

Environments

The Filtration, Recirculation, and Ventilation System components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Air/Gas - Wetted

Aging Effects Requiring Management

The following aging effects associated with the Filtration, Recirculation, and Ventilation System components require management:

- Hardening and Loss of Strength/Elastomer Degradation
- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Filtration, Recirculation, and Ventilation System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)

Table 3.2.2-3, Summary of Aging Management Evaluation – Filtration, Recirculation, and Ventilation System summarizes the results of the aging management review for the Filtration, Recirculation, and Ventilation System.

3.2.2.1.4 High Pressure Coolant Injection (HPCI) System

Materials

The materials of construction for the High Pressure Coolant Injection (HPCI) System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy with 15% Zinc or More
- Copper Alloy with less than 15% Zinc
- Glass
- Gray Cast Iron
- Stainless Steel Bolting
- Stainless Steel

Environments

The High Pressure Coolant Injection (HPCI) System components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Wetted
- Lubricating Oil
- Steam
- Treated Water
- Treated Water > 140 ^{o}F

Aging Effects Requiring Management

The following aging effects associated with the High Pressure Coolant Injection (HPCI) System components require management:

- Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading
- Cumulative Fatigue Damage/Fatigue
- Loss of Material/Galvanic Corrosion
- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Material/Selective Leaching
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening
- Reduction of Heat Transfer/Fouling
- Wall Thinning/Flow Accelerated Corrosion

Aging Management Programs

The following aging management programs manage the aging effects for the High Pressure Coolant Injection (HPCI) System components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1.1)
- Bolting Integrity (B.2.1.12)
- BWR Stress Corrosion Cracking (B.2.1.7)
- External Surfaces Monitoring (B.2.1.25)
- Flow-Accelerated Corrosion (B.2.1.11)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Lubricating Oil Analysis (B.2.1.27)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Selective Leaching of Materials (B.2.1.23)
- Small-Bore Class 1 Piping Inspection (B.2.2.6)
- TLAA
- Water Chemistry (B.2.1.2)

Table 3.2.2-4, Summary of Aging Management Evaluation – High Pressure Coolant Injection (HPCI) System summarizes the results of the aging management review for the High Pressure Coolant Injection (HPCI) System.

3.2.2.1.5 Hydrogen and Oxygen Analyzer System

Materials

The materials of construction for the Hydrogen and Oxygen Analyzer System components are:

- Carbon and Low Alloy Steel Bolting
- Glass
- Stainless Steel

Environments

The Hydrogen and Oxygen Analyzer System components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Air/Gas - Dry
- Air/Gas - Wetted

Aging Effects Requiring Management

The following aging effects associated with the Hydrogen and Oxygen Analyzer System components require management:

- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening
- Reduction of Heat Transfer/Fouling

Aging Management Programs

The following aging management programs manage the aging effects for the Hydrogen and Oxygen Analyzer System components:

- Bolting Integrity (B.2.1.12)
- Periodic Inspection (B.2.2.2)

Table 3.2.2-5, Summary of Aging Management Evaluation – Hydrogen and Oxygen Analyzer System summarizes the results of the aging management review for the Hydrogen and Oxygen Analyzer System.

3.2.2.1.6 Reactor Core Isolation Cooling (RCIC) System

Materials

The materials of construction for the Reactor Core Isolation Cooling (RCIC) System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy with 15% Zinc or More
- Copper Alloy with less than 15% Zinc
- Glass
- Gray Cast Iron
- Stainless Steel Bolting
- Stainless Steel

Environments

The Reactor Core Isolation Cooling (RCIC) System components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Wetted
- Lubricating Oil
- Steam
- Treated Water
- Treated Water > 140 ^{o}F

Aging Effects Requiring Management

The following aging effects associated with the Reactor Core Isolation Cooling (RCIC) System components require management:

- Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading
- Cumulative Fatigue Damage/Fatigue
- Loss of Material/Galvanic Corrosion
- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Material/Selective Leaching
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening
- Reduction of Heat Transfer/Fouling
- Wall Thinning/Flow Accelerated Corrosion

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Core Isolation Cooling (RCIC) System components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1.1)
- Bolting Integrity (B.2.1.12)
- BWR Stress Corrosion Cracking (B.2.1.7)
- External Surfaces Monitoring (B.2.1.25)
- Flow-Accelerated Corrosion (B.2.1.11)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Lubricating Oil Analysis (B.2.1.27)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Selective Leaching of Materials (B.2.1.23)
- Small-Bore Class 1 Piping Inspection (B.2.2.6)
- TLAA
- Water Chemistry (B.2.1.2)

Table 3.2.2-6, Summary of Aging Management Evaluation – Reactor Core Isolation Cooling (RCIC) System summarizes the results of the aging management review for the Reactor Core Isolation Cooling (RCIC) System.

3.2.2.1.7 Residual Heat Removal (RHR) System

Materials

The materials of construction for the Residual Heat Removal (RHR) System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Ductile Cast Iron
- Glass
- Gray Cast Iron
- Stainless Steel Bolting
- Stainless Steel

Environments

The Residual Heat Removal (RHR) System components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Wetted
- Treated Water
- Treated Water > 140 ^{o}F

Aging Effects Requiring Management

The following aging effects associated with the Residual Heat Removal (RHR) System components require management:

- Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading
- Cumulative Fatigue Damage/Fatigue
- Loss of Material/Galvanic Corrosion
- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Material/Selective Leaching
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Residual Heat Removal (RHR) System components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1.1)
- Bolting Integrity (B.2.1.12)
- BWR Stress Corrosion Cracking (B.2.1.7)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Selective Leaching of Materials (B.2.1.23)
- Small-Bore Class 1 Piping Inspection (B.2.2.6)
- TLAA
- Water Chemistry (B.2.1.2)

Table 3.2.2-7, Summary of Aging Management Evaluation – Residual Heat Removal (RHR) System summarizes the results of the aging management review for the Residual Heat Removal (RHR) System.

3.2.2.1.8 Vacuum Relief Valve System

Materials

The materials of construction for the Vacuum Relief Valve System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel

Environments

The Vacuum Relief Valve System components are exposed to the following environments:

- Air - Indoor
- Air/Gas – Wetted

Aging Effects Requiring Management

The following aging effects associated with the Vacuum Relief Valve System components require management:

- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Vacuum Relief Valve System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)

Table 3.2.2-8, Summary of Aging Management Evaluation – Vacuum Relief Valve System summarizes the results of the aging management review for the Vacuum Relief Valve System.

3.2.2.2 AMR Results for Which Further Evaluation is Recommended by the GALL Report

NUREG-1801 provides the basis for identifying those programs that warrant further evaluation by the reviewer in the license renewal application. For the Engineered Safety Features, those programs are addressed in the following subsections.

3.2.2.2.1 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of metal fatigue as a TLAA for the High Pressure Coolant Injection (HPCI) System, Reactor Core Isolation Cooling (RCIC) System and Residual Heat Removal (RHR) System is discussed in Section 4.3.

3.2.2.2.2 Loss of Material due to Cladding

Item Number 3.2.1-2 is applicable to PWRs only and is not used for Hope Creek.

3.2.2.2.3 Loss of Material due to Pitting and Crevice Corrosion

1. *Loss of material due to pitting and crevice corrosion could occur for internal surfaces of stainless steel containment isolation piping, piping components, and piping elements exposed to treated water. The existing AMP relies on monitoring and control of water chemistry to mitigate degradation. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.*

   Item Number 3.2.1-3 is not applicable to Hope Creek Engineered Safety Features systems. Engineered Safety Features system stainless steel containment isolation piping, piping components, and piping elements exposed to treated water are evaluated with other Class 1 components. See LRA Table 3.1.1 Item Number 3.1.1-15. As discussed in subsection 3.1.2.2.2.3 for Item Number 3.1.1-15 in LRA Table 3.1.1, Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to pitting and crevice corrosion of the stainless steel, reactor coolant pressure boundary components including piping, piping components and fittings exposed to treated water (including steam) in the following ESF systems: Core Spray, High Pressure Coolant Injection (HPCI), Reactor Core Isolation Cooling (RCIC) and Residual Heat Removal (RHR). The One-Time Inspection and Water Chemistry programs are described in Appendix B.

2. *Loss of material from pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.*

   Item Number 3.2.1-4 is not applicable to Hope Creek. There are no stainless steel piping, piping components, or piping elements exposed to soil in the Hope Creek Engineered Safety Features systems.

3. *Loss of material from pitting and crevice corrosion could occur for BWR stainless steel and aluminum piping, piping components, and piping elements exposed to treated water. The existing AMP relies on monitoring and control of water chemistry for BWRs to mitigate degradation. However, control of water chemistry does not preclude loss of material due to pitting and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the water chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.*

   Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements and tanks exposed to treated water in the Containment Hydrogen Recombiner System, Core Spray System, High Pressure Coolant Injection (HPCI) System, Reactor Core Isolation Cooling (RCIC) System and Residual Heat Removal (RHR) System. The Water Chemistry and One-Time Inspection programs are described in Appendix B.

4. *Loss of material from pitting and crevice corrosion could occur for stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation to verify the effectiveness of the lubricating oil program. A one-time inspection of*

selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage the loss of material due to pitting and crevice corrosion in stainless steel and copper alloy piping, piping components, piping elements and heat exchangers exposed to lubricating oil in the High Pressure Coolant Injection (HPCI) System and Reactor Core Isolation Cooling (RCIC) System. The Lubricating Oil Analysis and One-Time Inspection programs are described in Appendix B.

5. *Loss of material from pitting and crevice corrosion could occur for of partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed. The GALL Report recommends that a plant-specific AMP be evaluated because moisture and water can egress under the tank if the perimeter seal is degraded. Acceptance criteria are described in Branch Technical Position RSLB-1.*

   Item Number 3.2.1-7 is not applicable to Hope Creek. There are no partially encased stainless steel tanks in the Hope Creek Engineered Safety Features systems.

6. *Loss of material from pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RSLB-1.*

   Hope Creek will implement the Periodic Inspection program, B.2.2.2, to manage the loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, heat exchangers and tanks exposed to an air/gas wetted internal environment in the Containment Hydrogen Recombiner System, Filtration, Recirculation, and Ventilation System, High Pressure Coolant Injection (HPCI) System, Hydrogen and Oxygen Analyzer System, Main Steam System, Nuclear Boiler Instrumentation, Reactor Core Isolation Cooling (RCIC) System, Residual Heat Removal (RHR) System and Vacuum Relief Valve System. The Periodic Inspection program is used to manage the aging effects of components that are not covered by other aging management programs, including external surfaces and internal surfaces of non-steel components. The Periodic Inspection program includes visual inspections, physical manipulation and nondestructive volumetric examinations to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Periodic Inspection program is described in Appendix B.

3.2.2.2.4 Reduction of Heat Transfer due to Fouling

1. *Reduction of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The existing AMP relies on monitoring and control of lube oil chemistry to mitigate reduction of heat transfer due to fouling. However, control of lube oil chemistry may not always have been adequate to preclude fouling. Therefore, the effectiveness of lube oil chemistry control should be verified to ensure that fouling is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of lube oil chemistry control. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.*

   Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage the reduction of heat transfer due to fouling in copper alloy heat exchanger components exposed to lubricating oil in the High Pressure Coolant Injection (HPCI) System, Reactor Core Isolation Cooling (RCIC) System and Closed Cycle Cooling Water System. The Lubricating Oil Analysis and One-Time Inspection programs are described in Appendix B.

2. *Reduction of heat transfer due to fouling could occur for stainless steel heat exchanger tubes exposed to treated water. The existing program relies on control of water chemistry to manage reduction of heat transfer due to fouling. However, control of water chemistry may have been inadequate. Therefore, the GALL report recommends that the effectiveness of the chemistry control program should be verified to ensure that reduction of heat transfer due to fouling is not occurring. A one-time inspection is an acceptable method to ensure that reduction of heat transfer is not occurring and that the component's intended function will be maintained during the period of extended operation.*

   Item Number 3.2.1-10 is not applicable to the Hope Creek Engineered Safety Features systems. There are no stainless steel heat exchanger tubes exposed to treated water in the Engineered Safety Features systems. The stainless steel heat exchanger components in the Residual Heat Removal (RHR) System have been evaluated with the Closed Cycle Cooling Water System. See Table 3.3.1 Item Number 3.3.1-3.

3.2.2.2.5 Hardening and Loss of Strength due to Elastomer Degradation

Hardening and loss of strength due to elastomer degradation could occur in elastomer seals and components associated with the BWR Standby Gas Treatment System ductwork and filters exposed to air-indoor uncontrolled. The GALL Report recommends further evaluation of a plant specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

Hope Creek will implement the Periodic Inspection program, B.2.2.2, to manage hardening and loss of strength due to elastomer degradation in elastomer seals and components that are exposed to indoor air in the Filtration, Recirculation, and Ventilation System. The Periodic Inspection program is used to manage the aging effects of components that are not covered by other aging management programs, including external surfaces and internal surfaces of non-steel components. The Periodic Inspection program includes visual inspections, physical manipulation and nondestructive volumetric examinations to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Periodic Inspection program is described in Appendix B.

3.2.2.2.6 Loss of Material due to Erosion

Item Number 3.2.1-12 is applicable to PWRs only and is not used for Hope Creek.

3.2.2.2.7 Loss of Material due to General Corrosion and Fouling

Loss of material due to general corrosion and fouling can occur for steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air - indoor uncontrolled. This could result in plugging of the spray nozzles and flow orifices. This aging mechanism and effect will apply since the spray nozzles and flow orifices are occasionally wetted, even though the majority of the time this system is on standby. The wetting and drying of these components can accelerate corrosion and fouling. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

Item Number 3.2.1-13 is not applicable to Hope Creek Engineered Safety Features systems. There are no steel spray nozzles in the Hope Creek Engineered Safety Features systems. The spray nozzles in the Residual Heat Removal (RHR) System are stainless steel and are evaluated with Item Number 3.2.1-8. The spray header piping is not subject to wetting and drying, and is normally drained. The open spray nozzles expose the spray header piping internal surfaces to the inerted containment environment. The spray header piping normal internal environment is assumed to be Air/Gas – Wetted and is evaluated with Item Number 3.2.1-32.

3.2.2.2.8 Loss of Material due to General, Pitting, and Crevice Corrosion

1. *Loss of material due to general, pitting and crevice corrosion could occur for BWR steel piping, piping components, and piping elements exposed to treated water. The existing AMP relies on monitoring and control of water chemistry) for BWRs to mitigate degradation. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends*

further evaluation of programs to verify the effectiveness of the water chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to general, pitting, and crevice corrosion steel piping, piping components, piping elements and tanks exposed to treated water in the Containment Hydrogen Recombiner System, Core Spray, High Pressure Coolant Injection (HPCI) System, Reactor Core Isolation Cooling (RCIC) System and Residual Heat Removal (RHR) System. The Water Chemistry and One-Time Inspection programs are described in Appendix B.

2. *Loss of material due to general, pitting and crevice corrosion could occur for the internal surfaces of steel containment isolation piping, piping components, and piping elements exposed to treated water. The existing AMP relies on monitoring and control of water chemistry to mitigate degradation. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.*

   Engineered Safety Features system steel containment isolation piping, piping components, and piping elements exposed to treated water are evaluated with other Class 1 components. See LRA Table 3.1.1 Item Number 3.1.1-13. The non-reactor coolant pressure boundary steel components that are exposed to treated water are addressed in line Item Number 3.2.1-14.

3. *Loss of material due to general, pitting and crevice corrosion could occur for steel piping, piping components, and piping elements exposed to lubricating oil. The existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to*

ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage the loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, piping elements and tanks exposed to lubricating oil in the High Pressure Coolant Injection (HPCI) System and Reactor Core Isolation Cooling (RCIC) System. The Lubricating Oil Analysis and One-Time Inspection programs are described in Appendix B.

3.2.2.2.9 Loss of Material due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion (MIC)

Loss of material due to general, pitting, crevice, and MIC could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

Item Number 3.2.1-17 is not applicable to Hope Creek Engineered Safety Features systems. There are no steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil in the Hope Creek Engineered Safety Features systems.

3.2.2.2.10 Quality Assurance for Aging Management of Non-Safety Related Components

QA provisions applicable to License Renewal are discussed in Section B.1.3.

3.2.2.3 Time-Limited Aging Analysis

The time-limited aging analyses identified below are associated with the Engineered Safety Features components:

- Section 4.3, Metal Fatigue of the Reactor Pressure Vessel, Internals, and Reactor Coolant Pressure Boundary Piping and Components.

3.2.3 CONCLUSION

The Engineered Safety Features piping, piping components, piping elements, heat exchangers, and tanks that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Engineered

Safety Features components are identified in the summaries in Section 3.2.2.1 above.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the conclusions provided in Appendix B, the effects of aging associated with the Engineered Safety Features components will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-1	Steel and stainless steel piping, piping components, and piping elements in emergency core cooling system	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue is a TLAA; further evaluation is documented in Subsection 3.2.2.2.1.
3.2.1-2	PWR Only				
3.2.1-3	Stainless steel containment isolation piping and components internal surfaces exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not Applicable. See Subsection 3.2.2.2.3.1.
3.2.1-4	Stainless steel piping, piping components, and piping elements exposed to soil	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific	Not Applicable. See Subsection 3.2.2.2.3.2.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-5	Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements and tanks exposed to treated water. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See Subsection 3.2.2.2.3.3.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-6	Stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage the loss of material due to pitting and crevice corrosion in stainless steel and copper alloy piping, piping components, piping elements and heat exchangers exposed to lubricating oil. Exceptions apply to the NUREG-1801 recommendations for Lubricating Oil Analysis program implementation. See Subsection 3.2.2.2.3.4.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-7	Partially encased stainless steel tanks with breached moisture barrier exposed to raw water	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated for pitting and crevice corrosion of tank bottoms because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering.	Yes, plant-specific	Not Applicable. See Subsection 3.2.2.2.3.5.
3.2.1-8	Stainless steel piping, piping components, piping elements, and tank internal surfaces exposed to condensation (internal)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant-specific	The Periodic Inspection program, B.2.2.2, will be used to manage the loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, heat exchangers and tanks internal surfaces exposed to an air/gas wetted environment. See Subsection 3.2.2.2.3.6.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-9	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage the reduction of heat transfer due to fouling in copper alloy heat exchanger tubes exposed to lubricating oil. Exceptions apply to the NUREG-1801 recommendations for the Lubricating Oil Analysis program implementation. See Subsection 3.2.2.2.4.1.
3.2.1-10	Stainless steel heat exchanger tubes exposed to treated water	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not Applicable. See Subsection 3.2.2.2.4.2.
3.2.1-11	Elastomer seals and components in standby gas treatment system exposed to air – indoor uncontrolled	Hardening and loss of strength due to elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant-specific	The Periodic Inspection program, B.2.2.2, will be used to manage hardening and loss of strength due to elastomer degradation in elastomer seals and components that are exposed to indoor air. See Subsection 3.2.2.2.5.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-12	PWR Only				
3.2.1-13	Steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air – indoor uncontrolled (internal)	Loss of material due to general corrosion and fouling	A plant-specific aging management program is to be evaluated.	Yes, plant-specific	Not Applicable. See Subsection 3.2.2.2.7.
3.2.1-14	Steel piping, piping components, and piping elements exposed to treated water	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to general, pitting, and crevice corrosion steel piping, piping components, piping elements and tanks exposed to treated water. Exceptions apply to the NUREG-1801 recommendations for the Water Chemistry program implementation. See Subsection 3.2.2.2.8.1.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-15	Steel containment isolation piping, piping components, and piping elements internal surfaces exposed to treated water	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not Applicable. See Subsection 3.2.2.2.8.2.
3.2.1-16	Steel piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, piping elements and tanks exposed to lubricating oil. Exceptions apply to the NUREG-1801 recommendations for the Lubricating Oil Analysis program implementation. See Subsection 3.2.2.2.8.3.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-17	Steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes, detection of aging effects and operating experience are to be further evaluated	Not Applicable. See Subsection 3.2.2.2.9.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-18	Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Consistent with NUREG-1801 with exceptions. The Water Chemistry program, B.2.1.2, and BWR Stress Corrosion Cracking program, B.2.1.7, will be used to manage the cracking due to stress corrosion cracking and intergranular stress corrosion cracking in stainless steel piping, piping components, and piping elements exposed to treated water >140°F in the High Pressure Coolant Injection (HPCI) System, Reactor Core Isolation Cooling (RCIC) System and Residual Heat Removal (RHR) System. Exceptions apply to the NUREG-1801 recommendations for the Water Chemistry program implementation.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-19	Steel piping, piping components, and piping elements exposed to steam or treated water	Wall thinning due to flow accelerated corrosion	Flow-Accelerated Corrosion	No	Consistent with NUREG-1801 with exceptions. The Flow-Accelerated Corrosion program, B.2.1.11, will be used to manage wall thinning due to flow accelerated corrosion in steel piping, piping components, and piping elements exposed to steam in the High Pressure Coolant Injection (HPCI) System and Reactor Core Isolation Cooling (RCIC) System. Exceptions apply to the NUREG-1801 recommendations for the Flow-Accelerated Corrosion program implementation.
3.2.1-20	Cast austenitic stainless steel piping, piping components, and piping elements exposed to treated water (borated or unborated) >250°C (>482°F)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not Applicable. There are no cast austenitic stainless steel piping, piping components or piping elements, subject to treated water >482°F in the Engineered Safety Features systems.
3.2.1-21	High-strength steel closure bolting exposed to air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Not Applicable. There is no high-strength steel closure bolting in the Engineered Safety Features systems.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-22	Steel closure bolting exposed to air with steam or water leakage	Loss of material due to general corrosion	Bolting Integrity	No	Not Applicable. AMR methodology for steel closure bolting predicts pitting and crevice corrosion in addition to general corrosion. See Item Number 3.2.1-23.
3.2.1-23	Steel bolting and closure bolting exposed to air – outdoor (external), or air – indoor uncontrolled (external)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Consistent with NUREG-1801 with exceptions. The Bolting Integrity program, B.2.1.12, will be used to manage the loss of material due to general, pitting, and crevice corrosion in steel bolting exposed to outdoor air and indoor air the Containment Hydrogen Recombiner System, Core Spray System, Feedwater System, High Pressure Coolant Injection (HPCI) System, Hydrogen and Oxygen Analyzer System, Main Steam System, Nuclear Boiler Instrumentation, Process and Post-Accident Sampling Systems, Reactor Core Isolation Cooling (RCIC) System, Reactor Pressure Vessel, Reactor Recirculation System, Reactor Water Cleanup System, Residual Heat Removal (RHR) System, Standby Liquid Control System and Vacuum Relief Valve System. Exceptions apply to the NUREG-1801 recommendations for the Bolting Integrity program implementation. Components in the Filtration, Recirculation, and Ventilation

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					System have been aligned to this item based on material, environment and aging effect. The External Surfaces Monitoring program, B.2.1.25, has been substituted to manage the loss of material due to general, pitting, and crevice corrosion in steel bolting exposed to outdoor air in this system. Components in the Primary Containment have been aligned to this item based on material, environment and aging effect. The ASME Section XI, Subsection IWE program, B.2.1.28, has been substituted to manage loss of material due to general, pitting, and crevice corrosion in steel bolting exposed to indoor air in this structure. Internal air environments are assumed to contain significant amounts of moisture where condensation may occur. Steel components are subject to the additional aging mechanisms of pitting and crevice corrosion in this environment. See Item Number 3.2.1-34.
3.2.1-24	Steel closure bolting exposed to air – indoor uncontrolled (external)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Consistent with NUREG-1801 with exceptions. The Bolting Integrity program, B.2.1.12, will be used to manage the loss of preload due to thermal effects, gasket creep, and self-loosening in steel bolting

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					exposed to indoor air in the Containment Hydrogen Recombiner System, Core Spray System, Filtration, Recirculation, and Ventilation System, High Pressure Coolant Injection (HPCI) System, Hydrogen and Oxygen Analyzer System, Reactor Core Isolation Cooling (RCIC) System, Residual Heat Removal (RHR) System and Vacuum Relief Valve System. Exceptions apply to the NUREG-1801 recommendations for the Bolting Integrity program implementation. Components in the Primary Containment have been aligned to this item based on material, environment and aging effect. The ASME Section XI, Subsection IWE program, B.2.1.28, and the 10 CFR Part 50, Appendix J program, B.2.1.30, have been substituted to manage loss of preload due self-loosening in steel bolting exposed to indoor air in this structure.
3.2.1-25	Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water >60°C (>140°F)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	Not Applicable. There are no stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water >60°C (>140°F) in the Engineered Safety Features systems.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-26	Steel piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Not Applicable. There are no steel piping, piping components, and piping elements exposed to closed cycle cooling water in the Engineered Safety Features systems.
3.2.1-27	Steel heat exchanger components exposed to closed cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not Applicable. The steel heat exchanger components in the Residual Heat Removal (RHR) System have been evaluated with the Closed Cycle Cooling Water System. See Table 3.3.1 Item Number 3.3.1-48, which has the same material, environment and aging effect combinations this line Item Number.
3.2.1-28	Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Not Applicable. There are no stainless steel piping, piping components and piping elements exposed to closed-cycle cooling water in the Engineered Safety Features systems. The stainless steel heat exchanger components in the Residual Heat Removal (RHR) System have been evaluated with the Closed Cycle Cooling Water System. See Table 3.3.1 Item Number 3.3.1-50.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-29	Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not Applicable. The copper alloy heat exchanger components exposed to closed cycle cooling water in the Core Spray System, Filtration, Recirculation, and Ventilation System, High Pressure Coolant Injection (HPCI) System, Reactor Core Isolation Cooling (RCIC) System and Residual Heat Removal (RHR) System have been evaluated with the Closed Cycle Cooling Water System. See Table 3.3.1 Item Number 3.3.1-51.
3.2.1-30	Stainless steel and copper alloy heat exchanger tubes exposed to closed cycle cooling water	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Not Applicable. The stainless steel and copper alloy heat exchanger components exposed to closed cycle cooling water in the Core Spray System, Filtration, Recirculation, and Ventilation System, High Pressure Coolant Injection (HPCI) System, Reactor Core Isolation Cooling (RCIC) System and Residual Heat Removal (RHR) System have been evaluated with the Closed Cycle Cooling Water System. See Table 3.3.1 Item Number 3.3.1-52.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-31	External surfaces of steel components including ducting, piping, ducting closure bolting, and containment isolation piping external surfaces exposed to air - indoor uncontrolled (external); condensation (external) and air - outdoor (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. The External Surfaces Monitoring program, B.2.1.25, will be used to manage the loss of material due to general corrosion on the external surfaces of piping, piping components and piping elements, fan housing, turbine casing, ducting and components, bolting and tanks exposed to indoor air in the Containment Hydrogen Recombiner System, Core Spray System, Filtration, Recirculation, and Ventilation System, High Pressure Coolant Injection (HPCI) System, Nuclear Boiler Instrumentation, Reactor Core Isolation Cooling (RCIC) System, Residual Heat Removal (RHR) System and Vacuum Relief Valve System.
3.2.1-32	Steel piping and ducting components and internal surfaces exposed to air – indoor uncontrolled (Internal)	Loss of material due to general corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Not Applicable. There are no steel piping and ducting components with internal surfaces exposed to indoor air in the Engineered Safety Features systems. AMR methodology assumes internal surfaces are exposed to an Air/Gas – Wetted environment, which includes condensation. AMR methodology predicts pitting and crevice corrosion in addition to general corrosion. See Item Number 3.2.1-34.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-33	Steel encapsulation components exposed to air-indoor uncontrolled (internal)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Not Applicable. There are no steel encapsulation components exposed to indoor uncontrolled air in the Engineered Safety Features systems.
3.2.1-34	Steel piping, piping components, and piping elements exposed to condensation (internal)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Consistent with NUREG-1801. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program, B.2.1.26, will be used to manage the loss of material due to general, pitting, and crevice corrosion on steel piping, piping components, piping elements, turbine casing, damper housing, tanks, and fan housings exposed to an air/gas wetted environment in the Containment Hydrogen Recombiner System, Filtration, Recirculation, and Ventilation System, High Pressure Coolant Injection (HPCI) System, Reactor Core Isolation Cooling (RCIC) System, Residual Heat Removal System and Vacuum Relief Valve System.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-35	Steel containment isolation piping and components internal surfaces exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not Applicable. There are no steel piping and components internal surfaces exposed to raw water in the Engineered Safety Features systems.
3.2.1-36	Steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not Applicable. There are no steel heat exchanger components exposed to raw water in the Engineered Safety Features systems.
3.2.1-37	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Open-Cycle Cooling Water System	No	Not Applicable. There are no stainless steel piping, piping components, and piping elements exposed to raw water in the Engineered Safety Features systems.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-38	Stainless steel containment isolation piping and components internal surfaces exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Components in the Equipment and Floor Drainage System and Radwaste System have been aligned to this item based on material, environment and aging effect. The Periodic Inspection program, B.2.2.2, will be substituted to manage loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling in stainless steel piping and components and tanks exposed to raw water for these systems. Components in the Fire Protection System have been aligned to this item based on material, environment and aging effect. The Fire Water System program, B.2.1.18, will be substituted to manage loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling in stainless steel piping and components exposed to raw water in this system.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-39	Stainless steel heat exchanger components exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not Applicable. There are no stainless steel heat exchanger components exposed to raw water in the Engineered Safety Features systems.
3.2.1-40	Steel and stainless steel heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Not Applicable. There are no steel or stainless steel heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water in the Engineered Safety Features systems.
3.2.1-41	Copper alloy >15% Zn piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not Applicable. There are no copper alloy >15% Zn piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water in the Engineered Safety Features systems.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-42	Gray cast iron piping, piping components, piping elements exposed to closed-cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not Applicable. There are no gray cast iron piping, piping components, piping elements exposed to closed-cycle cooling water in the Engineered Safety Features systems.
3.2.1-43	Gray cast iron piping, piping components, and piping elements exposed to soil	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not Applicable. There are no gray cast iron piping, piping components, and piping elements exposed to soil in the Engineered Safety Features systems.
3.2.1-44	Gray cast iron motor cooler exposed to treated water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Consistent with NUREG-1801. The Selective Leaching of Materials program, B.2.1.23, will be used to manage loss of material due to selective leaching in gray cast iron components exposed to treated water in the Core Spray System and Residual Heat Removal (RHR) System. There are no gray cast iron motor coolers exposed to treated water in the Engineered Safety Features systems. However, the Engineered Safety Features systems contain a gray cast iron pump casing and site glass that are exposed to treated water.
3.2.1-45	PWR Only				

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-46	PWR Only				
3.2.1-47	PWR Only				
3.2.1-48	PWR Only				
3.2.1-49	PWR Only				
3.2.1-50	Aluminum piping, piping components, and piping elements exposed to air- indoor uncontrolled (internal/external)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.2.1-51	Galvanized steel ducting exposed to air – indoor controlled (external)	None	None	NA - No AEM or AMP	Not Applicable. There is no galvanized steel ducting exposed to controlled indoor air at Hope Creek. All indoor air environments at Hope Creek are assumed to be uncontrolled for license renewal.
3.2.1-52	Glass piping elements exposed to air – indoor uncontrolled (external), lubricating oil, raw water, treated water, or treated borated water	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.

Table 3.2.1 Summary of Aging Management Evaluations for the Engineered Safety Features

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.2.1-53	Stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.2.1-54	Steel piping, piping components, and piping elements exposed to air – indoor controlled (external)	None	None	NA - No AEM or AMP	Not Applicable. There are no steel piping, piping components, and piping elements exposed to indoor controlled air at Hope Creek. All indoor air environments at Hope Creek are assumed to be uncontrolled for license renewal.
3.2.1-55	Steel and stainless steel piping, piping components, and piping elements in concrete	None	None	NA - No AEM or AMP	Not Applicable. There are no Steel and stainless steel piping, piping components, and piping elements in concrete in the Engineered Safety Features systems.
3.2.1-56	Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.2.1-57	PWR Only				

Table 3.2.2-1
Containment Hydrogen Recombiner System
Summary of Aging Management Evaluation

Table 3.2.2-1 Containment Hydrogen Recombiner System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	V.E-5	3.2.1-24	B
Eductor	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Eductor	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Eductor	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Eductor	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Fan Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Fan Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	C
Flow Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Flow Element	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A

Table 3.2.2-1 Containment Hydrogen Recombiner System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Spray Nozzles	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Spray Nozzles	Pressure Boundary	Stainless Steel	Air/Gas Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Spray Nozzles	Spray	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Spray Nozzles	Spray	Stainless Steel	Air/Gas Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Strainer Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Strainer Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Tanks (Reaction Chamber)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	C

Table 3.2.2-1 Containment Hydrogen Recombiner System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tanks (Reaction Chamber)	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Tanks (Water Separator)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	C
Tanks (Water Separator)	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Tanks (Water Separator)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	C
Tanks (Water Separator)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	D
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Thermowell	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. NUREG-1801 specifies a plant-specific program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.2.2-2
Core Spray System
Summary of Aging Management Evaluation

Table 3.2.2-2 Core Spray System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	V.E-5	3.2.1-24	B
Bolting	Mechanical Closure	Stainless Steel Bolting	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Bolting Integrity			G, 1
Bolting	Mechanical Closure	Stainless Steel Bolting	Treated Water (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity			G, 1
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-11	3.1.1-4	A, 2
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A

Table 3.2.2-2 Core Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 3
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A

Table 3.2.2-2 Core Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 3
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Cyclone Separator (on Core Spray pump)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Cyclone Separator (on Core Spray pump)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Cyclone Separator (on Core Spray pump)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Flow Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B

Table 3.2.2-2 Core Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A

Table 3.2.2-2 Core Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Pump Casing (Core Spray)	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Pump Casing (Core Spray)	Pressure Boundary	Gray Cast Iron	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Pump Casing (Core Spray)	Pressure Boundary	Gray Cast Iron	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Pump Casing (Core Spray)	Pressure Boundary	Gray Cast Iron	Treated Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	V.A-18	3.2.1-44	C
Restricting Orifices	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A

Table 3.2.2-2 Core Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Restricting Orifices	Throttle	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 4
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 4
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 4
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 4
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Table 3.2.2-2 Core Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer	Filter	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Filter	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer	Filter	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Filter	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A

Table 3.2.2-2 Core Spray System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The aging effects for closure bolting in a treated water environment include loss of material and loss of preload. Loss of preload is managed through the Bolting Integrity aging management program. Loss of material for bolting in a submerged environment is managed in conjunction with the Water Chemistry and One Time Inspection aging management programs.

2. The TLAA designation in the Aging Management Program column indicates fatigue of this component is evaluated in Section 4.3.

3. The NUREG-1801 "One-Time Inspection of ASME Code Class 1 Small-Bore Piping" aging management program is applicable only to plants that have not experienced cracking of ASME Code Class 1 small-bore piping. Based on previous Hope Creek operating experience with Class 1 small-bore pipe cracking, a new plant-specific periodic inspection program will be used. The "Small-Bore Class 1 Piping Inspection" aging management program is a plant-specific periodic program that will be implemented to manage cracking by periodic volumetric examinations of small-bore Class 1 piping.

4. The Water Chemistry and ASME Section XI In-service Inspection, Subsections IWB, IWC, and IWD aging management programs will be used to manage the aging effect of cracking in restricting orifices and valve bodies < NPS 4".

Table 3.2.2-3
Filtration, Recirculation, and Ventilation System
Summary of Aging Management Evaluation

Table 3.2.2-3 Filtration, Recirculation, and Ventilation System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bird Screen	Filter	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	C
Bird Screen	Filter	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	C
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.B-2	3.2.1-31	A
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	V.E-5	3.2.1-24	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	V.E-1	3.2.1-23	E, 1
Bolting	Mechanical Closure	Stainless Steel Bolting	Air - Indoor (External)	None	None	III.B2-8	3.5.1-59	A
Damper Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.B-3	3.2.1-31	A
Damper Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	C
Door Seal	Pressure Boundary	Elastomer	Air - Indoor (External)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	V.B-4	3.2.1-11	E, 2

Table 3.2.2-3 Filtration, Recirculation, and Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Door Seal	Pressure Boundary	Elastomer	Air/Gas - Wetted (Internal)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F3-7	3.3.1-11	E, 2
Ducting and Components	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.B-3	3.2.1-31	A
Ducting and Components	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	C
Ducting and Components	Pressure Boundary	Polymer	Air - Indoor (External)	None	None			F, 3
Ducting and Components	Pressure Boundary	Polymer	Air/Gas - Wetted (Internal)	None	None			F, 3
Fan Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.B-3	3.2.1-31	A
Fan Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	C
Filter Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.B-3	3.2.1-31	A
Filter Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	C
Flexible Connection	Pressure Boundary	Elastomer	Air - Indoor (External)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	V.B-4	3.2.1-11	E, 4
Flexible Connection	Pressure Boundary	Elastomer	Air/Gas - Wetted (Internal)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F3-7	3.3.1-11	E, 4
Flow Element	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	A
Flow Element	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 2

Table 3.2.2-3 Filtration, Recirculation, and Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (FRVS Recirc cooling coils)	Evaluated with the Closed Cycle Cooling Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.B-3	3.2.1-31	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (External)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A, 5
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Piping and Fittings	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Piping and Fittings	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2, 5
Piping and Fittings	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (External)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A, 5
Piping and Fittings	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A

Table 3.2.2-3 Filtration, Recirculation, and Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 6
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 2
Tanks (Drum Trap)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Tanks (Drum Trap)	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	C
Thermowell	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.B-3	3.2.1-31	A
Thermowell	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Thermowell	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 2
Valve Body	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Valve Body	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Valve Body	Pressure Boundary	Stainless Steel	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 6

Table 3.2.2-3 Filtration, Recirculation, and Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 2

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The External Surfaces Monitoring program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

2. NUREG-1801 specifies a plant-specfic program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

3. The polymer (plexiglass) material located indoors and subject to an indoor air or air-gas (wetted) environment is not subject to significant aging effects. Polymer materials do not experience aging effects unless exposed to temperatures, radiation or chemicals capable of attacking the specific polymer chemical composition. Polymer materials are selected for compatibility with the environment during the design, and if properly selected will not experience significant degradation. Polymer (plexiglass) material in this non-aggressive air environment is not expected to experience significant aging effects. This is consistent with plant operating experience.

4. NUREG-1801 specifies a plant-specific program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination. Inspection of the expansion joints require physical manipulation; therefore, internal and external inspections, which include physical manipulation of elastomers, will be performed at the same time under the Periodic Inspection program.

5. The environment of Air/Gas - Wetted is applicable to the external surfaces during normal operation. This component is located within the HVAC ductwork and the external surfaces of this component are exposed to the HVAC Air/Gas - Wetted environment.

6. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.2.2-4
High Pressure Coolant Injection (HPCI) System
Summary of Aging Management Evaluation

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	V.E-5	3.2.1-24	B
Bolting	Mechanical Closure	Stainless Steel Bolting	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Bolting Integrity			G, 1
Bolting	Mechanical Closure	Stainless Steel Bolting	Treated Water (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity			G, 1
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-11	3.1.1-4	A, 2
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cracking/Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cracking/Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 3
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cracking/Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D, 4
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 3

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D, 4
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 3
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 3
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 5
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 5
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 5
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 5
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Filter Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Filter Housing	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Filter Housing	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Flow Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flow Element (HPCI Steam Flow Venturi) (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Flow Element (HPCI Steam Flow Venturi) (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Flow Element (HPCI Steam Flow Venturi) (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Flow Element (HPCI Steam Flow Venturi) (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Flow Element (HPCI Steam Flow Venturi) (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	BWR Stress Corrosion Cracking	V.D2-29	3.2.1-18	A
Flow Element (HPCI Steam Flow Venturi) (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	V.D2-29	3.2.1-18	B
Flow Element (HPCI Steam Flow Venturi) (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Flow Element (HPCI Steam Flow Venturi) (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Gearbox	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Gearbox	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Gearbox	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Heat Exchanger Components (Lube Oil Cooler)	Heat Transfer	Copper Alloy with 15% Zinc or More (Tubes)	Lubricating Oil (External)	Reduction of Heat Transfer/Fouling	Lubricating Oil Analysis	V.D2-9	3.2.1-9	B

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Lube Oil Cooler)	Heat Transfer	Copper Alloy with 15% Zinc or More (Tubes)	Lubricating Oil (External)	Reduction of Heat Transfer/Fouling	One-Time Inspection	V.D2-9	3.2.1-9	A
Heat Exchanger Components (Lube Oil Cooler)	Heat Transfer	Copper Alloy with 15% Zinc or More (Tubes)	Treated Water (Internal)	Reduction of Heat Transfer/Fouling	One-Time Inspection	VIII.E-10	3.4.1-9	A
Heat Exchanger Components (Lube Oil Cooler)	Heat Transfer	Copper Alloy with 15% Zinc or More (Tubes)	Treated Water (Internal)	Reduction of Heat Transfer/Fouling	Water Chemistry	VIII.E-10	3.4.1-9	B
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Shell Side Components)	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Shell Side Components)	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-22	3.2.1-6	D
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Shell Side Components)	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-22	3.2.1-6	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubes)	Lubricating Oil (External)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-22	3.2.1-6	D
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubes)	Lubricating Oil (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-22	3.2.1-6	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubes)	Treated Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	One-Time Inspection	VII.A4-7	3.3.1-31	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubes)	Treated Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Water Chemistry	VII.A4-7	3.3.1-31	D

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubes)	Treated Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.F1-9	3.3.1-84	A
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Shell Side Components)	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Shell Side Components)	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-22	3.2.1-6	D
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Shell Side Components)	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-22	3.2.1-6	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tube Side Components)	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tube Side Components)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-5	3.4.1-15	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tube Side Components)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.A-5	3.4.1-15	D
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubesheet)	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-22	3.2.1-6	D
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubesheet)	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-22	3.2.1-6	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubesheet)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-5	3.4.1-15	C

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubesheet)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.A-5	3.4.1-15	D
Hoses	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Hoses	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 6
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Piping and Fittings	Leakage Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	V.D2-34	3.2.1-19	B, 7
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 6
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	V.D2-32	3.2.1-1	A, 2
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	V.D2-34	3.2.1-19	B, 7
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 6
Piping and Fittings	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D1-24	3.2.1-6	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D1-24	3.2.1-6	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.B2-1	3.4.1-13	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.B2-1	3.4.1-13	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	VII.E3-14	3.3.1-2	A, 2
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Piping and Fittings	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Structural Support	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D, 4, 7
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D, 4, 7
Pump Casing (HPCI booster pump)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump Casing (HPCI booster pump)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Pump Casing (HPCI booster pump)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Pump Casing (HPCI pump)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Pump Casing (HPCI pump)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Pump Casing (HPCI pump)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Pump Casing (Jockey Pump)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Pump Casing (Jockey Pump)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Pump Casing (Jockey Pump)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Pump Casing (Turbine Aux Oil Pump)	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Pump Casing (Turbine Aux Oil Pump)	Pressure Boundary	Gray Cast Iron	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Pump Casing (Turbine Aux Oil Pump)	Pressure Boundary	Gray Cast Iron	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Pump Casing (Turbine Main Oil Pump)	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump Casing (Turbine Main Oil Pump)	Pressure Boundary	Gray Cast Iron	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Pump Casing (Turbine Main Oil Pump)	Pressure Boundary	Gray Cast Iron	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Pump Casing (Vacuum Tank Condensate Pump)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Pump Casing (Vacuum Tank Condensate Pump)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Pump Casing (Vacuum Tank Condensate Pump)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Restricting Orifices	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Restricting Orifices	Leakage Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Restricting Orifices	Leakage Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Restricting Orifices	Leakage Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Restricting Orifices	Leakage Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Restricting Orifices	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Restricting Orifices	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Restricting Orifices	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Restricting Orifices	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Restricting Orifices	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restricting Orifices	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 6
Restricting Orifices	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D1-24	3.2.1-6	B
Restricting Orifices	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D1-24	3.2.1-6	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Restricting Orifices	Throttle	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Restricting Orifices	Throttle	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 6
Restricting Orifices	Throttle	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D1-24	3.2.1-6	B
Restricting Orifices	Throttle	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D1-24	3.2.1-6	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 5
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 5
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 5
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 5
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Sight Glasses	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Sight Glasses	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Sight Glasses	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Sight Glasses	Leakage Boundary	Glass	Air - Indoor (External)	None	None	V.F-6	3.2.1-52	A
Sight Glasses	Leakage Boundary	Glass	Treated Water (Internal)	None	None	V.F-10	3.2.1-52	A
Sight Glasses	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Sight Glasses	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Sight Glasses	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Sight Glasses	Pressure Boundary	Glass	Air - Indoor (External)	None	None	V.F-6	3.2.1-52	A
Sight Glasses	Pressure Boundary	Glass	Lubricating Oil (Internal)	None	None	V.F-7	3.2.1-52	A
Sparger	Spray	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Sparger	Spray	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Sparger	Spray	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Sparger	Spray	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Strainer	Filter	Carbon Steel	Lubricating Oil (External)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Strainer	Filter	Carbon Steel	Lubricating Oil (External)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Strainer	Filter	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Strainer	Filter	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Strainer	Filter	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer	Filter	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer	Filter	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Filter	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer	Pressure Boundary	Carbon Steel	Lubricating Oil (External)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Strainer	Pressure Boundary	Carbon Steel	Lubricating Oil (External)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Strainer	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Strainer	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Strainer	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Strainer Body	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Strainer Body	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Strainer Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Tank (Turbine Lube Oil Reservoirs)	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Tank (Turbine Lube Oil Reservoirs)	Pressure Boundary	Gray Cast Iron	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	D
Tank (Turbine Lube Oil Reservoirs)	Pressure Boundary	Gray Cast Iron	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	C
Tank (Vacuum Tank)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Tank (Vacuum Tank)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	C
Tank (Vacuum Tank)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	D
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Thermowell	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D1-24	3.2.1-6	B
Thermowell	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D1-24	3.2.1-6	A
Thermowell	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Thermowell	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Turbine Casing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Turbine Casing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Valve Body	Leakage Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Valve Body	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Valve Body	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Valve Body	Leakage Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	V.D2-34	3.2.1-19	B, 7
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Valve Body	Leakage Boundary	Copper Alloy with 15% Zinc or More	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Valve Body	Leakage Boundary	Copper Alloy with 15% Zinc or More	Treated Water (Internal)	Loss of Material/Pitting, Crevice, and Galvanic Corrosion	One-Time Inspection	VII.A4-7	3.3.1-31	A
Valve Body	Leakage Boundary	Copper Alloy with 15% Zinc or More	Treated Water (Internal)	Loss of Material/Pitting, Crevice, and Galvanic Corrosion	Water Chemistry	VII.A4-7	3.3.1-31	B
Valve Body	Leakage Boundary	Copper Alloy with 15% Zinc or More	Treated Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.A4-9	3.3.1-84	A

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Valve Body	Leakage Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 6
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Valve Body	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Valve Body	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Valve Body	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Valve Body	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Valve Body	Pressure Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	V.D2-34	3.2.1-19	B, 7
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 6
Valve Body	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D1-24	3.2.1-6	B
Valve Body	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D1-24	3.2.1-6	A
Valve Body	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.B2-1	3.4.1-13	A
Valve Body	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.B2-1	3.4.1-13	B
Valve Body	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Valve Body	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D, 4

Table 3.2.2-4 High Pressure Coolant Injection (HPCI) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D, 4
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 5
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 5
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 5
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 5
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The aging effects for closure bolting in a treated water environment include loss of material and loss of preload. Loss of preload is managed through the Bolting Integrity aging management program. Loss of material for bolting in a submerged environment is managed in conjunction with the Water Chemistry and One Time Inspection aging management programs.

2. The TLAA designation in the Aging Management Program column indicates fatigue of this component is evaluated in Section 4.3.

3. The NUREG-1801 "One-Time Inspection of ASME Code Class 1 Small-Bore Piping" aging management program is applicable only to plants that have not experienced cracking of ASME Code Class 1 small-bore piping. Based on previous Hope Creek operating experience with Class 1 small-bore pipe cracking, a new plant-specific periodic inspection program will be used. The "Small-Bore Class 1 Piping Inspection" aging management program is a plant-specific periodic program that will be implemented to manage cracking by periodic volumetric examinations of small-bore Class 1 piping.

4. Line Item IV.C1-7 and V.D2-31 for flow-accelerated corrosion is not an applicable aging mechanism as this system is normally in standby except for the HPCI drain line.

5. The Water Chemistry and ASME Section XI In-service Inspection, Subsections IWB, IWC, and IWD aging management programs will be used to manage the aging effect of cracking in condensing chambers, valve bodies and restricting orifices < NPS 4.

6. NUREG-1801 specifies a plant-specific program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

7. According to station procedure, the HPCI Drain lines are susceptible to FAC and are included in the scope of the Flow accelerated Corrosion Program.

Table 3.2.2-5
Hydrogen and Oxygen Analyzer System
Summary of Aging Management Evaluation

Table 3.2.2-5 Hydrogen and Oxygen Analyzer System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	V.E-5	3.2.1-24	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-1	3.2.1-23	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Outdoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Filter Housing	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Filter Housing	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Flow Device	Pressure Boundary	Glass	Air - Indoor (External)	None	None	V.F-6	3.2.1-52	A
Flow Device	Pressure Boundary	Glass	Air/Gas - Wetted (Internal)	None	None	VII.J-7	3.3.1-93	A
Flow Device	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Flow Device	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Heat Exchanger Components (Air Cooled - H2O2 Analyzer)	Heat Transfer	Stainless Steel (Tubes)	Air - Indoor (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			G, 2

Table 3.2.2-5 Hydrogen and Oxygen Analyzer System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Air Cooled - H2O2 Analyzer)	Heat Transfer	Stainless Steel (Tubes)	Air/Gas - Wetted (Internal)	Reduction of Heat Transfer/Fouling	Periodic Inspection			H, 2
Heat Exchanger Components (Air Cooled - H2O2 Analyzer)	Pressure Boundary	Stainless Steel (Tubes)	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	C
Heat Exchanger Components (Air Cooled - H2O2 Analyzer)	Pressure Boundary	Stainless Steel (Tubes)	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 3
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	V.F-15	3.2.1-56	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Pump Casing (H2O2 Analyzer)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Pump Casing (H2O2 Analyzer)	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Restricting Orifices	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Restricting Orifices	Throttle	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Restricting Orifices	Throttle	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. NUREG-1801 specifies a plant-specific program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

2. The Periodic Inspection aging management program will be used to manage the identified aging effects for this component type, material and environment combination.

3. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.2.2-6
Reactor Core Isolation Cooling (RCIC) System
Summary of Aging Management Evaluation

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	V.E-5	3.2.1-24	B
Bolting	Mechanical Closure	Stainless Steel Bolting	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Bolting Integrity			G, 1
Bolting	Mechanical Closure	Stainless Steel Bolting	Treated Water (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity			G, 1
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-11	3.1.1-4	A, 2
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cracking/Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cracking/Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 3
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cracking/Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D, 4
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 3

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D, 4
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 3
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 3
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Drain Traps	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Drain Traps	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Drain Traps	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Filter Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Filter Housing	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Filter Housing	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Flow Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Flow Element (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Flow Element (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Flow Element (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Flow Element (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Flow Element (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	BWR Stress Corrosion Cracking	V.D2-29	3.2.1-18	A
Flow Element (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	V.D2-29	3.2.1-18	B

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flow Element (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Flow Element (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Heat Exchanger Components (Lube Oil Cooler)	Heat Transfer	Copper Alloy with 15% Zinc or More (Tubes)	Lubricating Oil (External)	Reduction of Heat Transfer/Fouling	Lubricating Oil Analysis	V.D2-9	3.2.1-9	B
Heat Exchanger Components (Lube Oil Cooler)	Heat Transfer	Copper Alloy with 15% Zinc or More (Tubes)	Lubricating Oil (External)	Reduction of Heat Transfer/Fouling	One-Time Inspection	V.D2-9	3.2.1-9	A
Heat Exchanger Components (Lube Oil Cooler)	Heat Transfer	Copper Alloy with 15% Zinc or More (Tubes)	Treated Water (Internal)	Reduction of Heat Transfer/Fouling	One-Time Inspection	VIII.E-10	3.4.1-9	A
Heat Exchanger Components (Lube Oil Cooler)	Heat Transfer	Copper Alloy with 15% Zinc or More (Tubes)	Treated Water (Internal)	Reduction of Heat Transfer/Fouling	Water Chemistry	VIII.E-10	3.4.1-9	B
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Shell Side Components)	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Shell Side Components)	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-22	3.2.1-6	D
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Shell Side Components)	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-22	3.2.1-6	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubes)	Lubricating Oil (External)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-22	3.2.1-6	D
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubes)	Lubricating Oil (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-22	3.2.1-6	C

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubes)	Treated Water (Internal)	Loss of Material/Pitting, Crevice, and Galvanic Corrosion	One-Time Inspection	VII.A4-7	3.3.1-31	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubes)	Treated Water (Internal)	Loss of Material/Pitting, Crevice, and Galvanic Corrosion	Water Chemistry	VII.A4-7	3.3.1-31	D
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubes)	Treated Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.F1-9	3.3.1-84	A
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tube Side Components)	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tube Side Components)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-5	3.4.1-15	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tube Side Components)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.A-5	3.4.1-15	D
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubesheet)	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-22	3.2.1-6	D
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubesheet)	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-22	3.2.1-6	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubesheet)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-5	3.4.1-15	C
Heat Exchanger Components (Lube Oil Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubesheet)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.A-5	3.4.1-15	D
Hoses	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Hoses	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 5
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Piping and Fittings	Leakage Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	V.D2-34	3.2.1-19	B, 7
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 5
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	V.D2-32	3.2.1-1	A, 2
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	V.D2-34	3.2.1-19	B, 7
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 5
Piping and Fittings	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D1-24	3.2.1-6	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D1-24	3.2.1-6	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.B2-1	3.4.1-13	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.B2-1	3.4.1-13	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	VII.E3-14	3.3.1-2	A, 2
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Piping and Fittings	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Structural Support	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D, 4, 7
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D, 4, 7
Pump Casing (Jockey Pump)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump Casing (Jockey Pump)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Pump Casing (Jockey Pump)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Pump Casing (RCIC Gland Seal Cond. Vacuum Pump)	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Pump Casing (RCIC Gland Seal Cond. Vacuum Pump)	Structural Support	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Pump Casing (RCIC Pump)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Pump Casing (RCIC Pump)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Pump Casing (RCIC Pump)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Pump Casing (Turbine Aux Oil Pump)	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Pump Casing (Turbine Aux Oil Pump)	Pressure Boundary	Gray Cast Iron	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Pump Casing (Turbine Aux Oil Pump)	Pressure Boundary	Gray Cast Iron	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Pump Casing (Turbine Main Oil Pump)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump Casing (Turbine Main Oil Pump)	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Pump Casing (Turbine Main Oil Pump)	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Pump Casing (Vacuum Tank Condensate Pump)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Pump Casing (Vacuum Tank Condensate Pump)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Pump Casing (Vacuum Tank Condensate Pump)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Restricting Orifices	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 5
Restricting Orifices	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D1-24	3.2.1-6	B
Restricting Orifices	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D1-24	3.2.1-6	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Restricting Orifices	Throttle	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Restricting Orifices	Throttle	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 5

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restricting Orifices	Throttle	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D1-24	3.2.1-6	B
Restricting Orifices	Throttle	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D1-24	3.2.1-6	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 6
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 6
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 6
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 6
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Sight Glasses	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Sight Glasses	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Sight Glasses	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Sight Glasses	Leakage Boundary	Glass	Treated Water (Internal)	None	None	V.F-10	3.2.1-52	A
Sight Glasses	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Sight Glasses	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Sight Glasses	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Sight Glasses	Pressure Boundary	Glass	Air - Indoor (External)	None	None	V.F-6	3.2.1-52	A
Sight Glasses	Pressure Boundary	Glass	Lubricating Oil (External)	None	None	V.F-7	3.2.1-52	A
Sparger (Turbine Exhaust)	Spray	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Sparger (Turbine Exhaust)	Spray	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Sparger (Turbine Exhaust)	Spray	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Sparger (Turbine Exhaust)	Spray	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer	Filter	Carbon Steel	Lubricating Oil (External)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Strainer	Filter	Carbon Steel	Lubricating Oil (External)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Strainer	Filter	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Strainer	Filter	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Strainer	Filter	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Filter	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer	Filter	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Filter	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer	Pressure Boundary	Carbon Steel	Lubricating Oil (External)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Strainer	Pressure Boundary	Carbon Steel	Lubricating Oil (External)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Strainer	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Strainer	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Strainer	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Strainer Body	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B
Strainer Body	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Strainer Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Strainer Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Tank (Turbine Lube Oil Reservoirs)	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Tank (Turbine Lube Oil Reservoirs)	Pressure Boundary	Gray Cast Iron	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	D
Tank (Turbine Lube Oil Reservoirs)	Pressure Boundary	Gray Cast Iron	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	C
Tank (Vacuum Tank)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Tank (Vacuum Tank)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	C

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tank (Vacuum Tank)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	D
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Thermowell	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D1-24	3.2.1-6	B
Thermowell	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D1-24	3.2.1-6	A
Thermowell	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Thermowell	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Turbine Casing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Turbine Casing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Valve Body	Leakage Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Valve Body	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Valve Body	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Valve Body	Leakage Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	V.D2-34	3.2.1-19	B, 7

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Valve Body	Leakage Boundary	Copper Alloy with 15% Zinc or More	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Valve Body	Leakage Boundary	Copper Alloy with 15% Zinc or More	Treated Water (Internal)	Loss of Material/Pitting, Crevice, and Galvanic Corrosion	One-Time Inspection	VII.A4-7	3.3.1-31	A
Valve Body	Leakage Boundary	Copper Alloy with 15% Zinc or More	Treated Water (Internal)	Loss of Material/Pitting, Crevice, and Galvanic Corrosion	Water Chemistry	VII.A4-7	3.3.1-31	B
Valve Body	Leakage Boundary	Copper Alloy with 15% Zinc or More	Treated Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.A4-9	3.3.1-84	A
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Valve Body	Leakage Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 5
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Valve Body	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D2-30	3.2.1-16	B

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-30	3.2.1-16	A
Valve Body	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Valve Body	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Valve Body	Pressure Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	V.D2-34	3.2.1-19	B, 7
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B, 4
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 5
Valve Body	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	V.D1-24	3.2.1-6	B
Valve Body	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D1-24	3.2.1-6	A
Valve Body	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.B2-1	3.4.1-13	A
Valve Body	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.B2-1	3.4.1-13	B
Valve Body	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Valve Body	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Valve Body	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Valve Body	Structural Support	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.D2-2	3.2.1-31	A
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D, 4
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D, 4
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A

Table 3.2.2-6 Reactor Core Isolation Cooling (RCIC) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 6
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 6
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 6
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 6
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The aging effects for closure bolting in a treated water environment include loss of material and loss of preload. Loss of preload is managed through the Bolting Integrity aging management program. Loss of material for bolting in a submerged environment is managed in conjunction with the Water Chemistry and One Time Inspection aging management programs.

2. The TLAA designation in the Aging Management Program column indicates fatigue of this component is evaluated in Section 4.3.

3. The NUREG-1801 "One-Time Inspection of ASME Code Class 1 Small-Bore Piping" aging management program is applicable only to plants that have not experienced cracking of ASME Code Class 1 small-bore piping. Based on previous Hope Creek operating experience with Class 1 small-bore pipe cracking, a new plant-specific periodic inspection program will be used. The "Small-Bore Class 1 Piping Inspection" aging management program is a plant-specific periodic program that will be implemented to manage cracking by periodic volumetric examinations of small-bore Class 1 piping.

4. Line Item IV.C1-7 and V.D2-31 for flow-accelerated corrosion is not an applicable aging mechanism as this system is normally in standby except for the RCIC drain line.

5. NUREG-1801 specifies a plant-specific program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

6. The Water Chemistry and ASME Section XI In-service Inspection, Subsections IWB, IWC, and IWD aging management programs will be used to manage the aging effect of cracking in valve bodies and restricting orifices < NPS 4".

7. According to station procedure, the RCIC Drain lines are susceptible to FAC and are included in the scope of the Flow Accelerated Corrosion Program.

Table 3.2.2-7

Residual Heat Removal (RHR) System

Summary of Aging Management Evaluation

Table 3.2.2-7 Residual Heat Removal (RHR) System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	V.E-5	3.2.1-24	B
Bolting	Mechanical Closure	Stainless Steel Bolting	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Bolting Integrity			G, 1
Bolting	Mechanical Closure	Stainless Steel Bolting	Treated Water (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity			G, 1
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-11	3.1.1-4	A, 2
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A

Table 3.2.2-7 Residual Heat Removal (RHR) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 3
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A

Table 3.2.2-7 Residual Heat Removal (RHR) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 3
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Cyclone Separator (on RHR Pump)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Cyclone Separator (on RHR Pump)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Cyclone Separator (on RHR Pump)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Flow Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Heat Exchanger Components (RHR)	Evaluated with the Closed Cycle Cooling Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			

Table 3.2.2-7 Residual Heat Removal (RHR) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	V.D2-32	3.2.1-1	A, 2
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A

Table 3.2.2-7 Residual Heat Removal (RHR) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Piping and Fittings (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Piping and Fittings (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	BWR Stress Corrosion Cracking	V.D2-29	3.2.1-18	A
Piping and Fittings (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	V.D2-29	3.2.1-18	B
Piping and Fittings (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Piping and Fittings (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A

Table 3.2.2-7 Residual Heat Removal (RHR) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Pump Casing (Jockey)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Pump Casing (Jockey)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Pump Casing (Jockey)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Pump Casing (RHR)	Pressure Boundary	Ductile Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Pump Casing (RHR)	Pressure Boundary	Ductile Cast Iron	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Pump Casing (RHR)	Pressure Boundary	Ductile Cast Iron	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Restricting Orifices	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Restricting Orifices	Throttle	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 4

Table 3.2.2-7 Residual Heat Removal (RHR) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 4
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 4
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 4
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Sight Glasses	Leakage Boundary	Glass	Air - Indoor (External)	None	None	V.F-6	3.2.1-52	A
Sight Glasses	Leakage Boundary	Glass	Treated Water (Internal)	None	None	V.F-10	3.2.1-52	A
Sight Glasses	Leakage Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Sight Glasses	Leakage Boundary	Gray Cast Iron	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Sight Glasses	Leakage Boundary	Gray Cast Iron	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Sight Glasses	Leakage Boundary	Gray Cast Iron	Treated Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	V.A-18	3.2.1-44	C
Spray Nozzles	Spray	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Spray Nozzles	Spray	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 5

Table 3.2.2-7 Residual Heat Removal (RHR) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer	Filter	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Filter	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer	Filter	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Filter	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Strainer	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Strainer	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Thermowell	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Thermowell	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A

Table 3.2.2-7 Residual Heat Removal (RHR) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	V.D2-33	3.2.1-14	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	V.D2-33	3.2.1-14	B
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	V.D2-28	3.2.1-5	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	V.D2-28	3.2.1-5	B
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.E-7	3.2.1-31	A
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 2
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 4
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 4

Table 3.2.2-7 Residual Heat Removal (RHR) System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The aging effects for closure bolting in a treated water environment include loss of material and loss of preload. Loss of preload is managed through the Bolting Integrity aging management program. Loss of material for bolting in a submerged environment is managed in conjunction with the Water Chemistry and One Time Inspection aging management programs.

2. The TLAA designation in the Aging Management Program column indicates fatigue of this component is evaluated in Section 4.3.

3. The NUREG-1801 "One-Time Inspection of ASME Code Class 1 Small-Bore Piping" aging management program is applicable only to plants that have not experienced cracking of ASME Code Class 1 small-bore piping. Based on previous Hope Creek operating experience with Class 1 small-bore pipe cracking, a new plant-specific periodic inspection program will be used. The "Small-Bore Class 1 Piping Inspection" aging management program is a plant-specific periodic program that will be implemented to manage cracking by periodic volumetric examinations of small-bore Class 1 piping.

4. The Water Chemistry and ASME Section XI In-service Inspection, Subsections IWB, IWC, and IWD aging management programs will be used to manage the aging effect of cracking in restricting orifices and valve bodies < NPS 4".

5. NUREG-1801 specifies a plant specific program. The Periodic Inspection program is used to manage the aging effects applicable to this component type, material and environment.

Table 3.2.2-8
Vacuum Relief Valve System
Summary of Aging Management Evaluation

Table 3.2.2-8 Vacuum Relief Valve System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	V.E-5	3.2.1-24	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.B-3	3.2.1-31	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	V.B-3	3.2.1-31	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	V.D2-17	3.2.1-34	A
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	V.F-12	3.2.1-53	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 1

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. NUREG-1801 specifies a plant-specific program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

3.3 AGING MANAGEMENT OF AUXILIARY SYSTEMS

3.3.1 INTRODUCTION

This section provides the results of the aging management review for those components identified in Section 2.3.3, Auxiliary Systems, as being subject to aging management review. The systems, or portions of systems, which are addressed in this section are described in the indicated sections.

- Chilled Water System (2.3.3.1)
- Closed Cycle Cooling Water System (2.3.3.2)
- Compressed Air System (2.3.3.3)
- Containment Inerting and Purging System (2.3.3.4)
- Control Area Chilled Water System (2.3.3.5)
- Control Rod Drive System (2.3.3.6)
- Control Room and Control Area HVAC Systems (2.3.3.7)
- Cranes & Hoists (2.3.3.8)
- Equipment and Floor Drainage System (2.3.3.9)
- Fire Protection System (2.3.3.10)
- Fire Pump House Ventilation System (2.3.3.11)
- Fresh Water Supply System (2.3.3.12)
- Fuel Handling and Storage System (2.3.3.13)
- Fuel Pool Cooling and Cleanup System (2.3.3.14)
- Hardened Torus Vent System (2.3.3.15)
- Hydrogen Water Chemistry System (2.3.3.16)
- Leak Detection and Radiation Monitoring System (2.3.3.17)
- Makeup Demineralizer System (2.3.3.18)
- Primary Containment Instrument Gas System (2.3.3.19)
- Primary Containment Leakage Rate Testing System (2.3.3.20)
- Process and Post-Accident Sampling Systems (2.3.3.21)
- Radwaste System (2.3.3.22)
- Reactor Building Ventilation System (2.3.3.23)
- Reactor Water Cleanup System (2.3.3.24)
- Remote Shutdown Panel Room HVAC System (2.3.3.25)
- Service Water Intake Ventilation System (2.3.3.26)
- Service Water System (2.3.3.27)
- Standby Diesel Generator Area Ventilation Systems (2.3.3.28)
- Standby Diesel Generators and Auxiliary Systems (2.3.3.29)
- Standby Liquid Control System (2.3.3.30)
- Torus Water Cleanup System (2.3.3.31)
- Traversing Incore Probe System (2.3.3.32)

3.3.2 RESULTS

The following tables summarize the results of the aging management review for Auxiliary Systems.

Table 3.3.2-1 Summary of Aging Management Evaluation – Chilled Water System

Table 3.3.2-2 Summary of Aging Management Evaluation – Closed Cycle Cooling Water System

Table 3.3.2-3 Summary of Aging Management Evaluation – Compressed Air System

Table 3.3.2-4 Summary of Aging Management Evaluation – Containment Inerting and Purging System

Table 3.3.2-5 Summary of Aging Management Evaluation – Control Area Chilled Water System

Table 3.3.2-6 Summary of Aging Management Evaluation – Control Rod Drive System

Table 3.3.2-7 Summary of Aging Management Evaluation – Control Room and Control Area HVAC Systems

Table 3.3.2-8 Summary of Aging Management Evaluation – Cranes & Hoists

Table 3.3.2-9 Summary of Aging Management Evaluation – Equipment and Floor Drainage System

Table 3.3.2-10 Summary of Aging Management Evaluation – Fire Protection System

Table 3.3.2-11 Summary of Aging Management Evaluation – Fire Pump House Ventilation System

Table 3.3.2-12 Summary of Aging Management Evaluation – Fresh Water Supply System

Table 3.3.2-13 Summary of Aging Management Evaluation – Fuel Handling and Storage System

Table 3.3.2-14 Summary of Aging Management Evaluation – Fuel Pool Cooling and Cleanup System

Table 3.3.2-15 Summary of Aging Management Evaluation – Hardened Torus Vent System

Table 3.3.2-16 Summary of Aging Management Evaluation – Hydrogen Water Chemistry System

3.3.2.1 Materials, Environments, Aging Effects Requiring Management And Aging Managements Programs

3.3.2.1.1 Chilled Water System

Materials

The materials of construction for the Chilled Water System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy with less than 15% Zinc
- Ductile Cast Iron
- Gray Cast Iron
- Stainless Steel

Environments

The Chilled Water System components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Wetted
- Closed Cycle Cooling Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Chilled Water System components require management:

- Loss of Material/General, Pitting, Crevice and Galvanic Corrosion
- Loss of Material/Selective Leaching
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Chilled Water System components:

- Bolting Integrity (B.2.1.12)
- Closed-Cycle Cooling Water System (B.2.1.14)
- External Surfaces Monitoring (B.2.1.25)
- Periodic Inspection (B.2.2.2)
- Selective Leaching of Materials (B.2.1.23)

Table 3.3.2-1, Summary of Aging Management Evaluation – Chilled Water System summarizes the results of the aging management review for the Chilled Water System.

3.3.2.1.2 Closed Cycle Cooling Water System

Materials

The materials of construction for the Closed Cycle Cooling Water System components are:

- Aluminum
- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy with 15% Zinc or More
- Copper Alloy with less than 15% Zinc
- Gray Cast Iron
- Stainless Steel

Environments

The Closed Cycle Cooling Water System components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Dry
- Air/Gas - Wetted
- Closed Cycle Cooling Water
- Lubricating Oil
- Raw Water
- Treated Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Closed Cycle Cooling Water System components require management:

- Loss of Material/Galvanic Corrosion
- Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion
- Loss of Material/Selective Leaching
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening
- Reduction of Heat Transfer/Fouling

Aging Management Programs

The following aging management programs manage the aging effects for the Closed Cycle Cooling Water System components:

- Bolting Integrity (B.2.1.12)
- Closed-Cycle Cooling Water System (B.2.1.14)
- External Surfaces Monitoring (B.2.1.25)
- Lubricating Oil Analysis (B.2.1.27)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Selective Leaching of Materials (B.2.1.23)
- Water Chemistry (B.2.1.2)

Table 3.3.2-2, Summary of Aging Management Evaluation – Closed Cycle Cooling Water System summarizes the results of the aging management review for the Closed Cycle Cooling Water System.

3.3.2.1.3 Compressed Air System

Materials

The materials of construction for the Compressed Air System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel

Environments

The Compressed Air System components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Dry

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Compressed Air System components require management:

- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self- Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Compressed Air System components:

- Bolting Integrity (B.2.1.12)
- Compressed Air Monitoring (B.2.1.16)
- External Surfaces Monitoring (B.2.1.25)

Table 3.3.2-3, Summary of Aging Management Evaluation – Compressed Air System summarizes the results of the aging management review for the Compressed Air System.

3.3.2.1.4 Containment Inerting and Purging System

Materials

The materials of construction for the Containment Inerting and Purging System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel

Environments

The Containment Inerting and Purging System components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Dry
- Air/Gas - Wetted

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Containment Inerting and Purging System components require management:

- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Containment Inerting and Purging System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)

Table 3.3.2-4, Summary of Aging Management Evaluation – Containment Inerting and Purging System summarizes the results of the aging management review for the Containment Inerting and Purging System.

3.3.2.1.5 Control Area Chilled Water System

Materials

The materials of construction for the Control Area Chilled Water System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy with 15% Zinc or More
- Copper Alloy with less than 15% Zinc
- Glass
- Stainless Steel

Environments

The Control Area Chilled Water System components are exposed to the following environments:

- Air – Indoor
- Air/Gas - Dry
- Air/Gas – Wetted
- Closed Cycle Cooling Water
- Treated Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Control Area Chilled Water System components require management:

- Loss of Material/General, Pitting, Crevice and Galvanic Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening
- Reduction of Heat Transfer/Fouling

Aging Management Programs

The following aging management programs manage the aging effects for the Control Area Chilled Water System components:

- Bolting Integrity (B.2.1.12)
- Closed-Cycle Cooling Water System (B.2.1.14)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Water Chemistry (B.2.1.2)

Table 3.3.2-5, Summary of Aging Management Evaluation– Control Area Chilled Water System summarizes the results of the aging management review for Control Area Chilled Water System.

3.3.2.1.6 Control Rod Drive System

Materials

The materials of construction for the Control Rod Drive System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Gray Cast Iron
- Stainless Steel

Environments

The Control Rod Drive System components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Dry
- Air/Gas - Wetted
- Lubricating Oil
- Treated Water
- Treated Water > 140° F

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Control Rod Drive System components require management:

- Cracking/Stress Corrosion Cracking
- Loss of Material/General, Pitting, Crevice and Galvanic Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Control Rod Drive System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Lubricating Oil Analysis (B.2.1.27)
- One-Time Inspection (B.2.1.22)
- Water Chemistry (B.2.1.2)

Table 3.3.2-6, Summary of Aging Management Evaluation – Control Rod Drive System summarizes the results of the aging management review for the Control Rod Drive System.

3.3.2.1.7 Control Room and Control Area HVAC Systems

Materials

The materials of construction for the Control Room and Control Area HVAC System components are:

- Aluminum
- Aluminum Bolting
- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy with 15% Zinc or More
- Copper Alloy with less than 15% Zinc
- Elastomer
- Galvanized Steel
- Gray Cast Iron
- Polymer

- Stainless Steel
- Stainless Steel Bolting

Environments

The Control Room and Control Area HVAC System components are exposed to the following environments:

- Air – Indoor
- Air - Outdoor
- Air/Gas - Wetted

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Control Room and Control Area HVAC System components require management:

- Hardening and Loss of Strength/Elastomer Degradation
- Loss of Material/General, Pitting, Crevice and Microbiologically Influenced Corrosion

Aging Management Programs

The following aging management programs manage the aging effects for the Control Room and Control Area HVAC System components:

- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)

Table 3.3.2-7, Summary of Aging Management Evaluation – Control Room and Control Area HVAC Systems summarizes the results of the aging management review for Control Room and Control Area HVAC Systems.

3.3.2.1.8 Cranes & Hoists

Materials

The materials of construction for the Cranes & Hoists components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel

Environments

The Cranes & Hoists components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Cranes & Hoists components require management:

- Cumulative Fatigue Damage/Fatigue
- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Material/Wear
- Loss of Preload/Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Cranes & Hoists components:

- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (B.2.1.15)
- TLAA

Table 3.3.2-8, Summary of Aging Management Evaluation – Cranes & Hoists summarizes the results of the aging management review for the Cranes & Hoists.

3.3.2.1.9 Equipment and Floor Drainage System

Materials

The materials of construction for the Equipment and Floor Drainage System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy with less than 15% Zinc
- Ductile Cast Iron
- Galvanized Steel
- Gray Cast Iron
- Stainless Steel

Environments

The Equipment and Floor Drainage System components are exposed to the following environments:

- Air - Indoor
- Raw Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Equipment and Floor Drainage System components require management:

- Loss of Material/General, Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling
- Loss of Material/Selective Leaching
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Equipment and Floor Drainage System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)
- Selective Leaching of Materials (B.2.1.23)

Table 3.3.2-9, Summary of Aging Management Evaluation – Equipment and Floor Drainage System summarizes the results of the aging management review for the Equipment and Floor Drainage System.

3.3.2.1.10 Fire Protection System

Materials

The materials of construction for the Fire Protection System components are:

- Aluminum
- Alumina Silicate
- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Concrete
- Copper Alloy with 15% Zinc or More

- Copper Alloy with less than 15% Zinc
- Ductile Cast Iron
- Elastomer
- Galvanized Steel
- Gray Cast Iron
- Grout
- Polymer
- Reinforced Concrete
- Stainless Steel

Environments

The Fire Protection System components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Air/Gas - Dry
- Air/Gas - Wetted
- Fuel Oil
- Groundwater/Soil
- Raw Water
- Soil

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Fire Protection System components require management:

- Change in Material Properties
- Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment
- Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel
- Cracks and Distortion/Increased Stress Levels from Settlement
- Increased Hardness, Shrinkage and Loss of Strength/Weathering
- Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/Aggressive Chemical Attack
- Loss of Material/General, Pitting, Crevice, Galvanic, Microbiologically Influenced Corrosion, and Fouling
- Loss of Material/Wear

- Loss of Material (Spalling, Scaling) and Cracking/Freeze-Thaw
- Loss of Material/Selective Leaching
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Fire Protection System components:

- Aboveground Steel Tanks (B.2.1.19)
- Bolting Integrity (B.2.1.12)
- Buried Non-Steel Piping Inspection (B.2.2.4)
- Buried Piping Inspection (B.2.1.24)
- External Surfaces Monitoring (B.2.1.25)
- Fire Protection (B.2.1.17)
- Fire Water System (B.2.1.18)
- Fuel Oil Chemistry (B.2.1.20)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Selective Leaching of Materials (B.2.1.23)
- Structures Monitoring Program (B.2.1.32)

Table 3.3.2-10, Summary of Aging Management Evaluation – Fire Protection System summarizes the results of the aging management review for the Fire Protection System.

3.3.2.1.11 Fire Pump House Ventilation System

Materials

The materials of construction for the Fire Pump House Ventilation System components are:

- Carbon Steel
- Aluminum

Environments

The Fire Pump House Ventilation System components are exposed to the following environments:

- Air/Gas - Wetted
- Air – Outdoor

Aging Effects Requiring Management

The following aging effects associated with the Fire Pump House Ventilation System components require management:

- Loss of Material/General, Pitting and Crevice Corrosion

Aging Management Programs

The following aging management programs manage the aging effects for the Fire Pump House Ventilation System components:

- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)
- Structures Monitoring Program (B.2.1.32)

Table 3.3.2-11, Summary of Aging Management Evaluation – Fire Pump House Ventilation System summarizes the results of the aging management review for the Fire Pump House Ventilation System.

3.3.2.1.12 Fresh Water Supply System

Materials

The materials of construction for the Fresh Water Supply System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy with less than 15% Zinc
- Ductile Cast Iron
- Gray Cast Iron
- Stainless Steel

Environments

The Fresh Water Supply System components are exposed to the following environments:

- Air – Indoor
- Raw Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Fresh Water Supply System components require management:

- Loss of Material/General, Pitting, Crevice, Galvanic, Microbiologically Influenced Corrosion, and Fouling
- Loss of Material/Selective Leaching
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Fresh Water Supply System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)
- Selective Leaching of Materials (B.2.1.23)

Table 3.3.2-12 Summary of Aging Management Evaluation – Fresh Water Supply System summarizes the results of the aging management review for the Fresh Water Supply System.

3.3.2.1.13 Fuel Handling and Storage System

Materials

The materials of construction for the Fuel Handling and Storage components are:

- Aluminum
- Boral
- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel Bolting
- Stainless Steel

Environments

The Fuel Handling and Storage components are exposed to the following environments:

- Air - Indoor
- Treated Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Fuel Handling and Storage components require management:

- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Material/Wear
- Loss of Preload/Self-Loosening
- Reduction of Neutron-Absorbing Capacity and Loss of Material/General Corrosion

Aging Management Programs

The following aging management programs manage the aging effects for the Fuel Handling and Storage components:

- Boral Monitoring (B.2.2.5)
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (B.2.1.15)
- One-Time Inspection (B.2.1.22)
- Water Chemistry (B.2.1.2)

Table 3.3.2-13, Summary of Aging Management Evaluation – Fuel Handling and Storage System summarizes the results of the aging management review for the Fuel Handling and Storage System.

3.3.2.1.14 Fuel Pool Cooling and Cleanup System

Materials

The materials of construction for the Fuel Pool Cooling and Cleanup System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel
- Stainless Steel Bolting

Environments

The Fuel Pool Cooling and Cleanup System components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Wetted
- Concrete

- Treated Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Fuel Pool Cooling and Cleanup System components require management:

- Loss of Material/General, Pitting, Crevice and Galvanic Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Fuel Pool Cooling and Cleanup System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- One-Time Inspection (B.2.1.22)
- Water Chemistry (B.2.1.2)

Table 3.3.2-14, Summary of Aging Management Evaluation – Fuel Pool Cooling and Cleanup System summarizes the results of the aging management review for the Fuel Pool Cooling and Cleanup System.

3.3.2.1.15 Hardened Torus Vent System

Materials

The materials of construction for the Hardened Torus Vent System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel

Environments

The Hardened Torus Vent System components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Wetted

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Hardened Torus Vent System components require management:

- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Hardened Torus Vent System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)

Table 3.3.2-15, Summary of Aging Management Evaluation – Hardened Torus Vent System summarizes the results of the aging management review for the Hardened Torus Vent System.

3.3.2.1.16 Hydrogen Water Chemistry System

Materials

The materials of construction for the Hydrogen Water Chemistry System components are:

- Carbon and Low Alloy Steel
- Stainless Steel

Environments

The Hydrogen Water Chemistry System components are exposed to the following environments:

- Air - Indoor
- Treated Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Hydrogen Water Chemistry System components require management:

- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Hydrogen Water Chemistry System components:

- Bolting Integrity (B.2.1.12)
- One-Time Inspection (B.2.1.22)
- Water Chemistry (B.2.1.2)

Table 3.3.2-16, Summary of Aging Management Evaluation – Hydrogen Water Chemistry System summarizes the results of the aging management review for the Hydrogen Water Chemistry System.

3.3.2.1.17 Leak Detection and Radiation Monitoring System

Materials

The materials of construction for the Leak Detection and Radiation Monitoring System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel

Environments

The Leak Detection and Radiation Monitoring System components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Wetted

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Leak Detection and Radiation Monitoring System components require management:

- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Leak Detection and Radiation Monitoring System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)

- Periodic Inspection (B.2.2.2)

Table 3.3.2-17, Summary of Aging Management Evaluation - Leak Detection and Radiation Monitoring System summarizes the results of the aging management review for the Leak Detection and Radiation Monitoring System.

3.3.2.1.18 Makeup Demineralizer System

Materials

The materials of construction for the Makeup Demineralizer System components are:

- Carbon and Low Alloy Steel Bolting
- Stainless Steel

Environments

The Makeup Demineralizer System components are exposed to the following environments:

- Air – Indoor
- Air/Gas - Wetted
- Treated Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Makeup Demineralizer System components require management:

- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Makeup Demineralizer System components:

- Bolting Integrity (B.2.1.12)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Water Chemistry (B.2.1.2)

Table 3.3.2-18, Summary of Aging Management Evaluation – Makeup Demineralizer System summarizes the results of the aging management review for the Makeup Demineralizer System.

3.3.2.1.19 Primary Containment Instrument Gas System

Materials

The materials of construction for the Primary Containment Instrument Gas System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Ductile Cast Iron
- Stainless Steel

Environments

The Primary Containment Instrument Gas System components are exposed to the following environments:

- Air - Indoor
- Air/Gas - Dry
- Air/Gas - Wetted

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Primary Containment Instrument Gas System components require management:

- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Primary Containment Instrument Gas System components:

- Bolting Integrity (B.2.1.12)
- Compressed Air Monitoring (B.2.1.16)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)

Table 3.3.2-19, Summary of Aging Management Evaluation – Primary Containment Instrument Gas System summarizes the results of the aging management review for the Primary Containment Instrument Gas System.

3.3.2.1.20 Primary Containment Leakage Rate Testing System

Materials

The materials of construction for the Primary Containment Leakage Rate Testing System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy with less than 15% Zinc
- Stainless Steel

Environments

The Primary Containment Leakage Rate Testing System components are exposed to the following environments:

- Air - Indoor
- Air/Gas – Wetted
- Air/Gas – Dry

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Primary Containment Leakage Rate Testing System components require management:

- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Primary Containment Leakage Rate Testing System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)

Table 3.3.2-20, Summary of Aging Management Evaluation – Primary Containment Leakage Rate Testing System summarizes the results of the aging management review for the Primary Containment Leakage Rate Testing System.

3.3.2.1.21 Process and Post-Accident Sampling Systems

Materials

The materials of construction for the Process and Post-Accident Sampling System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel

Environments

The Process and Post-Accident Sampling System components are exposed to the following environments:

- Air - Indoor
- Air/Gas – Wetted
- Treated Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Process and Post-Accident Sampling System components require management:

- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Process and Post-Accident Sampling System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Water Chemistry (B.2.1.2)

Table 3.3.2-21, Summary of Aging Management Evaluation – Process and Post-Accident Sampling Systems summarizes the results of the aging management review for the Process and Post-Accident Sampling Systems.

3.3.2.1.22 Radwaste System

Materials

The materials of construction for the Radwaste System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel

Environments

The Radwaste System components are exposed to the following environments:

- Air – Indoor
- Raw Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Radwaste System components require management:

- Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Radwaste System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)

Table 3.3.2-22, Summary of Aging Management Evaluation – Radwaste System summarizes the results of the aging management review for the Radwaste System.

3.3.2.1.23 Reactor Building Ventilation System

Materials

The materials of construction for the Reactor Building Ventilation System components are:

- Aluminum
- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy with 15% Zinc or More
- Copper Alloy with less than 15% Zinc
- Elastomer
- Galvanized Steel
- Stainless Steel

Environments

The Reactor Building Ventilation System components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Air/Gas - Dry
- Air/Gas - Wetted

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Reactor Building Ventilation System components require management:

- Hardening and Loss of Strength/Elastomer Degradation
- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Building Ventilation System components:

- Bolting Integrity (B.2.1.12)
- Compressed Air Monitoring (B.2.1.16)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)

Table 3.3.2-23, Summary of Aging Management Evaluation – Reactor Building Ventilation System summarizes the results of the aging management review for the Reactor Building Ventilation System.

3.3.2.1.24 Reactor Water Cleanup System

Materials

The materials of construction for the Reactor Water Cleanup System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Glass
- Stainless Steel

Environments

The Reactor Water Cleanup System components are exposed to the following environments:

- Air - Indoor
- Treated Water
- Treated Water > 140 F

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Reactor Water Cleanup System components require management:

- Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading
- Cumulative Fatigue Damage/Fatigue
- Loss of Material/General, Pitting, Crevice and Galvanic Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening
- Wall Thinning/Flow Accelerated Corrosion

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Water Cleanup System components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1.1)
- Bolting Integrity (B.2.1.12)
- BWR Stress Corrosion Cracking (B.2.1.7)

- External Surfaces Monitoring (B.2.1.25)
- Flow-Accelerated Corrosion (B.2.1.11)
- One-Time Inspection (B.2.1.22)
- Small-bore Class 1 Piping Inspection (B.2.2.6)
- TLAA
- Water Chemistry (B.2.1.2)

Table 3.3.2-24, Summary of Aging Management Evaluation – Reactor Water Cleanup System summarizes the results of the aging management review for the Reactor Water Cleanup System.

3.3.2.1.25 Remote Shutdown Panel Room HVAC System

Materials

The materials of construction for the Remote Shutdown Panel Room HVAC System components are:

- Aluminum
- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy with less than 15% Zinc
- Elastomer
- Galvanized Steel
- Stainless Steel

Environments

The Remote Shutdown Panel Room HVAC System components are exposed to the following environments:

- Air – Indoor
- Air – Outdoor
- Air/Gas – Wetted

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Remote Shutdown Panel Room HVAC System components require management:

- Hardening and Loss of Strength/Elastomer Degradation
- Loss of Material/General, Pitting, Crevice, and Microbiological Influenced Corrosion

Aging Management Programs

The following aging management programs manage the aging effects for the Remote Shutdown Panel Room HVAC System components:

- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)

Table 3.3.2-25, Summary of Aging Management Evaluation – Remote Shutdown Panel Room HVAC System summarizes the results of the aging management review for the Remote Shutdown Panel Room HVAC System.

3.3.2.1.26 Service Water Intake Ventilation System

Materials

The materials of construction for the Service Water Intake Ventilation System components are:

- Aluminum
- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Elastomer
- Galvanized Steel
- Galvanized Steel Bolting
- Stainless Steel

Environments

The Service Water Intake Ventilation System components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Air/Gas - Wetted

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Service Water Intake Ventilation System components require management:

- Hardening and Loss of Strength/Elastomer Degradation
- Loss of Material/General, Pitting, and Crevice Corrosion

Aging Management Programs

The following aging management programs manage the aging effects for the Service Water Intake Ventilation System components:

- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)

Table 3.3.2-26, Summary of Aging Management Evaluation – Service Water Intake Ventilation System summarizes the results of the aging management review for the Service Water Intake Ventilation System.

3.3.2.1.27 Service Water System

Materials

The materials of construction for the Service Water System components are:

- Aluminum Bronze Bolting with 8% Al or more
- Aluminum Bronze with 8% Al or more
- Carbon and Low Alloy Steel Bolting
- Carbon or Low Alloy Steel with Nickel Alloy Cladding
- Carbon Steel
- Carbon Steel (Epoxy lined)
- Carbon Steel (Concrete lined)
- Copper Alloy with less than 15% Zinc
- Ductile Cast Iron
- Elastomer
- Nickel Alloy Bolting
- Nickel Alloy
- Reinforced Concrete
- Stainless Steel Bolting
- Stainless Steel
- Titanium Alloy

Environments

The Service Water System components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Closed Cycle Cooling Water
- Concrete
- Groundwater/Soil
- Raw Water
- Soil

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Service Water System components require management:

- Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel
- Hardening and Loss of Strength/Elastomer Degradation
- Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack
- Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide
- Loss of Material/ Abrasion; Cavitation
- Loss of Material/General, Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling
- Loss of Material/Selective Leaching
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening
- Reduction of Heat Transfer/Fouling

Aging Management Programs

The following aging management programs manage the aging effects for the Service Water System components:

- Bolting Integrity (B.2.1.12)
- Buried Non-Steel Piping Inspection (B.2.2.4)
- Buried Piping Inspection (B.2.1.24)
- Closed-Cycle Cooling Water System (B.2.1.14)
- External Surfaces Monitoring (B.2.1.25)

- Open-Cycle Cooling Water System (B.2.1.13)
- Selective Leaching of Materials (B.2.1.23)

Table 3.3.2-27, Summary of Aging Management Evaluation – Service Water System summarizes the results of the aging management review for the Service Water System.

3.3.2.1.28 Standby Diesel Generator Area Ventilation Systems

Materials

The materials of construction for the Standby Diesel Generator Area Ventilation System components are:

- Aluminum
- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy with 15% Zinc or More
- Elastomer
- Galvanized Steel
- Stainless Steel
- Stainless Steel Bolting

Environments

The Standby Diesel Generator Area Ventilation System components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Air/Gas - Wetted

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Standby Diesel Generator Area Ventilation System components require management:

- Hardening and Loss of Strength/Elastomer Degradation
- Loss of Material/General, Pitting and Crevice Corrosion

Aging Management Programs

The following aging management programs manage the aging effects for the Standby Diesel Generator Area Ventilation System components:

- External Surfaces Monitoring (B.2.1.25)

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Periodic Inspection (B.2.2.2)

Table 3.3.2-28, Summary of Aging Management Evaluation – Standby Diesel Generator Area Ventilation Systems summarizes the results of the aging management review for the Standby Diesel Generator Area Ventilation Systems.

3.3.2.1.29 Standby Diesel Generators and Auxiliary Systems

Materials

The materials of construction for the Standby Diesel Generators and Auxiliary System components are:

- Aluminum
- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Copper Alloy Bolting with 15% Zinc or More
- Stainless Steel
- Stainless Steel Bolting

Environments

The Standby Diesel Generators and Auxiliary System components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Air/Gas - Dry
- Air/Gas - Wetted
- Closed Cycle Cooling Water
- Closed Cycle Cooling Water > 140° F
- Diesel Exhaust
- Fuel Oil
- Lubricating Oil
- Treated Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Standby Diesel Generators and Auxiliary System components require management:

- Cracking/Stress Corrosion Cracking
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening
- Loss of Material/General, Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling

Aging Management Programs

The following aging management programs manage the aging effects for the Standby Diesel Generators and Auxiliary System components require management:

- Bolting Integrity (B.2.1.12)
- Closed-Cycle Cooling Water System (B.2.1.14)
- External Surfaces Monitoring (B.2.1.25)
- Fuel Oil Chemistry (B.2.1.20)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- Lubricating Oil Analysis (B.2.1.27)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Water Chemistry (B.2.1.2)

Table 3.3.2-29, Summary of Aging Management Evaluation – Standby Diesel Generators and Auxiliary Systems summarizes the results of the aging management review for the Standby Diesel Generators and Auxiliary Systems.

3.3.2.1.30 Standby Liquid Control System

Materials

The materials of construction for the Standby Liquid Control System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel

Environments

The Standby Liquid Control System components are exposed to the following environments:

- Air - Indoor
- Sodium Pentaborate
- Treated Water
- Treated Water > 140° F

Aging Effects/'Mechanisms Requiring Management

The following aging effects associated with the Standby Liquid Control System components require management:

- Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading
- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Standby Liquid Control System components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1.1)
- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- One-Time Inspection (B.2.1.22)
- Small-Bore Class 1 Piping Inspection (B.2.2.6)
- Water Chemistry (B.2.1.2)

Table 3.3.2-30, Summary of Aging Management Evaluation – Standby Liquid Control System summarizes the results of the aging management review for the Standby Liquid Control System.

3.3.2.1.31 Torus Water Cleanup System

Materials

The materials of construction for the Torus Water Cleanup System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel

Environments

The Torus Water Cleanup System components are exposed to the following environments:

- Air – Indoor
- Air/Gas - Wetted
- Treated Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Torus Water Cleanup System components require management:

- Loss of Material/General, Pitting, Crevice and Galvanic Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Crevice Corrosion

Aging Management Programs

The following aging management programs manage the aging effects for the Torus Water Cleanup System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Water Chemistry (B.2.1.2)

Table 3.3.2-31, Summary of Aging Management Evaluation – Torus Water Cleanup System summarizes the results of the aging management review for the Torus Water Cleanup System.

3.3.2.1.32 Traversing Incore Probe System

Materials

The materials of construction for the Traversing Incore Probe System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel

Environments

The Traversing Incore Probe System components are exposed to the following environments:

- Air - Indoor

- Air/Gas - Dry

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Traversing Incore Probe System components require management:

- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Traversing Incore Probe System components:

- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)

Table 3.3.2-32, Summary of Aging Management Evaluation – Traversing Incore Probe System summarizes the results of the aging management review for the Traversing Incore Probe System.

3.3.2.2 <u>AMR Results for Which Further Evaluation is Recommended by the GALL Report</u>

NUREG-1801 provides the basis for identifying those programs that warrant further evaluation by the reviewer in the license renewal application. For the Auxiliary Systems, those programs are addressed in the following subsections.

3.3.2.2.1 <u>Cumulative Fatigue Damage</u>

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of metal fatigue as a TLAA for the High Pressure Coolant Injection (HPCI) System, Main Steam System, Reactor Core Isolation Cooling (RCIC) System, and Reactor Water Cleanup System is discussed in Section 4.3. The evaluation of crane load cycles as a TLAA for the Cranes and Hoists is discussed in Section 4.7.

3.3.2.2.2 <u>Reduction of Heat Transfer due to Fouling</u>

Reduction of heat transfer due to fouling could occur for stainless steel heat exchanger tubes exposed to treated water. The existing program relies on control of water chemistry to manage reduction of heat transfer due to fouling. However, control of water chemistry may have been inadequate. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that reduction of heat transfer due to fouling is not occurring. A one-time inspection is an acceptable method to ensure that reduction of heat transfer is not occurring and that the component's intended function will be maintained during the period of extended operation.

Hope Creek will implement a One-Time Inspection program, B.2.1.22, to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the reduction of heat transfer due to fouling in stainless steel heat exchanger components exposed to treated water. The Water Chemistry program and One-Time Inspection program manage reduction of heat transfer for the Fuel Pool Cooling Heat Exchanger stainless steel plates, Residual Heat Removal heat exchanger stainless steel tubes and Residual Heat Removal pump seal heat exchanger stainless steel tubes in a treated water environment. These heat exchanger components have been evaluated with the Closed Cycle Cooling Water system, which provides the cooling water to these heat exchangers. The Water Chemistry and One-Time Inspection programs are described in Appendix B.

3.3.2.2.3 Cracking due to Stress Corrosion Cracking (SCC)

1. *Cracking due to SCC could occur in the stainless steel piping, piping components, and piping elements of the BWR Standby Liquid Control system that are exposed to sodium pentaborate solution greater than 60°C (>140°F). The existing aging management program relies on monitoring and control of water chemistry to manage the aging effects of cracking due to SCC. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause SCC. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that SCC is not occurring. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that SCC is not occurring and that the component's intended function will be maintained during the period of extended operation.*

   Item Number 3.3.1-4 is not applicable to Hope Creek. The stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution are maintained at a temperature less than 140° F at Hope Creek.

2. *Cracking due to SCC could occur in stainless steel and stainless clad steel heat exchanger components exposed to treated water greater than 60°C (>140°F). The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.*

   Hope Creek will implement the One-Time Inspection program, B.2.1.22, to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage cracking due to stress corrosion cracking of the stainless steel heat exchanger components exposed to treated water >60°C (>140°F) in the Reactor Water Cleanup System. The Water Chemistry program activities provide for monitoring and controlling of water chemistry in accordance with EPRI BWR Vessel and Internals Project BWR Water Chemistry Guidelines. The Water Chemistry program activities prevent or mitigate cracking due to stress corrosion cracking of the stainless steel heat exchanger components exposed to treated water >60°C (>140°F) to ensure there is no loss of component intended function.

The One-Time Inspection program and Water Chemistry program are described in Appendix B.

3. *Cracking due to SCC could occur in stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.*

   Hope Creek will implement a Periodic Inspection program, B.2.2.2, to manage cracking due to stress corrosion cracking in stainless steel expansion joints exposed to diesel exhaust for the Standby Diesel Generators and Auxiliary Systems. The Periodic Inspection program is used to manage the aging effects of components that are not covered by other aging management programs, including internal surfaces of stainless steel components not covered by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26) program. The Periodic Inspection program includes focused visual inspections to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Periodic Inspection program is described in Appendix B.

3.3.2.2.4 <u>Cracking due to Stress Corrosion Cracking and Cyclic Loading</u>

1. *Cracking due to SCC and cyclic loading could occur in stainless steel PWR non-regenerative heat exchanger components exposed to treated borated water greater than 60°C (>140°F) in the chemical and volume control system. The existing aging management program on monitoring and control of primary water chemistry in PWRs to manage the aging effects of cracking due to SCC. However, control of water chemistry does not preclude cracking due to SCC and cyclic loading. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that cracking is not occurring. The GALL Report recommends that a plant-specific aging management program be evaluated to verify the absence of cracking due to SCC and cyclic loading to ensure that these aging effects are managed adequately. An acceptable verification program is to include temperature and radioactivity monitoring of the shell side water, and eddy current testing of tubes.*

   Item Number 3.3.1-7 is not applicable to Hope Creek. This item is applicable to PWRs only.

2. *Cracking due to SCC and cyclic loading could occur in stainless steel PWR regenerative heat exchanger components exposed to treated borated water greater than 60°C (>140°F). The existing aging management program relies on monitoring and control of primary water chemistry in PWRs to manage the aging effects of cracking due to SCC. However, control of*

water chemistry does not preclude cracking due to SCC and cyclic loading. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that cracking is not occurring. The GALL Report recommends that a plant-specific aging management program be evaluated to verify the absence of cracking due to SCC and cyclic loading to ensure that these aging effects are managed adequately. Acceptance criteria are described in Branch Technical Position RLSB-1

Item Number 3.3.1-8 is not applicable to Hope Creek. This item is applicable to PWRs only.

3. *Cracking due to SCC and cyclic loading could occur for the stainless steel pump casing for the PWR high-pressure pumps in the chemical and volume control system. The existing aging management program relies on monitoring and control of primary water chemistry in PWRs to manage the aging effects of cracking due to SCC. However, control of water chemistry does not preclude cracking due to SCC and cyclic loading. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that cracking is not occurring. The GALL Report recommends that a plant-specific aging management program be evaluated to verify the absence of cracking due to SCC and cyclic loading to ensure that these aging effects are managed adequately. Acceptance criteria are described in Branch Technical Position RLSB-1*

   Item Number 3.3.1-9 is not applicable to Hope Creek. This item is applicable to PWRs only.

4. Item Number 3.3.1-10 is not applicable to Hope Creek. There is no high strength bolting in the Auxiliary Systems.

3.3.2.2.5 Hardening and Loss of Strength due to Elastomer Degradation

1. *Hardening and loss of strength due to elastomer degradation could occur in elastomer seals and components of heating and ventilation systems exposed to air – indoor uncontrolled (internal/external). The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1*

   Hope Creek will implement the Periodic Inspection program, B.2.2.2, to manage hardening and loss of strength due to elastomer degradation of the elastomer door seals and flexible connections exposed to indoor air or wetted air/gas for the Control Room and Control Area HVAC Systems, Filtration, Recirculation, and Ventilation System, Reactor Building Ventilation System, Remote Shutdown Panel Room HVAC System, Service Water Intake Ventilation System, and Standby Diesel Generator Area Ventilation Systems. The Periodic Inspection program is used to manage the aging effects of components that are not covered by other aging management programs, including external surfaces of non-steel components not covered by the External Surfaces Monitoring (B.2.1.25) program and internal surfaces of non-steel components not covered by the

Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26) program. The Periodic Inspection program includes visual inspections and physical manipulation of elastomer components to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Periodic Inspection program is described in Appendix B.

Hope Creek will also implement the Structures Monitoring Program, B.2.1.32, to manage hardening and loss of strength due to elastomer degradation of the compressible joint seals in the Reactor Building exposed to indoor air. The Structures Monitoring Program includes visual inspections of elastomer components to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Structures Monitoring program is described in Appendix B.

2. *Hardening loss of strength due to elastomer degradation could occur in elastomer linings of the filters, valves, and ion exchangers in spent fuel pool cooling and cleanup systems (BWR and PWR) exposed to treated water or to treated borated water. The GALL Report recommends that a plant-specific aging management program be evaluated to determine and assesses the qualified life of the linings in the environment to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.*

   Hope Creek will implement the Structures Monitoring Program, B.2.1.32, to manage hardening and loss of strength due to elastomer degradation of the compressible joint seals in the Reactor Building exposed to treated water. The Structures Monitoring Program includes visual inspections of elastomer components to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Structures Monitoring program is described in Appendix B.

3.3.2.2.6 <u>Reduction of Neutron-Absorbing Capacity and Loss of Material due to General Corrosion</u>

Reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur in the neutron-absorbing sheets of BWR and PWR spent fuel storage racks exposed to treated water or to treated borated water. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

Hope Creek will implement the Boral Monitoring Program, B.2.2.5, to manage reduction of neutron-absorbing capacity and loss of material due to general corrosion of the irradiated fuel storage racks exposed to treated water. The Boral Monitoring Program monitors the Boral test coupon inspection or testing results at other Boiling Water Reactor (BWR) sites. If these results indicate a problem with Boral neutron absorbing material potentially affecting its intended function (i. e., absorb neutrons), Hope Creek will initiate inspection or testing of its Boral test coupons. The Boral Monitoring Program is described in Appendix B.

Hope Creek will also implement a Water Chemistry program, B.2.1.2, to manage reduction of neutron-absorbing capacity and loss of material due to general corrosion of the boral, boron steel spent fuel storage racks neutron-absorbing sheets exposed to treated water in the fuel handling and fuel storage system. The Water Chemistry program activities provide for monitoring and controlling of water chemistry in accordance with EPRI BWR Vessel and Internals Project BWR Water Chemistry Guidelines. The Water Chemistry program activities prevent or mitigate loss of material due to general corrosion to ensure there is no loss of component intended function. The Water Chemistry program is described in Appendix B.

3.3.2.2.7 Loss of Material due to General, Pitting, and Crevice Corrosion

1. *Loss of material due to general, pitting, and crevice corrosion could occur in steel piping, piping components, and piping elements, including the tubing, valves, and tanks in the reactor coolant pump oil collection system, exposed to lubricating oil (as part of the fire protection system). The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.*

   In addition, corrosion may occur at locations in the reactor coolant pump oil collection tank where water from wash downs may accumulate. Therefore, the effectiveness of the program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion, to include determining the thickness of the lower portion of the tank. A one-time inspection is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

   Item Numbers 3.3.1-15 and 3.3.1-16 are not applicable to Hope Creek. Hope Creek does not have a reactor coolant pump oil collection system or a reactor coolant pump oil collection system tank.

Hope Creek will implement a One-Time Inspection program, B.2.1.22, to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage loss of material due to general, pitting and crevice corrosion of the steel piping, piping components, and piping elements, heat exchanger components and tanks exposed to lubricating oil in the Control Rod Drive System and Standby Diesel Generators and Auxiliary Systems. The Lubricating Oil Analysis and One-Time Inspection programs are described in Appendix B.

2. *Loss of material due to general, pitting, and crevice corrosion could occur in steel piping, piping components, and piping elements in the BWR reactor water cleanup and shutdown cooling systems exposed to treated water. The existing aging management program relies on monitoring and control of reactor water chemistry to manage the aging effects of loss of material from general, pitting and crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause general, pitting, or crevice corrosion. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from general, pitting, and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.*

   Hope Creek will implement a One-Time Inspection program, B.2.1.22, to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to general, pitting and crevice corrosion of the steel piping, piping components, and piping elements, heat exchanger components and tanks exposed to treated water for the Control Area Chilled Water System, Control Rod Drive System, Fuel Handling and Storage System, Fuel Pool Cooling and Cleanup System, Primary Containment, Reactor Water Cleanup System, Standby Diesel Generators and Auxiliary Systems, Standby Liquid Control System, and Torus Water Cleanup System. The Water Chemistry and One-Time Inspection programs are described in Appendix B.

3. *Loss of material due to general (steel only) pitting and crevice corrosion could occur for steel and stainless steel diesel exhaust piping, piping components, and piping elements exposed to diesel exhaust. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.*

   Hope Creek will implement the Periodic Inspection program, B.2.2.2, to manage loss of material due to pitting and crevice corrosion of the stainless steel exhaust system expansion joints exposed to diesel exhaust for the Standby Diesel Generators and Auxiliary Systems. The Periodic Inspection program is used to manage the aging effects of components that are not covered by other aging management programs, including internal surfaces of stainless steel components not covered by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26) program. The Periodic Inspection program includes visual inspections to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Periodic Inspection program is described in Appendix B.

Hope Creek will implement the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program, B.2.1.26, to manage loss of material due to general, pitting and crevice corrosion of the steel exhaust system piping and silencer/muffler exposed to diesel exhaust for the Standby Diesel Generators and Auxiliary Systems. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26) program consists of inspections of steel components that are not covered by other aging management programs. These inspections are performed during the periodic system and component surveillances or during the performance of maintenance activities when the surfaces are made accessible for visual inspection. These inspections assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is described in Appendix B.

3.3.2.2.8 Loss of Material due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion (MIC)

Loss of material due to general, pitting, crevice corrosion, and microbiologically-influenced corrosion (MIC) could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

Hope Creek will implement the Buried Piping Inspection, B.2.1.24, to manage loss of material due to general, pitting, crevice, and microbiologically influenced corrosion of the external surfaces of steel (including epoxy lined), galvanized steel, gray cast iron, and ductile cast Iron piping and fittings, fire hydrants, and valve bodies exposed to soil in the Fire Protection System and Service Water System. The Buried Piping Inspection aging management program manages buried steel piping and components for loss of material through the use of coatings and wrappings, and periodic inspections. The program relies on preventive measures such as coating and wrapping to mitigate corrosion and periodic inspection of external surfaces to identify coating degradation, if coated, or base metal corrosion, if uncoated. These inspections assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Buried Piping Inspection program is described in Appendix B.

3.3.2.2.9 Loss of Material due to General, Pitting, Crevice, Microbiologically-Influenced Corrosion and Fouling

1. *Loss of material due to general, pitting, crevice, MIC, and fouling could occur for steel piping, piping components, piping elements, and tanks exposed to fuel oil. The existing aging management program relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination to manage loss of material due to corrosion or fouling. Corrosion or fouling may occur at locations where contaminants accumulate. The effectiveness of the fuel oil chemistry control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, crevice, MIC, and fouling to verify the effectiveness of the fuel oil chemistry program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.*

   Hope Creek will implement a One-Time Inspection program, B.2.1.22, to verify the effectiveness of the Fuel Oil Chemistry program, B.2.1.20, to manage loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling of the steel piping, piping components, and piping elements, and tanks exposed to fuel oil for the Fire Protection System and Standby Diesel Generators and Auxiliary Systems. The Fuel Oil Chemistry and One-Time Inspection programs are described in Appendix B.

2. *Loss of material due to general, pitting, crevice, MIC, and fouling could occur for steel heat exchanger components exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.*

   Hope Creek will implement a One-Time Inspection program, B.2.1.22, to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage loss of material due to general, pitting and crevice corrosion of steel heat exchanger components exposed to lubricating oil for the Closed Cycle Cooling Water System. The Lubricating Oil Analysis program and

One-Time Inspection program manage loss of material on the standby diesel generator steel lube oil heat exchanger components in a lubricating oil environment. Loss of material due to microbiologically influenced corrosion is not applicable for stainless steel in a Lubricating Oil environment. Industry and plant operating experience indicates that the potential for significant degradation of lubricating oil systems due to microbiologically influenced corrosion is minimal. Lubricating oil systems are maintained to high cleanliness standards by design, lubricating oil formulations include corrosion inhibitors, and the potential for water and contaminant intrusion is low compared to fuel oil systems, where the bulk storage, delivery and transport of the fuel oil increases the likelihood of moisture and microorganism contamination. These heat exchanger components have been evaluated with the Closed Cycle Cooling Water system, which provides the cooling water to these heat exchangers. The Lubricating Oil Analysis program and One-Time Inspection program also manage reduction of heat transfer due to fouling of these heat exchanger components (see Table 3.2.1 Item Number 3.2.1-9). The Lubricating Oil Analysis and One-Time Inspection programs are described in Appendix B.

3.3.2.2.10 <u>Loss of Material due to Pitting and Crevice Corrosion</u>

1. *Loss of material due to pitting and crevice corrosion could occur in BWR and PWR steel piping with elastomer lining or stainless steel cladding that are exposed to treated water and treated borated water if the cladding or lining is degraded. The existing aging management program relies on monitoring and control of reactor water chemistry to manage the aging effects of loss of material from pitting and crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting, or crevice corrosion. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.*

   Item Number 3.3.1-22 is not applicable to Hope Creek. There is no steel piping with elastomer lining or steel piping with stainless steel cladding exposed to treated water in the auxiliary systems that are in the scope of license renewal at Hope Creek.

2. *Loss of material due to pitting and crevice corrosion could occur for stainless steel and aluminum piping, piping components, piping elements, and for stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water. The existing aging management program relies on monitoring and control of reactor water chemistry to manage the aging effects of loss of material from pitting and crevice corrosion. However, high concentrations of impurities at crevices*

and locations of stagnant flow conditions could cause pitting, or crevice corrosion. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

Hope Creek will implement a One-Time Inspection program, B.2.1.22, to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to pitting and crevice corrosion of stainless steel heat exchanger components exposed to treated water in the Hydrogen Water Chemistry System and Reactor Water Cleanup System.

The One-Time Inspection program is also used to verify the effectiveness of the Water Chemistry program to manage loss of material due to pitting and crevice corrosion on stainless steel fuel pool cooling heat exchanger components, residual heat removal heat exchanger components and residual heat removal pump seal heat exchanger components exposed to treated water. These heat exchanger components have been evaluated with the Closed Cycle Cooling Water system, which provides the cooling water to these heat exchangers.

The One-Time Inspection program is also used to verify the effectiveness of the Water Chemistry program to manage loss of material due to pitting and crevice corrosion of the stainless steel piping, piping components, and piping elements and tanks exposed to treated water for the Control Area Chilled Water System, Control Rod Drive System, Fuel Pool Cooling and Cleanup System, Hydrogen Water Chemistry System, Makeup Demineralizer System, Process and Post-Accident Sampling System, Reactor Water Cleanup System, Standby Diesel Generators and Auxiliary Systems, Standby Liquid Control System, Torus Water Cleanup System and Primary Containment.

The One-Time Inspection program is also used to verify the effectiveness of the Water Chemistry program to manage loss of material due to pitting and crevice corrosion of the stainless steel skimmer surge tank liner and screen and miscellaneous aluminum structural components exposed to treated water in the Fuel Handling and Storage System and Reactor Building.

The Water Chemistry and One-Time Inspection programs are described in Appendix B.

3. *Loss of material due to pitting and crevice corrosion could occur for copper alloy HVAC piping, piping components, and piping elements exposed to condensation (external). The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.*

Hope Creek will implement a Periodic Inspection program, B.2.2.2, to manage loss of material due to pitting and crevice corrosion of the copper alloy HVAC piping, piping components and piping elements exposed to wetted air/gas in the Control Room and Control Area HVAC Systems, Filtration, Recirculation, and Ventilation System, Remote Shutdown Panel Room HVAC System and Standby Diesel Generator Area Ventilation System. The wetted air/gas environment assumed for these components includes the potential for wetting due to condensation. The Periodic Inspection program is used to manage the aging effects of components that are not covered by other aging management programs, including external surfaces of non-steel components not covered by the External Surfaces Monitoring (B.2.1.25) program and internal surfaces of non-steel components not covered by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26) program. The Periodic Inspection program includes visual inspections to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions.

Hope Creek will implement a Periodic Inspection program, B.2.2.2, to manage loss of material due to pitting and crevice corrosion of the copper alloy HVAC heat exchanger components exposed to wetted air/gas. These HVAC heat exchanger components have been evaluated with the Chilled Water System, Closed Cycle Cooling Water System or Control Area Chilled Water System, which are the systems that provide the cooling water to these heat exchangers. The wetted air/gas environment assumed for these heat exchanger tubes includes the potential for wetting due to condensation. The Periodic Inspection program includes visual inspections of these heat exchanger tube surfaces to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Periodic Inspection program is described in Appendix B.

4. *Loss of material due to pitting and crevice corrosion could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.*

Hope Creek will implement a One-Time Inspection program, B.2.1.22, to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage loss of material due to pitting and crevice corrosion of the copper alloy heat exchanger components exposed to lubricating oil. The

Lubricating Oil Analysis program and One-Time Inspection program manage loss of material on the standby diesel generator lube oil and residual heat removal pump motor bearing copper alloy heat exchanger components in a lubricating oil environment. These heat exchanger components have been evaluated with the Closed Cycle Cooling Water system, which provides the cooling water to these heat exchangers. The Lubricating Oil Analysis and One-Time Inspection programs are described in Appendix B.

5. *Loss of material due to pitting and crevice corrosion could occur for HVAC aluminum piping, piping components, and piping elements and stainless steel ducting and components exposed to condensation. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.*

   Hope Creek will implement a Periodic Inspection program, B.2.2.2 to manage loss of material due to pitting and crevice corrosion of the stainless steel and aluminum HVAC ducting and ducting components, piping, piping components, and piping elements exposed to wetted air/gas in the Control Room and Control Area HVAC Systems, Fire Pump House Ventilation System, Makeup Demineralizer System, Reactor Building Ventilation System, Remote Shutdown Panel Room HVAC System, Service Water Intake Ventilation System, Standby Diesel Generators and Auxiliary Systems and Standby Diesel Generator Area Ventilation Systems. The wetted air/gas environment assumed for these components includes the potential for wetting due to condensation. The Periodic Inspection program is used to manage the aging effects of components that are not covered by other aging management programs, including internal surfaces of non-steel components not covered by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26) program. The Periodic Inspection program includes visual inspections to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Periodic Inspection program is described in Appendix B.

6. *Loss of material due to pitting and crevice corrosion could occur for copper alloy fire protection system piping, piping components, and piping elements exposed to internal condensation. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.*

   Hope Creek will implement the Fire Protection program, B.2.1.17, and Fire Water System program, B.2.1.18, to manage loss of material due to pitting and crevice corrosion of the copper alloy fire protection sprinkler heads and restricting orifices exposed to wetted air in the Fire Protection System. The Fire Protection program and Fire Water System program include periodic system and component inspections that include inspection of the sprinkler heads and restricting orifices as part of the fire protection system surveillance activities. In addition, the Fire Water System program includes

50-year sprinkler head inspections using the guidance of NFPA-25. The Fire Protection program and Fire Water System program are described in Appendix B.

7. *Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.*

   Item Number 3.3.1-29 is not applicable for Hope Creek. The AMR methodology for stainless steel piping, piping components, and piping elements exposed to soil predicts microbiologically influenced corrosion in addition to pitting, and crevice corrosion. There are no NUREG-1801 AMR lines available for stainless steel components exposed to soil that include all of these mechanisms.

   The Buried Non-Steel Piping Inspection program, B.2.2.4, will be used to manage loss of material due to pitting, crevice and microbiologically influenced corrosion of the stainless steel piping components and piping elements exposed to soil. The Buried Non-Steel Piping Inspection aging management program manages the buried piping and components that are not included in the Buried Piping Inspection (B.2.1.24) aging management program. The Buried Non-Steel Piping Inspection program manages piping and components that are exposed to an external soil environment for loss of material due to pitting, crevice and microbiologically influenced corrosion. Loss of material will be monitored and identified through visual inspections of the external surfaces of the piping and components. Inspection of buried components identifies coating degradation, if coated, or base metal corrosion, if uncoated. These inspections assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Buried Non-Steel Piping Inspection aging management program is described in Appendix B.

8. *Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements of the BWR Standby Liquid Control System that are exposed to sodium pentaborate solution. The existing aging management program relies on monitoring and control of water chemistry to manage the aging effects of loss of material due to pitting and crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause loss of material due to pitting and crevice corrosion. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure this aging is not occurring. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that loss of material due to pitting and crevice corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.*

Hope Creek will implement a One-Time Inspection program, B.2.1.22, to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to pitting and crevice corrosion of the stainless steel piping, piping components, and piping elements, and tanks exposed to sodium pentaborate in the Standby Liquid Control System. The Water Chemistry and One-Time Inspection programs are described in Appendix B.

3.3.2.2.11 Loss of Material due to Pitting, Crevice, and Galvanic Corrosion

The GALL Report recommends further evaluation of programs to manage the loss of material due to pitting, crevice, and galvanic corrosion of copper alloy piping, piping components, and piping elements that are exposed to treated water. The reviewer reviews the applicant's proposed program on a case-by-case basis to ensure that an adequate program will be in place for the management of these aging effects.

Hope Creek will implement a One-Time Inspection program, B.2.1.22, to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to pitting, crevice and galvanic corrosion of the copper alloy valve body and heat exchanger components exposed to treated water in the High Pressure Coolant Injection (HPCI) System and Reactor Core Isolation Cooling (RCIC) System. The Water Chemistry program activities provide for monitoring and controlling of water chemistry in accordance with EPRI BWR Vessel and Internals Project BWR Water Chemistry Guidelines. The Water Chemistry program activities prevent or mitigate loss of material aging effects to ensure there is no loss of component intended function. The Water Chemistry and One-Time Inspection programs are described in Appendix B.

3.3.2.2.12 Loss of Material due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

1. *Loss of material due to pitting, crevice, and MIC could occur in stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to fuel oil. The existing aging management program relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination to manage loss of material due to corrosion. However, corrosion may occur at locations where contaminants accumulate and the effectiveness of fuel oil chemistry control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the fuel oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.*

   Hope Creek will implement a One-Time Inspection program, B.2.1.22, to verify the effectiveness of the Fuel Oil Chemistry program, B.2.1.20, to manage loss of material due to pitting, crevice, and microbiologically influenced corrosion of the stainless steel and copper alloy piping, piping components, and piping elements exposed to fuel oil in the Fire Protection System and Standby Diesel Generators and Auxiliary Systems. The Fuel Oil Chemistry and One-Time Inspection programs are described in Appendix B.

2. *Loss of material due to pitting, crevice, and MIC could occur in stainless steel piping, piping components, and piping elements exposed to lubricating oil. The existing program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lubricating oil program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.*

   Hope Creek will implement a One-Time Inspection program, B.2.1.22, to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage loss of material due to pitting and crevice corrosion of the stainless steel piping, piping components, and piping elements exposed to lubricating oil for the Standby Diesel Generators and Auxiliary Systems. Loss of material due to microbiologically influenced corrosion is not applicable for stainless steel in a Lubricating Oil environment. Industry and plant operating experience indicates that the potential for significant degradation of lubricating oil systems due to microbiologically influenced corrosion is minimal. Lubricating oil systems are maintained to high cleanliness standards by design, lubricating oil formulations include corrosion inhibitors, and the potential for water and contaminant intrusion is low compared to fuel oil systems, where the bulk storage, delivery and transport of the fuel oil increases the likelihood of moisture and microorganism contamination. The One-Time Inspection program and Lubricating Oil Analysis program are described in Appendix B.

3.3.2.2.13 <u>Loss of Material due to Wear</u>

Loss of material due to wear could occur in the elastomer seals and components exposed to air indoor uncontrolled (internal or external). The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

Item Number 3.3.1-34 is not applicable for Hope Creek. Elastomer components determined to be subject to wear based on plant operating experience are periodically replaced and therefore not subject to aging management review. Elastomer components that are not periodically replaced are evaluated for Hardening and Loss of Strength due to Elastomer Degradation under Item Number 3.3.1-11 and are included in the plant-specific Periodic Inspection (B.2.2.2) program. Elastomer fire barrier components are evaluated for Increased Hardness, Shrinkage and Loss of Strength due to Weathering under Item Number 3.3.1-61 and are included in the Fire Protection (B.2.1.17) program. The Periodic Inspection program and Fire Protection program are described in Appendix B.

3.3.2.2.14 Loss of Material due to Cladding Breach

Loss of material due to cladding breach could occur for PWR steel charging pump casings with stainless steel cladding exposed to treated borated water. The GALL Report references NRC Information Notice 94-63, Boric Acid Corrosion of Charging Pump Casings Caused by Cladding Cracks, and recommends further evaluation of a plant-specific aging management program to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

Item Number 3.3.1-35 is not applicable to Hope Creek. This item number is applicable to PWRs only.

3.3.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in Branch Technical Position 1QMB-1. QA provisions applicable to License Renewal are discussed in Section B.1.3.

3.3.2.3 Time-Limited Aging Analysis

The time-limited aging analyses identified below are associated with the Auxiliary Systems components:

- Section 4.3, Metal Fatigue of the Reactor Vessel, Internals, and Reactor Coolant Pressure Boundary Piping and Components
- Section 4.7, Crane Load Cycle Limits

3.3.3 CONCLUSION

The Auxiliary Systems piping, fittings, and components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Auxiliary Systems components are identified in the summaries in Section 3.3.2.1 above.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the conclusions provided in Appendix B, the effects of aging associated with the Auxiliary Systems components will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-1	Steel cranes - structural girders exposed to air – indoor uncontrolled (external)	Cumulative fatigue damage	TLAA to be evaluated for structural girders of cranes. See the Standard Review Plan, Section 4.7 for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, TLAA	Fatigue is a TLAA; further evaluation is documented in Subsection 3.3.2.2.1.
3.3.1-2	Steel and stainless steel piping, piping components, piping elements, and heat exchanger components exposed to air – indoor uncontrolled, treated borated water or treated water	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue is a TLAA; further evaluation is documented in Subsection 3.3.2.2.1.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-3	Stainless steel heat exchanger tubes exposed to treated water	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the reduction of heat transfer due to fouling in stainless steel heat exchanger components exposed to treated water. Exceptions apply to the NUREG-1801 recommendations for the Water Chemistry program implementation. See subsection 3.3.2.2.2.
3.3.1-4	Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution >60 C (>140° F)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not applicable. See subsection 3.3.2.2.3.1.
3.3.1-5	Stainless steel and stainless clad steel heat exchanger components exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking	A plant specific aging management program is to be evaluated.	Yes, plant specific	The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage cracking due to stress corrosion cracking of the stainless steel and stainless clad steel heat

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					exchanger components exposed to treated water >60°C (>140°F). See subsection 3.3.2.2.3.2.
3.3.1-6	Stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust	Cracking due to stress corrosion cracking	A plant specific aging management program is to be evaluated.	Yes, plant specific	The Periodic Inspection program, B.2.2.2, will be used to manage cracking due to stress corrosion cracking in stainless steel expansion joints exposed to diesel exhaust. See subsection 3.3.2.2.3.3.
3.3.1-7	PWRs only.				
3.3.1-8	PWRs only				
3.3.1-9	PWRs only				
3.3.1-10	High-strength steel closure bolting exposed to air with steam or water leakage.	Cracking due to stress corrosion cracking, cyclic loading	Bolting Integrity The AMP is to be augmented by appropriate inspection to detect cracking if	Yes, if the bolts are not replaced during maintenance	Not Applicable. See subsection 3.3.2.2.4.4.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
			the bolts are not otherwise replaced during maintenance.		
3.3.1-11	Elastomer seals and components exposed to air – indoor uncontrolled (internal/external)	Hardening and loss of strength due to elastomer degradation	A plant specific aging management program is to be evaluated.	Yes, plant specific	The Periodic Inspection program, B.2.2.2, will be used to manage hardening and loss of strength due to elastomer degradation of the elastomer components exposed to indoor air or wetted air/gas. Compressible joint seals in the Reactor Building have been aligned to this item number based on material, environment and aging effect. The Structures Monitoring Program, B.2.1.32, will be used to manage hardening and loss of strength due to elastomer degradation for these seals. See subsection 3.3.2.2.5.1.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-12	Elastomer lining exposed to treated water or treated borated water	Hardening and loss of strength due to elastomer degradation	A plant-specific aging management program is to be evaluated.	Yes, plant specific	Compressible joint seals in the Reactor Building have been aligned to this item number based on material, environment and aging effect. The Structures Monitoring Program, B.2.1.32, will be used to manage hardening and loss of strength due to elastomer degradation for these seals. See subsection 3.3.2.2.5.2.
3.3.1-13	Boral, boron steel spent fuel storage racks neutron-absorbing sheets exposed to treated water or treated borated water	Reduction of neutron-absorbing capacity and loss of material due to general corrosion	A plant specific aging management program is to be evaluated.	Yes, plant specific	Hope Creek will implement the Boral Monitoring Program, B.2.2.5 and Water Chemistry program, B.2.1.2, to manage reduction of neutron-absorbing capacity and loss of material due to general corrosion of the irradiated fuel storage racks exposed to treated water. See subsection 3.3.2.2.6.
3.3.1-14	Steel piping, piping component, and piping elements exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage loss of material due to general, pitting and crevice

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					corrosion of the steel piping, piping components, and piping elements, heat exchanger components and tanks exposed to lubricating oil. Exceptions apply to the NUREG-1801 recommendations for the Lubricating Oil Analysis program implementation. See subsection 3.3.2.2.7.1.
3.3.1-15	Steel reactor coolant pump oil collection system piping, tubing, and valve bodies exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not Applicable. See subsection 3.3.2.2.7.1.
3.3.1-16	Steel reactor coolant pump oil collection system tank exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection to evaluate the thickness of the lower portion of the tank	Yes, detection of aging effects is to be evaluated	Not Applicable. See subsection 3.3.2.2.7.1.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-17	Steel piping, piping components, and piping elements exposed to treated water	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to general, pitting and crevice corrosion of the steel piping, piping components, and piping elements, heat exchanger components and tanks exposed to treated water. Exceptions apply to the NUREG-1801 recommendations for the Water Chemistry program implementation. See subsection 3.3.2.2.7.2.
3.3.1-18	Stainless steel and steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust	Loss of material/ general (steel only), pitting and crevice corrosion	A plant specific aging management program is to be evaluated.	Yes, plant specific	Hope Creek will implement the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program, B.2.1.26, to manage loss of material due to general, pitting and crevice corrosion of the steel piping, piping components, and piping elements exposed to diesel exhaust. Hope Creek will implement a Periodic Inspection program, B.2.2.2, to manage loss of material due to pitting and crevice corrosion of the stainless steel expansion

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					joints exposed to diesel exhaust. See subsection 3.3.2.2.7.3.
3.3.1-19	Steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes, detection of aging effects and operating experience are to be further evaluated	Consistent with NUREG-1801. The Buried Piping Inspection program, B.2.1.24, will be used to manage loss of material due to general, pitting, crevice, and microbiologically influenced corrosion of the steel (including epoxy lined and galvanized steel) piping, piping components, and piping elements exposed to soil. Hope Creek does not have any buried tanks in the scope of license renewal. See subsection 3.3.2.2.8. Components in the Auxiliary Boiler Building, Auxiliary Building Control/Diesel Generator Area, Auxiliary Building Service/Radwaste Area, Fire Protection System, Fire Water Pump House, Reactor Building, Service Water Intake Structures, Shoreline Protection and Dike, Switchyard, Turbine Building and Yard Structures have been aligned to this item number based on material, environment and aging effect. The Aboveground Steel Tanks program, B.2.1.19, RG 1.127 - Inspection of Water-Control Structures Associated with Nuclear

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Power Plants program, B.2.1.33, and Structures Monitoring Program, B.2.1.32, will be substituted to manage loss of material due to general, pitting, crevice, and microbiologically influenced corrosion in steel and galvanized steel penetration sleeves, steel piles and steel tank bottom surfaces for these systems and structures.
3.3.1-20	Steel piping, piping components, piping elements, and tanks exposed to fuel oil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling	Fuel Oil Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated)	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Fuel Oil Chemistry program, B.2.1.20, to manage loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling of the steel piping, piping components, and piping elements, and tanks exposed to fuel oil. Exceptions apply to the NUREG-1801 recommendations for the Fuel Oil Chemistry program implementation. See subsection 3.3.2.2.9.1.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-21	Steel heat exchanger components exposed to lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage loss of material due to general, pitting and crevice corrosion of the steel heat exchanger components exposed to lubricating oil. Loss of material due to microbiologically influenced corrosion and fouling are not predicted for this stainless steel component in a lubricating oil environment, based on industry guidance and plant-specific operating experience. Exceptions apply to the NUREG-1801 recommendations for the Lubricating Oil Analysis program implementation. See subsection 3.3.2.2.9.2.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-22	Steel with elastomer lining or stainless steel cladding piping, piping components, and piping elements exposed to treated water and treated borated water	Loss of material due to pitting and crevice corrosion (only for steel after lining/cladding degradation)	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not Applicable. See subsection 3.3.2.2.10.1.
3.3.1-23	Stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to pitting and crevice corrosion of stainless steel heat exchanger components exposed to treated water. Exceptions apply to the NUREG-1801 recommendations for the Water Chemistry program implementation. See subsection 3.3.2.2.10.2.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-24	Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to pitting and crevice corrosion of the stainless steel piping, piping components and piping elements and tanks exposed to treated water. The One-Time Inspection program will also be used to verify the effectiveness of the Water Chemistry program to manage loss of material due to pitting and crevice corrosion of stainless steel structural components submerged in treated water. Exceptions apply to the NUREG-1801 recommendations for the Water Chemistry program implementation. See subsection 3.3.2.2.10.2.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-25	Copper alloy HVAC piping, piping components, piping elements exposed to condensation (external)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific	The Periodic Inspection program, B.2.2.2, will be used to manage loss of material due to pitting and crevice corrosion of the copper alloy HVAC piping, piping components, piping elements and HVAC heat exchanger components exposed to wetted air/gas. See subsection 3.3.2.2.10.3
3.3.1-26	Copper alloy piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage loss of material due to pitting and crevice corrosion of the copper alloy heat exchanger components exposed to lubricating oil. Exceptions apply to the NUREG-1801 recommendations for the Lubricating Oil Analysis program implementation. See subsection 3.3.2.2.10.4.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-27	Stainless steel HVAC ducting and aluminum HVAC piping, piping components and piping elements exposed to condensation	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific	The Periodic Inspection program, B.2.2.2 will be used to manage loss of material due to pitting and crevice corrosion of the stainless steel and aluminum HVAC ducting and ducting components, piping, piping components, and piping elements exposed to wetted air/gas. See subsection 3.3.2.2.10.5.
3.3.1-28	Copper alloy fire protection piping, piping components, and piping elements exposed to condensation (internal)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific	The Fire Protection program, B.2.1.17, and Fire Water System program, B.2.1.18, will be used to manage loss of material due to pitting and crevice corrosion of the copper alloy fire protection sprinkler heads and restricting orifices exposed to wetted air. See subsection 3.3.2.2.10.6.
3.3.1-29	Stainless steel piping, piping components, and piping elements exposed to soil	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated.	Yes, plant specific	Not Applicable. See subsection 3.3.2.2.10.7.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-30	Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to pitting and crevice corrosion of the stainless steel piping, piping components, and piping elements, and tanks exposed to sodium pentaborate. Exceptions apply to the NUREG-1801 recommendations for the Water Chemistry program implementation. See subsection 3.3.2.2.10.8.
3.3.1-31	Copper alloy piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage loss of material due to pitting, crevice and galvanic corrosion of the copper alloy valve body and heat exchanger components exposed to treated water. Exceptions apply to the NUREG-1801

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					recommendations for the Water Chemistry program implementation. See subsection 3.3.2.2.11.
3.3.1-32	Stainless steel, aluminum and copper alloy piping, piping components, and piping elements exposed to fuel oil	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Fuel Oil Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Fuel Oil Chemistry program, B.2.1.20, to manage loss of material due to pitting, crevice, and microbiologically influenced corrosion of the stainless steel and copper alloy piping, piping components, and piping elements exposed to fuel oil. Exceptions apply to the NUREG-1801 recommendations for the Fuel Oil Chemistry program implementation. See subsection 3.3.2.2.12.1.
3.3.1-33	Stainless steel piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Lubricating Oil Analysis program, B.2.1.27, to manage loss of material due to pitting and crevice corrosion of the stainless steel piping, piping

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					components, and piping elements exposed to lubricating oil. Loss of material due to microbiologically influenced corrosion is not predicted for these stainless steel components in a lubricating oil environment, based on industry guidance and plant-specific operating experience. Exceptions apply to the NUREG-1801 recommendations for the Lubricating Oil Analysis program implementation. See subsection 3.3.2.2.12.2.
3.3.1-34	Elastomer seals and components exposed to air – indoor uncontrolled (internal or external)	Loss of material due to Wear	A plant specific aging management program is to be evaluated.	Yes, plant specific	Not Applicable. See subsection 3.3.2.2.13.
3.3.1-35	PWR Only				
3.3.1-36	Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated water	Reduction of neutron absorbing capacity due to boraflex degradation	Boraflex Monitoring	No	Not Applicable. There are no Boraflex spent fuel storage racks neutron-absorbing sheets exposed to treated water for the Auxiliary Systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-37	Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	BWR Reactor Water Cleanup System	No	Not Applicable. Hope Creek will not be implementing a BWR Reactor Water Cleanup System program. Hope Creek has met all of the following criteria; satisfactory completion of all actions requested in NRC GL 89-10, no detection of IGSCC in RWCU welds inboard of the second isolation valves (ongoing inspection in accordance with the guidance in NRC GL 88-01), and no detection of IGSCC in RWCU welds outboard of the second isolation valves after inspecting a minimum of 10% of the susceptible piping. All three of the screening criteria as specified in XI.M25 BWR Reactor Water Cleanup System have been satisfied at Hope Creek. Stainless steel components downstream of the outboard isolation valve exposed to treated water >140°F are evaluated for cracking due to stress corrosion cracking in Table 3.4.1 Item Number 3.4.1-14.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-38	Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Consistent with NUREG-1801 with exceptions. The BWR Stress Corrosion Cracking program, B.2.1.1.7, and the Water Chemistry program, B.2.1.2, will be used to manage cracking due to stress corrosion cracking of the stainless steel piping, piping components, and piping elements exposed to treated water >60°C (>140°F) for the Reactor Water Cleanup System. Exceptions apply to the NUREG-1801 recommendations for the Water Chemistry program implementation.
3.3.1-39	Stainless steel BWR spent fuel storage racks exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking	Water Chemistry	No	Not Applicable. The spent fuel storage racks are not exposed to treated water >140°F because the spent fuel pool water temperature is maintained below 140° F.
3.3.1-40	Steel tanks in diesel fuel oil system exposed to air - outdoor (external)	Loss of material due to general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	Consistent with NUREG-1801. The Aboveground Steel Tanks program, B.2.1.19, will be used to manage loss of material due to general, pitting, and crevice corrosion of the steel tanks exposed to outdoor air for the Fire Protection System.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-41	High-strength steel closure bolting exposed to air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Not Applicable. There is no high strength closure bolting in the Auxiliary Systems.
3.3.1-42	Steel closure bolting exposed to air with steam or water leakage	Loss of material due to general corrosion	Bolting Integrity	No	Not Applicable. AMR methodology for steel closure bolting predicts pitting and crevice corrosion in addition to general corrosion. See Item Number 3.3.1-43.
3.3.1-43	Steel bolting and closure bolting exposed to air – indoor uncontrolled (external) or air – outdoor (external)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Consistent with NUREG-1801 with exceptions. The Bolting Integrity program, B.2.1.12, will be used to manage loss of material due to general, pitting, and crevice corrosion of the steel bolting exposed to indoor or outdoor air for the Chilled Water System, Closed Cycle Cooling Water System, Compressed Air System, Containment Inerting and Purging System, Control Area Chilled Water System, Control Rod Drive System, Equipment and Floor Drainage System, Fire Protection System, Fresh Water Supply System, Fuel Pool Cooling and Cleanup System, Hardened Torus Vent System, Hydrogen Water Chemistry System, Leak Detection and Radiation Monitoring System, Makeup Demineralizer System, Primary

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Containment Instrument Gas System, Primary Containment Leakage Rate Testing System, Process and Post-Accident Sampling Systems, Radwaste System, Reactor Building Ventilation System, Reactor Water Cleanup System, Service Water System, Standby Diesel Generator Area Ventilation Systems, Standby Diesel Generators and Auxiliary Systems, Standby Liquid Control System, Torus Water Cleanup System, and Traversing Incore Probe System. Exceptions apply to the NUREG-1801 recommendations for the Bolting Integrity program implementation. Components in the Cranes & Hoists and Fuel Handling and Storage System have been aligned to this item number based on material, environment and aging effect. The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program, B.2.1.15, will be substituted to manage loss of material due to general, pitting, and crevice corrosion of the carbon and low alloy steel bolting for these systems and structures.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-44	Steel compressed air system closure bolting exposed to condensation	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Not Applicable. Steel closure bolting is evaluated by Item Number 3.3.1-43. The Bolting Integrity program, B.2.1.12, is used to manage loss of material due to general, pitting, and crevice corrosion of the steel bolting.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-45	Steel closure bolting exposed to air – indoor uncontrolled (external)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Consistent with NUREG-1801 with exceptions. The Bolting Integrity program, B.2.1.12, will be used to manage loss of preload due to thermal effects, gasket creep, and self-loosening of the carbon and low alloy steel bolting exposed to indoor air for the Chilled Water, Closed Cycle Cooling Water System, Compressed Air System, Containment Inerting and Purging System, Control Area Chilled Water System, Control Rod Drive System, Equipment and Floor Drainage System, Fire Protection System, Fresh Water Supply System, Fuel Pool Cooling and Cleanup System, Hardened Torus Vent System, Hydrogen Water Chemistry System, Leak Detection and Radiation Monitoring System, Primary Containment Instrument Gas System, Primary Containment Leakage Rate Testing System, Process and Post-Accident Sampling Systems, Reactor Building Ventilation System, Radwaste System, Reactor Water Cleanup System, Service Water System, Standby Diesel Generators and Auxiliary Systems, Standby Liquid Control System, Torus Water Cleanup System and Traversing Incore Probe System.

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Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Exceptions apply to the NUREG-1801 recommendations for the Bolting Integrity program implementation. Components in the Component Supports Commodity Group, Cranes & Hoists, Fuel Handling and Storage System, Service Water Intake Structures, Auxiliary Boiler Building, Turbine Building, Switchyard, Auxiliary Boiler Building, Auxiliary Building Control/Diesel Generator Area, Auxiliary Building Service/Radwaste Area, Reactor Building, Primary Containment, and Fire Water Pump House, systems and structures have been aligned to this item number based on material, environment and aging effect. The ASME Section XI, Subsection IWF, B.2.1.29, Structures Monitoring Program, B.2.1.32, The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems, B.2.1.15, RG 1.127, and Inspection of Water-Control Structures, B.2.1.33, will be substituted to manage loss of preload due to self-loosening of the carbon and low alloy steel, galvanized steel, and high strength low alloy steel structural bolting and structural supports bolting for these systems and structures.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-46	Stainless steel and stainless clad steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water >60°C (>140°F)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801 with exceptions. The Closed-Cycle Cooling Water System program, B.2.1.14, will be used to manage cracking due to stress corrosion cracking of stainless steel piping, piping components, piping elements exposed to closed cycle cooling water >140°F for the Standby Diesel Generators and Auxiliary Systems. Exceptions apply to the NUREG-1801 recommendations for Closed-Cycle Cooling Water System program implementation.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-47	Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801 with exceptions. The Closed-Cycle Cooling Water System program, B.2.1.14, will be used to manage loss of material due to general, pitting, and crevice corrosion of the steel piping, piping components and piping elements and tanks exposed to closed cycle cooling water for the Chilled Water System, Closed Cycle Cooling Water System, Control Area Chilled Water System, and Standby Diesel Generators and Auxiliary Systems. Exceptions apply to the NUREG-1801 recommendations for the Closed-Cycle Cooling Water System program implementation.
3.3.1-48	Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801 with exceptions. The Closed-Cycle Cooling Water System program, B.2.1.14, will be used to manage loss of material due to general, pitting, crevice and galvanic corrosion of the steel piping, piping components, piping elements and heat exchanger components exposed to closed cycle cooling water for the Chilled Water

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					System, Closed Cycle Cooling Water System, Control Area Chilled Water System and Service Water System. Exceptions apply to the NUREG-1801 recommendations for Closed-Cycle Cooling Water System program implementation.
3.3.1-49	Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water	Loss of material due to microbiologically influenced corrosion	Closed-Cycle Cooling Water System	No	Not Applicable. AMR methodology for stainless steel heat exchanger components exposed to closed cycle cooling water predicts loss of material due to pitting and crevice corrosion. Loss of material due to microbiologically influenced corrosion is not predicted for these stainless steel heat exchanger components exposed to closed cycle cooling water, based on industry guidance and plant-specific operating experience. See Item Number 3.3.1-50.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-50	Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801 with exceptions. The Closed-Cycle Cooling Water System program, B.2.1.14, will be used to manage loss of material due to pitting and crevice corrosion of the stainless steel piping, piping components and piping elements, heat exchanger components and tanks exposed to closed cycle cooling water in the Closed Cycle Cooling Water System, Chilled Water System, Control Area Chilled Water System, and Standby Diesel Generators and Auxiliary Systems. Exceptions apply to the NUREG-1801 recommendations for the Closed-Cycle Cooling Water System program implementation.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-51	Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801 with exceptions. The Closed-Cycle Cooling Water System program, B.2.1.14, will be used to manage loss of material due to pitting, crevice and galvanic corrosion of the copper alloy piping, piping components and piping elements and heat exchanger components exposed to closed cycle cooling water for the Closed Cycle Cooling Water System, Chilled Water System, and Control Area Chilled Water System. Exceptions apply to the NUREG-1801 recommendations for the Closed-Cycle Cooling Water System program implementation.
3.3.1-52	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801 with exceptions. The Closed-Cycle Cooling Water System program, B.2.1.14, will be used to manage reduction of heat transfer due to fouling of the copper alloy heat exchanger components exposed to closed cycle cooling water for the Closed Cycle Cooling Water System and Control Area Chilled Water System. Exceptions apply to the NUREG-1801 recommendations for the Closed-Cycle

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Cooling Water System program implementation.
3.3.1-53	Steel compressed air system piping, piping components, and piping elements exposed to condensation (internal)	Loss of material due to general and pitting corrosion	Compressed Air Monitoring	No	Consistent with NUREG-1801. The Compressed Air Monitoring program, B.2.1.16, will be used to manage loss of material due to general, pitting and crevice corrosion of the steel piping, piping components and piping elements and tanks exposed to wetted air/gas in the Primary Containment Instrument Gas System.
3.3.1-54	Stainless steel compressed air system piping, piping components, and piping elements exposed to internal condensation	Loss of material due to pitting and crevice corrosion	Compressed Air Monitoring	No	Consistent with NUREG-1801. The Compressed Air Monitoring program, B.2.1.16, will be used to manage loss of material due to general, pitting and crevice corrosion of the stainless steel piping, piping components and piping elements exposed to wetted air/gas in the Primary Containment Instrument Gas System. Components in the Containment Inerting and Purging System, Fire Protection System, Hardened Torus Vent System, Leak Detection and Radiation Monitoring System, Primary Containment Leakage Rate Testing System, Process and Post-

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Accident Sampling Systems, Standby Diesel Generators and Auxiliary Systems and Torus Water Cleanup System have been aligned to this item number based on material, environment and aging effect. The Periodic Inspection program, B.2.2.2, and Fire Protection program, B.2.1.17, will be substituted to manage loss of material due to pitting and crevice corrosion of the stainless steel piping, piping components and piping elements exposed to wetted air/gas in these systems.
3.3.1-55	Steel ducting closure bolting exposed to air – indoor uncontrolled (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. The External Surfaces Monitoring program, B.2.1.25, will be used to manage loss of material due to general corrosion of steel ducting closure bolting exposed to indoor air for the Control Room and Control Area HVAC System, Reactor Building Ventilation System, Remote Shutdown Panel Room HVAC System, Service Water Intake Ventilation System, and Standby Diesel Generator Area Ventilation Systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-56	Steel HVAC ducting and components external surfaces exposed to air – indoor uncontrolled (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. The External Surfaces Monitoring program, B.2.1.25, will be used to manage loss of material due to general corrosion of steel HVAC ducting and components external surfaces exposed to indoor air for the Control Area Chilled Water System, Control Room and Control Area HVAC Systems, Reactor Building Ventilation System, Remote Shutdown Panel Room HVAC System, Service Water Intake Ventilation System, and Standby Diesel Generator Area Ventilation Systems.
3.3.1-57	Steel piping and components external surfaces exposed to air – indoor uncontrolled (External)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. The External Surfaces Monitoring program, B.2.1.25, will be used to manage loss of material due to general corrosion of steel piping, piping components and piping elements, reactor vessel and reactor vessel nozzles, and tanks exposed to indoor air for the Chilled Water System, Closed Cycle Cooling Water System, Compressed Air System, Containment Inerting and Purging System, Control Area Chilled Water System, Control Room and Control Area HVAC Systems, Equipment and Floor Drainage System, Fire Protection System, Fresh Water Supply System, Fuel Pool

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Cooling and Cleanup System, Hardened Torus Vent System, Leak Detection and Radiation Monitoring System, Main Steam System, Primary Containment Instrument Gas System, Primary Containment Leakage Rate Testing System, Process and Post-Accident Sampling Systems, Radwaste System, Reactor Building Ventilation System, Reactor Pressure Vessel, Reactor Recirculation System, Reactor Water Cleanup System, Remote Shutdown Panel Room HVAC System, Service Water System, Standby Diesel Generators and Auxiliary Systems, Standby Liquid Control System, Torus Water Cleanup System, and Traversing Incore Probe System. Components in the Fire Protection System have been aligned to this item number based on material, environment and aging effect. The Fire Protection program, B.2.1.17, and Fire Water System program, B.2.1.18, will be used in addition to the External Surfaces Monitoring, B.2.1.25, program, to manage loss of material due to general corrosion of the steel piping, piping components and piping elements exposed to indoor in the Fire Protection System.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-58	Steel external surfaces exposed to air – indoor uncontrolled (external), air - outdoor (external), and condensation (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. The External Surfaces Monitoring program, B.2.1.25, will be used to manage loss of material due to general corrosion of steel piping, piping components and piping elements, heat exchanger components and tanks external surfaces exposed to indoor air for the Closed Cycle Cooling Water System, Control Area Chilled Water System, Control Rod Drive System, Equipment and Floor Drainage System, Standby Diesel Generators and Auxiliary Systems, Service Water System, Reactor Water Cleanup System, Standby Diesel Generators and Auxiliary Systems, Primary Containment Instrument Gas System, Fire Protection System, Control Rod Drive System, and Control Room and Control Area HVAC Systems. Components in the Fire Protection System have been aligned to this item number based on material, environment and aging effect. The Fire Protection program, B.2.1.17, and Fire Water System program, B.2.1.18, will be used in addition to the External Surfaces Monitoring program, B.2.1.25, to manage loss of material due to general corrosion of the steel fire doors,

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					tanks and gas bottles exposed to indoor air in the Fire Protection system. Thermowells in the Primary Containment structure have been aligned to this item number based on material, environment and aging effect. The Structures Monitoring Program, B.2.1.32, will be substituted to manage loss of material due to general corrosion of the steel thermowells exposed to indoor air for the Primary Containment structure.
3.3.1-59	Steel heat exchanger components exposed to air – indoor uncontrolled (external) or air -outdoor (external)	Loss of material due to general, pitting, and crevice corrosion	External Surfaces Monitoring	No	Not Applicable. There are no steel heat exchanger components located outdoors and exposed to an air –outdoor (external) environment. Steel heat exchanger components located indoors and exposed to an air – indoor uncontrolled environment are included with Item Number 3.3.1-58 because the Hope Creek AMR methodology does not predict external pitting and crevice corrosion for steel heat exchanger components located indoors.
3.3.1-60	Steel piping, piping components, and piping elements exposed to air -	Loss of material due to general, pitting, and crevice corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. The External Surfaces Monitoring program, B.2.1.25, will be used to manage loss of material due to general, pitting and crevice corrosion of the steel piping, piping

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	outdoor (external)				components and piping elements exposed to outdoor air for the Control Room and Control Area HVAC Systems, Filtration, Recirculation, and Ventilation System, Fire Protection System, Standby Diesel Generators and Auxiliary Systems, Standby Diesel Generator Area Ventilation Systems, Service Water System, Service Water Intake Ventilation System, Reactor Building Ventilation System and Fire Pump House Ventilation System. Components in the Fire Protection System have been aligned to this item number based on material, environment and aging effect. The Fire Protection program, B.2.1.17, and Fire Water System program, B.2.1.18, will be used, in addition to the External Surfaces Monitoring program, B.2.1.25, to manage loss of material due to general, pitting and crevice corrosion of the steel piping, piping components and piping elements in the Fire Protection System. Components in the Cranes & Hoists System have been aligned to this item number based on material, environment and aging effect. The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems, B.2.1.15, will be

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					substituted to manage loss of material due to general, pitting and crevice corrosion of the structural steel crane and hoist components in the Cranes & Hoists System.
3.3.1-61	Elastomer fire barrier penetration seals exposed to air – outdoor or air - indoor uncontrolled	Increased hardness, shrinkage and loss of strength due to weathering	Fire Protection	No	Consistent with NUREG-1801 with exceptions. The Fire Protection program, B.2.1.17, will be used to manage Increased hardness, shrinkage and loss of strength due to weathering of the elastomer fire barrier penetration seals exposed to indoor air for the Fire Protection System. Exceptions apply to the NUREG-1801 recommendations for the Fire Protection program implementation. Compressible joint seals in the Auxiliary Building Control/Diesel Generator Area, Auxiliary Building Service/Radwaste Area, Reactor Building, and Turbine Building have been aligned to this item number based on material, environment and aging effect. The Structures Monitoring Program, B.2.1.32, will be substituted to manage increased hardness, shrinkage and loss of strength due to weathering of compressible joints and seals for these structures.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-62	Aluminum piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion	Fire Protection	No	Not Applicable. There is no aluminum piping, piping components, and piping elements exposed to raw water for the Auxiliary Systems.
3.3.1-63	Steel fire rated doors exposed to air – outdoor or air - indoor uncontrolled	Loss of material due to Wear	Fire Protection	No	Consistent with NUREG-1801 with exceptions. The Fire Protection program, B.2.1.17, will be used to manage loss of material due to wear of the steel fire rated doors exposed to indoor and outdoor air for the Fire Protection System. Exceptions apply to the NUREG-1801 recommendations for the Fire Protection program implementation
3.3.1-64	Steel piping, piping components, and piping elements exposed to fuel oil	Loss of material due to general, pitting, and crevice corrosion	Fire Protection and Fuel Oil Chemistry	No	Not Applicable. AMR methodology for steel piping, piping components, and piping elements exposed to fuel oil predicts microbiologically influenced corrosion, and fouling in addition to general, pitting, and crevice corrosion. This component, material, environment, and aging effect/mechanism are being monitored in Item Number 3.3.1-20 for the Auxiliary Systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-65	Reinforced concrete structural fire barriers – walls, ceilings and floors exposed to air – indoor uncontrolled	Concrete cracking and spalling due to aggressive chemical attack, and reaction with aggregates	Fire Protection and Structures Monitoring Program	No	Not Applicable. These concrete aging effects and mechanisms are addressed with the applicable building structure in Section 3.5.
3.3.1-66	Reinforced concrete structural fire barriers – walls, ceilings and floors exposed to air – outdoor	Concrete cracking and spalling due to freeze thaw, aggressive chemical attack, and reaction with aggregates	Fire Protection and Structures Monitoring Program	No	Consistent with NUREG-1801 with exceptions. The Fire Protection program, B.2.1.17, and Structures Monitoring program, B.2.1.32, will be used to manage concrete cracking and spalling due to freeze thaw of the reinforced concrete structural fire barriers walls, ceilings, and floors exposed to outdoor air for the Fire Protection System. Exceptions apply to the NUREG-1801 recommendations for the Fire Protection program implementation.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-67	Reinforced concrete structural fire barriers – walls, ceilings and floors exposed to air – outdoor or air - indoor uncontrolled	Loss of material due to corrosion of embedded steel	Fire Protection and Structures Monitoring Program	No	Consistent with NUREG-1801 with exceptions. The Fire Protection program, B.2.1.17, and Structures Monitoring program, B.2.1.32, will be used to manage loss of material due to corrosion of embedded steel of the reinforced concrete structural fire barriers walls, ceilings, and floors exposed to indoor or outdoor air for the Fire Protection System. Exceptions apply to the NUREG-1801 recommendations for the Fire Protection program implementation.
3.3.1-68	Steel piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling	Fire Water System	No	Consistent with NUREG-1801. The Fire Water System program, B.2.1.18, will be used to manage loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling of steel piping, piping components and piping elements and tanks exposed to raw water for the Fire Protection System. Components in the Fresh Water Supply System, Radwaste System, and Equipment and Floor Drainage System have been aligned to this item number based on material, environment and aging effect. The Inspection of Internal Surfaces in

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Miscellaneous Piping and Ducting Components program, B.2.1.26, will be substituted to manage loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling of the steel piping, piping components and piping elements and tanks exposed to raw water for these systems.
3.3.1-69	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion, and fouling	Fire Water System	No	Not Applicable. AMR methodology for stainless steel piping, piping components, and piping elements exposed to raw water predicts microbiologically influenced corrosion in addition to general, pitting, and crevice corrosion and fouling. The Fire Protection System stainless steel piping, piping components, and piping elements exposed to raw water are included in Item Number 3.2.1-38.
3.3.1-70	Copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling	Fire Water System	No	Consistent with NUREG-1801. The Fire Water System program, B.2.1.18, will be used to manage loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling of the copper alloy piping, piping components and piping elements exposed to raw water for the Fire Protection System.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-71	Steel piping, piping components, and piping elements exposed to moist air or condensation (Internal)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Consistent with NUREG-1801. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program, B.2.1.26, will be used to manage loss of material due to general, pitting, and crevice corrosion of the steel piping, piping components and piping elements exposed to wetted air for the Containment Inerting and Purging System, Control Area Chilled Water System, Control Rod Drive System, Control Room and Control Area HVAC Systems, Fire Protection System, Fuel Pool Cooling and Cleanup System, Hardened Torus Vent System, Leak Detection and Radiation Monitoring System, Primary Containment Leakage Rate Testing System, Process and Post-Accident Sampling Systems, Reactor Building Ventilation System, Remote Shutdown Panel Room HVAC System and Standby Diesel Generators and Auxiliary Systems. Components in the Fire Protection System have been aligned to this item number based on material, environment and aging effect. The Fire Protection program will be substituted to manage loss of material due to general, pitting and crevice corrosion of

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					the steel piping, piping components and piping elements exposed to wetted air for the Fire Protection System.
3.3.1-72	Steel HVAC ducting and components internal surfaces exposed to condensation (Internal)	Loss of material due to general, pitting, crevice, and (for drip pans and drain lines) microbiologically influenced corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Consistent with NUREG-1801. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, B.2.1.26, will be used to manage loss of material due to general, pitting, crevice, and microbiologically influenced corrosion (drains) of the steel HVAC ducting and components internal surfaces, and compressor internal surfaces exposed to wetted air for the Control Room and Control Area HVAC Systems, Fire Pump House Ventilation System, Primary Containment Instrument Gas System, Reactor Building Ventilation System, Remote Shutdown Panel Room HVAC System, Service Water Intake Ventilation System and Standby Diesel Generator Area Ventilation System. Components in the Fire Protection System have been aligned to this item number based on material, environment and aging effect. The Fire Protection program will be substituted to manage loss of material due to general, pitting and crevice corrosion of

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					the steel damper housings for this system.
3.3.1-73	Steel crane structural girders in load handling system exposed to air-indoor uncontrolled (external)	Loss of material due to general corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	Consistent with NUREG-1801. The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program, B.2.1.15, will be used to manage loss of material due to general corrosion of the steel crane structural girders exposed to indoor air in the Cranes & Hoists System and Fuel Handling and Storage System.
3.3.1-74	Steel cranes - rails exposed to air – indoor uncontrolled (external)	Loss of material due to Wear	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	Consistent with NUREG-1801. The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program, B.2.1.15, will be used to manage loss of material due to wear of the steel crane rails exposed to indoor air for the Cranes and Hoists System and Fuel Handling and Storage System.
3.3.1-75	Elastomer seals and components exposed to raw water	Hardening and loss of strength due to elastomer degradation; loss of material due to erosion	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Open-Cycle Cooling Water System program, B.2.1.13, will be used to manage hardening and loss of strength due to elastomer degradation of the elastomer seals exposed to raw water for the Service Water System.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-76	Steel piping, piping components, and piping elements (without lining/coating or with degraded lining/coating) exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, fouling, and lining/coating degradation	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Open-Cycle Cooling Water System program, B.2.1.13, will be used to manage loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling of the steel piping, piping components and piping elements exposed to raw water for the Service Water System.
3.3.1-77	Steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Components in the Fire Protection System, Equipment and Floor Drainage System and Fresh Water Supply System have been aligned to this item number based on material, environment and aging effect. The Fire Water System program, B.2.1.18, and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, B.2.1.26, will be substituted to manage loss of material due to general, pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling of piping, piping components and piping elements exposed to raw water in these systems.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-78	Stainless steel, nickel alloy, and copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion	Open-Cycle Cooling Water System	No	Not Applicable. The stainless steel and copper alloy piping, piping components and piping elements exposed to raw water in the Control Room and Control Area HVAC Systems, Equipment and Floor Drainage System, Fire Protection System, Fresh Water Supply System, and Radwaste System do not reference this item because the raw water environment associated with these systems is well water, liquid radwaste or drainage water and is not associated with open-cycle cooling water. Stainless steel components in the Service Water system exposed to raw water have also been determined to be subject to the additional aging mechanism of microbiologically influenced corrosion and fouling, and are therefore evaluated in Table 3.4.1 Item Number 3.4.1-33. Copper alloy and nickel alloy components in the Service Water system exposed to raw water have been determined to be subject to the additional aging mechanism of microbiologically influenced corrosion and fouling, and are therefore evaluated with Item Number 3.3.1-81.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-79	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion, and fouling	Open-Cycle Cooling Water System	No	Not Applicable. The stainless steel piping, piping components and piping elements exposed to raw water in the Equipment and Floor Drainage System, Fire Protection System, Fresh Water Supply System, and Radwaste System do not reference this item because the raw water environment associated with these systems is well water, liquid radwaste or drainage water and is not associated with open-cycle cooling water. Stainless steel components in the Service Water system exposed to raw water have also been determined to be subject to the additional aging mechanism of microbiologically influenced corrosion, and are therefore evaluated in Table 3.4.1 Item Number 3.4.1-33.
3.3.1-80	Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Open-Cycle Cooling Water System	No	Not Applicable. The stainless steel and copper alloy piping, piping components and piping elements exposed to raw water in the Closed Cycle Cooling Water System, Control Room and Control Area HVAC Systems, Equipment and Floor Drainage System, Fire Protection System, Fresh Water Supply System, Leak Detection and Radiation Monitoring System, Radwaste System and Remote Shutdown Panel

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Room HVAC System do not reference this item because the raw water environment associated with these systems is well water, liquid radwaste or drainage water and is not associated with open-cycle cooling water. Copper alloy components in the Service Water system exposed to raw water have been determined to be subject to the additional aging mechanism of fouling, and are therefore evaluated with Item Number 3.3.1-81. Stainless steel components in the Service Water system exposed to raw water have also been determined to be subject to the additional aging mechanism of fouling, and are therefore evaluated in Table 3.4.1 Item Number 3.4.1-33.
3.3.1-81	Copper alloy piping, piping components, and piping elements, exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Open-Cycle Cooling Water System program, B.2.1.13, will be used to manage loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling of the copper alloy piping, piping components and piping elements exposed to raw water for the Service Water System.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Components in the Equipment and Floor Drainage System and Fresh Water Supply System have been aligned to this item number based on material, environment and aging effect. The Periodic Inspection program, B.2.2.2, will be substituted to manage loss of material due to pitting, crevice, and microbiologically influenced corrosion, and fouling of the copper alloy piping, piping components, and piping elements exposed to raw water in these systems.
3.3.1-82	Copper alloy heat exchanger components exposed to raw water	Loss of material due to pitting, crevice, galvanic, and microbiologically influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not Applicable. There are no copper alloy heat exchanger tubes exposed to raw water in the Auxiliary Systems at Hope Creek in the scope of license renewal. The copper alloy Heat Exchanger Components (Thermo-siphon) evaluated with the Closed Cycle Cooling Water System are exposed to glycol coolant that is considered raw water for purposes of determining aging effects because it is not monitored by a chemistry program. The Periodic Inspection program, B.2.2.2, will be used to manage loss of material due to pitting, crevice and microbiologically influenced corrosion of the copper alloy

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Heat Exchanger Components (Thermo-siphon) exposed to this environment.
3.3.1-83	Stainless steel and copper alloy heat exchanger tubes exposed to raw water	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Not Applicable. There are no stainless steel or copper alloy heat exchanger tubes exposed to raw water in the Auxiliary Systems at Hope Creek in the scope of license renewal. The copper alloy Heat Exchanger Components (Thermo-siphon) evaluated with the Closed Cycle Cooling Water System are exposed to glycol coolant that is considered raw water for purposes of determining aging effects because it is not monitored by a chemistry program. The Periodic Inspection program, B.2.2.2, will be used to manage reduction of heat transfer due to fouling of the copper alloy Heat Exchanger Components (Thermo-siphon) exposed to this environment.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-84	Copper alloy >15% Zn piping, piping components, piping elements, and heat exchanger components exposed to raw water, treated water, or closed cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Consistent with NUREG-1801. The Selective Leaching of Materials program, B.2.1.23, will be used to manage loss of material due to selective leaching of the copper alloy with greater than 15% zinc piping, piping components, and piping elements and heat exchanger components exposed to raw water, closed cycle cooling water or treated water for the Closed Cycle Cooling Water System, Fire Protection System, High Pressure Coolant Injection (HPCI) System, and Reactor Core Isolation Cooling (RCIC) System.
3.3.1-85	Gray cast iron piping, piping components, and piping elements exposed to soil, raw water, treated water, or closed-cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Consistent with NUREG-1801. The Selective Leaching of Materials program, B.2.1.23, will be used to manage loss of material due to selective leaching of the gray cast iron piping, piping components, and piping elements, tanks and heat exchanger components exposed to soil, raw water, or closed-cycle cooling water for the Chilled Water System, Closed Cycle Cooling Water System, Equipment and Floor Drainage System, Fire Protection System and Fresh Water Supply System.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-86	Structural steel (new fuel storage rack assembly) exposed to air – indoor uncontrolled (external)	Loss of material due to general, pitting, and crevice corrosion	Structures Monitoring Program	No	Not Applicable. The new fuel storage rack assembly at Hope Creek is aluminum and is not subject to aging effects in an indoor air environment. See Table 3.2.1 Item Number 3.2.1-50.
3.3.1-87	PWRs only				
3.3.1-88	PWRs only				
3.3.1-89	PWRs only				
3.3.1-90	PWRs only				
3.3.1-91	PWRs only				
3.3.1-92	Galvanized steel piping, piping components, and piping elements exposed to air – indoor uncontrolled	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-93	Glass piping elements exposed to air, air – indoor uncontrolled (external), fuel oil, lubricating oil, raw water, treated water, and treated borated water	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.3.1-94	Stainless steel and nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.3.1-95	Steel and aluminum piping, piping components, and piping elements exposed to air – indoor controlled (external)	None	None	NA - No AEM or AMP	Not Applicable. All indoor air environments at Hope Creek are assumed to be uncontrolled for license renewal aging management review.

Table 3.3.1 Summary of Aging Management Evaluations for the Auxiliary Systems

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-96	Steel and stainless steel piping, piping components, and piping elements in concrete	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.3.1-97	Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.3.1-98	Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to dried air	None	None	NA - No AEM or AMP	The Compressed Air Monitoring program, B.2.1.16, will be used to preclude aging effects for steel, stainless steel, and copper alloy piping, piping components, and piping elements in the Compressed Air System, Primary Containment Instrument Gas System and Reactor Building Ventilation Systems by maintaining dry air conditions in the system.
3.3.1-99	PWRs only				

Table 3.3.2-1
Chilled Water System
Summary of Aging Management Evaluation

Table 3.3.2-1 Chilled Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Flexible Connection	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flexible Connection	Leakage Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Flow Device	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Device	Leakage Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Flow Element	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Leakage Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Heat Exchanger Components (CRD Facility Unit Coolers)	Leakage Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 1
Heat Exchanger Components (CRD Facility Unit Coolers)	Leakage Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D, 2
Heat Exchanger Components (DW Cooler)	Leakage Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 1

Table 3.3.2-1 Chilled Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (DW Cooler)	Leakage Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D, 2
Heat Exchanger Components (Recirc Pump Motor Air Cooler)	Leakage Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 1
Heat Exchanger Components (Recirc Pump Motor Air Cooler)	Leakage Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D, 2
Heat Exchanger Components (Steam Tunnel Coolers)	Leakage Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 1
Heat Exchanger Components (Steam Tunnel Coolers)	Leakage Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D, 2
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	D
Piping and Fittings	Leakage Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Piping and Fittings	Leakage Boundary	Copper Alloy with less than 15% Zinc	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	B, 2
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.3.2-1 Chilled Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Pump Casing (CRD Facility Chilled Water Pump)	Leakage Boundary	Ductile Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Pump Casing (CRD Facility Chilled Water Pump)	Leakage Boundary	Ductile Cast Iron	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Restricting Orifices	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Restricting Orifices	Leakage Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Thermowell	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Thermowell	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Thermowell	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Thermowell	Leakage Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Valve Body	Leakage Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Valve Body	Leakage Boundary	Copper Alloy with less than 15% Zinc	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	B, 2

Table 3.3.2-1 Chilled Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Leakage Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Gray Cast Iron	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Valve Body	Leakage Boundary	Gray Cast Iron	Closed Cycle Cooling Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.C2-8	3.3.1-85	A
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. NUREG-1801 specifies a plant-specific program. The Periodic Inspection aging management program will be used to manage the identified aging effects for this component type, material and environment combination.

2. The aging mechanism of Galvanic Corrosion for this component, material and environment combination is not applicable.

Table 3.3.2-2
Closed Cycle Cooling Water System
Summary of Aging Management Evaluation

Table 3.3.2-2 Closed Cycle Cooling Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Filter Housing	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Filter Housing	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Flow Device	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Device	Leakage Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Flow Element	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Flow Element	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Flow Element	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Leakage Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Flow Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (1E Panel Room Chillers - Condensers)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Dry (External)	None	None	VII.J-4	3.3.1-97	C
Heat Exchanger Components (1E Panel Room Chillers - Condensers)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (1E Panel Room Chillers - Condensers)	Pressure Boundary	Carbon Steel (Shell Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (1E Panel Room Chillers - Condensers)	Pressure Boundary	Carbon Steel (Shell Side Components)	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	C
Heat Exchanger Components (1E Panel Room Chillers - Condensers)	Pressure Boundary	Carbon Steel (Tube Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (1E Panel Room Chillers - Condensers)	Pressure Boundary	Carbon Steel (Tube Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (1E Panel Room Chillers - Condensers)	Pressure Boundary	Carbon Steel (Tubesheet)	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	C

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (1E Panel Room Chillers - Condensers)	Pressure Boundary	Carbon Steel (Tubesheet)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (1E Panel Room Chillers - Condensers)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Dry (External)	None	None	VII.J-4	3.3.1-97	C
Heat Exchanger Components (1E Panel Room Chillers - Condensers)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (CRD Pump Cooler)	Leakage Boundary	Carbon Steel (Tube Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (CRD Pump Cooler)	Leakage Boundary	Carbon Steel (Tube Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (CS Pump Room Coolers)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes and Fins)	Air/Gas - Wetted (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			H, 1
Heat Exchanger Components (CS Pump Room Coolers)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes and Fins)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (CS Pump Room Coolers)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (CS Pump Room Coolers)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (Control Room Chillers - Condenser)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Dry (External)	None	None	VII.J-4	3.3.1-97	C
Heat Exchanger Components (Control Room Chillers - Condenser)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (Control Room Chillers - Condenser)	Pressure Boundary	Carbon Steel (Shell Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (Control Room Chillers - Condenser)	Pressure Boundary	Carbon Steel (Shell Side Components)	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	C
Heat Exchanger Components (Control Room Chillers - Condenser)	Pressure Boundary	Carbon Steel (Tube Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (Control Room Chillers - Condenser)	Pressure Boundary	Carbon Steel (Tube Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Control Room Chillers - Condenser)	Pressure Boundary	Carbon Steel (Tubesheet)	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	C
Heat Exchanger Components (Control Room Chillers - Condenser)	Pressure Boundary	Carbon Steel (Tubesheet)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (Control Room Chillers - Condenser)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Dry (External)	None	None	VII.J-4	3.3.1-97	C
Heat Exchanger Components (Control Room Chillers - Condenser)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (DG Intercoolers and Injectors)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (External)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (DG Intercoolers and Injectors)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (DG Intercoolers and Injectors)	Pressure Boundary	Carbon Steel (Shell Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (DG Intercoolers and Injectors)	Pressure Boundary	Carbon Steel (Shell Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (DG Intercoolers and Injectors)	Pressure Boundary	Carbon Steel (Tube Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (DG Intercoolers and Injectors)	Pressure Boundary	Carbon Steel (Tube Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (DG Intercoolers and Injectors)	Pressure Boundary	Carbon Steel (Tubesheet)	Closed Cycle Cooling Water (External)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (DG Intercoolers and Injectors)	Pressure Boundary	Carbon Steel (Tubesheet)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (DG Intercoolers and Injectors)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (External)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (DG Intercoolers and Injectors)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (DG Jacket Water)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (External)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (DG Jacket Water)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (DG Jacket Water)	Pressure Boundary	Carbon Steel (Shell Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (DG Jacket Water)	Pressure Boundary	Carbon Steel (Shell Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (DG Jacket Water)	Pressure Boundary	Carbon Steel (Tube Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (DG Jacket Water)	Pressure Boundary	Carbon Steel (Tube Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (DG Jacket Water)	Pressure Boundary	Carbon Steel (Tubesheet)	Closed Cycle Cooling Water (External)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (DG Jacket Water)	Pressure Boundary	Carbon Steel (Tubesheet)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (DG Jacket Water)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (External)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (DG Jacket Water)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (DG Lube Oil)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (DG Lube Oil)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Lubricating Oil (External)	Reduction of Heat Transfer/Fouling	Lubricating Oil Analysis	V.D2-9	3.2.1-9	B
Heat Exchanger Components (DG Lube Oil)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Lubricating Oil (External)	Reduction of Heat Transfer/Fouling	One-Time Inspection	V.D2-9	3.2.1-9	A
Heat Exchanger Components (DG Lube Oil)	Pressure Boundary	Carbon Steel (Shell Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (DG Lube Oil)	Pressure Boundary	Carbon Steel (Shell Side Components)	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-5	3.3.1-21	B, 3

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (DG Lube Oil)	Pressure Boundary	Carbon Steel (Shell Side Components)	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-5	3.3.1-21	A, 3
Heat Exchanger Components (DG Lube Oil)	Pressure Boundary	Carbon Steel (Tube Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (DG Lube Oil)	Pressure Boundary	Carbon Steel (Tube Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (DG Lube Oil)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubesheets)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (DG Lube Oil)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubesheets)	Closed Cycle Cooling Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.C2-6	3.3.1-84	C
Heat Exchanger Components (DG Lube Oil)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubesheets)	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-10	3.3.1-26	B
Heat Exchanger Components (DG Lube Oil)	Pressure Boundary	Copper Alloy with 15% Zinc or More (Tubesheets)	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-10	3.3.1-26	A
Heat Exchanger Components (DG Lube Oil)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (DG Lube Oil)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Lubricating Oil (External)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-10	3.3.1-26	B
Heat Exchanger Components (DG Lube Oil)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Lubricating Oil (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-10	3.3.1-26	A
Heat Exchanger Components (DG Room Coolers)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes and Fins)	Air/Gas - Wetted (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			H, 1

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (DG Room Coolers)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes and Fins)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (DG Room Coolers)	Pressure Boundary	Carbon Steel (Tube Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (DG Room Coolers)	Pressure Boundary	Carbon Steel (Tube Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (DG Room Coolers)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Heat Exchanger Components (DG Room Coolers)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (FRVS Cooling Coils)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes and Fins)	Air/Gas - Wetted (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			H, 1
Heat Exchanger Components (FRVS Cooling Coils)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes and Fins)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (FRVS Cooling Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Heat Exchanger Components (FRVS Cooling Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (Fuel Pool Cooling)	Heat Transfer	Stainless Steel (Plates)	Closed Cycle Cooling Water (External)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-3	3.3.1-52	D

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Fuel Pool Cooling)	Heat Transfer	Stainless Steel (Plates)	Treated Water (Internal)	Reduction of Heat Transfer/Fouling	One-Time Inspection	VII.A4-4	3.3.1-3	A
Heat Exchanger Components (Fuel Pool Cooling)	Heat Transfer	Stainless Steel (Plates)	Treated Water (Internal)	Reduction of Heat Transfer/Fouling	Water Chemistry	VII.A4-4	3.3.1-3	B
Heat Exchanger Components (Fuel Pool Cooling)	Pressure Boundary	Carbon Steel (Covers)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (Fuel Pool Cooling)	Pressure Boundary	Carbon Steel (Covers)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (Fuel Pool Cooling)	Pressure Boundary	Carbon Steel (Covers)	Treated Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	A
Heat Exchanger Components (Fuel Pool Cooling)	Pressure Boundary	Carbon Steel (Covers)	Treated Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	B
Heat Exchanger Components (Fuel Pool Cooling)	Pressure Boundary	Stainless Steel (Nozzles)	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Heat Exchanger Components (Fuel Pool Cooling)	Pressure Boundary	Stainless Steel (Nozzles)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	D
Heat Exchanger Components (Fuel Pool Cooling)	Pressure Boundary	Stainless Steel (Nozzles)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-2	3.3.1-23	A
Heat Exchanger Components (Fuel Pool Cooling)	Pressure Boundary	Stainless Steel (Nozzles)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-2	3.3.1-23	B
Heat Exchanger Components (Fuel Pool Cooling)	Pressure Boundary	Stainless Steel (Plates)	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Fuel Pool Cooling)	Pressure Boundary	Stainless Steel (Plates)	Closed Cycle Cooling Water (External)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	D
Heat Exchanger Components (Fuel Pool Cooling)	Pressure Boundary	Stainless Steel (Plates)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-2	3.3.1-23	A
Heat Exchanger Components (Fuel Pool Cooling)	Pressure Boundary	Stainless Steel (Plates)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-2	3.3.1-23	B
Heat Exchanger Components (Fuel Pool Cooling)	Structural Support	Carbon Steel (Carrying Bars)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (Fuel Pool Cooling)	Structural Support	Stainless Steel (Carrying Bars)	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Heat Exchanger Components (HPCI Pump Room Cooler)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes and Fins)	Air/Gas - Wetted (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			H, 1
Heat Exchanger Components (HPCI Pump Room Cooler)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes and Fins)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (HPCI Pump Room Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Heat Exchanger Components (HPCI Pump Room Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Heat Transfer	Stainless Steel (Tubes)	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	C

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Heat Transfer	Stainless Steel (Tubes)	Closed Cycle Cooling Water (External)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-3	3.3.1-52	B
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Pressure Boundary	Stainless Steel (Shell Side Components)	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Pressure Boundary	Stainless Steel (Shell Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	D
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Pressure Boundary	Stainless Steel (Tube Side Components)	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Pressure Boundary	Stainless Steel (Tube Side Components)	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	C
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Pressure Boundary	Stainless Steel (Tubes)	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	C
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Pressure Boundary	Stainless Steel (Tubes)	Closed Cycle Cooling Water (External)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	D
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Pressure Boundary	Stainless Steel (Tubesheet)	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	C
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Pressure Boundary	Stainless Steel (Tubesheet)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	D

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (RACS)	Leakage Boundary	Carbon Steel (Shell Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (RACS)	Leakage Boundary	Carbon Steel (Shell Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (RCIC Pump Room Coolers)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes and Fins)	Air/Gas - Wetted (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			H, 1
Heat Exchanger Components (RCIC Pump Room Coolers)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes and Fins)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (RCIC Pump Room Coolers)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Heat Exchanger Components (RCIC Pump Room Coolers)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (RHR Pump Motor Bearing Cooler)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (RHR Pump Motor Bearing Cooler)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Lubricating Oil (External)	Reduction of Heat Transfer/Fouling	Lubricating Oil Analysis	V.D2-9	3.2.1-9	B
Heat Exchanger Components (RHR Pump Motor Bearing Cooler)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Lubricating Oil (External)	Reduction of Heat Transfer/Fouling	One-Time Inspection	V.D2-9	3.2.1-9	A

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (RHR Pump Motor Bearing Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (RHR Pump Motor Bearing Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Lubricating Oil (External)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-10	3.3.1-26	B
Heat Exchanger Components (RHR Pump Motor Bearing Cooler)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Lubricating Oil (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-10	3.3.1-26	A
Heat Exchanger Components (RHR Pump Room Coolers)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes and Fins)	Air/Gas - Wetted (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			H, 1
Heat Exchanger Components (RHR Pump Room Coolers)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes and Fins)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (RHR Pump Room Coolers)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Heat Exchanger Components (RHR Pump Room Coolers)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (RHR Pump Seal Cooler)	Heat Transfer	Stainless Steel (Tubes)	Closed Cycle Cooling Water (External)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-3	3.3.1-52	B
Heat Exchanger Components (RHR Pump Seal Cooler)	Heat Transfer	Stainless Steel (Tubes)	Treated Water (Internal)	Reduction of Heat Transfer/Fouling	One-Time Inspection	VII.A4-4	3.3.1-3	A

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (RHR Pump Seal Cooler)	Heat Transfer	Stainless Steel (Tubes)	Treated Water (Internal)	Reduction of Heat Transfer/Fouling	Water Chemistry	VII.A4-4	3.3.1-3	B
Heat Exchanger Components (RHR Pump Seal Cooler)	Pressure Boundary	Gray Cast Iron (Shell Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (RHR Pump Seal Cooler)	Pressure Boundary	Gray Cast Iron (Shell Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (RHR Pump Seal Cooler)	Pressure Boundary	Gray Cast Iron (Shell Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.C2-8	3.3.1-85	C
Heat Exchanger Components (RHR Pump Seal Cooler)	Pressure Boundary	Stainless Steel (Tubes)	Closed Cycle Cooling Water (External)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	D
Heat Exchanger Components (RHR Pump Seal Cooler)	Pressure Boundary	Stainless Steel (Tubes)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-2	3.3.1-23	A
Heat Exchanger Components (RHR Pump Seal Cooler)	Pressure Boundary	Stainless Steel (Tubes)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-2	3.3.1-23	B
Heat Exchanger Components (RHR)	Heat Transfer	Stainless Steel (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-3	3.3.1-52	B
Heat Exchanger Components (RHR)	Heat Transfer	Stainless Steel (Tubes)	Treated Water (External)	Reduction of Heat Transfer/Fouling	One-Time Inspection	VII.A4-4	3.3.1-3	A
Heat Exchanger Components (RHR)	Heat Transfer	Stainless Steel (Tubes)	Treated Water (External)	Reduction of Heat Transfer/Fouling	Water Chemistry	VII.A4-4	3.3.1-3	B
Heat Exchanger Components (RHR)	Pressure Boundary	Carbon Steel (Shell Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (RHR)	Pressure Boundary	Carbon Steel (Shell Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (RHR)	Pressure Boundary	Carbon Steel (Tube Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (RHR)	Pressure Boundary	Carbon Steel (Tube Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (RHR)	Pressure Boundary	Carbon Steel (Tubesheet)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (RHR)	Pressure Boundary	Carbon Steel (Tubesheet)	Treated Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	A
Heat Exchanger Components (RHR)	Pressure Boundary	Carbon Steel (Tubesheet)	Treated Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	B
Heat Exchanger Components (RHR)	Pressure Boundary	Stainless Steel (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	D
Heat Exchanger Components (RHR)	Pressure Boundary	Stainless Steel (Tubes)	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-2	3.3.1-23	A
Heat Exchanger Components (RHR)	Pressure Boundary	Stainless Steel (Tubes)	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-2	3.3.1-23	B
Heat Exchanger Components (RWCU Non-Regen)	Leakage Boundary	Carbon Steel (Shell Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (RWCU Non-Regen)	Leakage Boundary	Carbon Steel (Shell Side Components)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (RWCU Pedestal)	Leakage Boundary	Carbon Steel (Shell)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (RWCU Pedestal)	Leakage Boundary	Carbon Steel (Shell)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (RWCU Pump HX)	Leakage Boundary	Carbon Steel (Shell)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (RWCU Pump HX)	Leakage Boundary	Carbon Steel (Shell)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (SACS)	Evaluated with the Service Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Heat Exchanger Components (Thermo-siphon)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (Thermo-siphon)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Raw Water (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			G, 4
Heat Exchanger Components (Thermo-siphon)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-4	3.3.1-51	D
Heat Exchanger Components (Thermo-siphon)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Raw Water (External)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Periodic Inspection			G, 4
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	D
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Leakage Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	D
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Piping and Fittings	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Structural Support	Carbon Steel	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	A
Piping and Fittings	Structural Support	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Pump Casing (RACS)	Leakage Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Pump Casing (RACS)	Leakage Boundary	Gray Cast Iron	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Pump Casing (RACS)	Leakage Boundary	Gray Cast Iron	Closed Cycle Cooling Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.C2-8	3.3.1-85	A
Pump Casing (SACS)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Pump Casing (SACS)	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Restricting Orifices	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Restricting Orifices	Throttle	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restricting Orifices	Throttle	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Sensor Element	Leakage Boundary	Aluminum	Air - Indoor (External)	None	None	V.F-2	3.2.1-50	A
Sensor Element	Leakage Boundary	Aluminum	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System			G
Sensor Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Sensor Element	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Strainer Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Strainer Body	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Tanks (RACS Chemical Addition)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (RACS Chemical Addition)	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Tanks (RACS Head Tank)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (RACS Head Tank)	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Tanks (SACS Chemical Addition)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (SACS Chemical Addition)	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Tanks (SACS Demineralizers)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (SACS Demineralizers)	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tanks (SACS Expansion)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (SACS Expansion)	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Tanks (Supply/Return Side Accumulator, Integral Attachments)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (Supply/Return Side Accumulator, Integral Attachments)	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Thermowell	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Thermowell	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Thermowell	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Thermowell	Leakage Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Thermowell	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Thermowell	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	A
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Thermowell	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B

Table 3.3.2-2 Closed Cycle Cooling Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	A
Valve Body	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Periodic Inspection aging management program will be used to manage the identified aging effects for this component type, material and environment combination.

2. NUREG-1801 specifies a plant-specific program. The Periodic Inspection aging management program will be used to manage the identified aging effects for this component type, material and environment combination.

3. Loss of material due to microbiologically influenced corrosion is not applicable for stainless steel components in a Lubricating Oil environment. Industry and plant operating experience indicates that the potential for significant degradation of lubricating oil systems due to microbiologically influenced corrosion is minimal. Lubricating oil systems are maintained to high cleanliness standards by design. Lubricating oil formulations include corrosion inhibitors, and the potential for water and contaminant intrusion is low compared to fuel oil systems; where the bulk storage, delivery and transport of the fuel oil increases the likelihood of moisture and microorganism contamination.

4. The environment for this component is glycol based coolant used in the compressor cooling system. This coolant is considered raw water for purposes of determining aging effects because it is not monitored by a chemistry program. The Periodic Inspection aging management program is used to manage the identified aging effects for this component type, material and environment combination.

Table 3.3.2-3
Compressed Air System
Summary of Aging Management Evaluation

Table 3.3.2-3 Compressed Air System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Accumulator	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Accumulator	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Hoses	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Hoses	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-22	3.3.1-98	E, 1
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1
Piping and Fittings	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Structural Support	Carbon Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-22	3.3.1-98	E, 1
Piping and Fittings	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Structural Support	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1

Table 3.3.2-3 Compressed Air System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-22	3.3.1-98	E, 1
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1
Valve Body	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Structural Support	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The environment of dried gas was used for the Compressed Air System. The Compressed Air Monitoring program is applied to the Compressed Air System components to confirm the internal environment remains sufficiently dry to preclude aging effects.

Table 3.3.2-4
Containment Inerting and Purging System
Summary of Aging Management Evaluation

Table 3.3.2-4 Containment Inerting and Purging System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Expansion Joints	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Expansion Joints	Structural Support	Carbon Steel	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	A
Expansion Joints	Structural Support	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Flow Element	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Structural Support	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Piping and Fittings	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.3.2-4 Containment Inerting and Purging System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Structural Support	Carbon Steel	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	A
Piping and Fittings	Structural Support	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Piping and Fittings	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Structural Support	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	A
Piping and Fittings	Structural Support	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Valve Body	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Structural Support	Carbon Steel	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	A
Valve Body	Structural Support	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Valve Body	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Structural Support	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	A
Valve Body	Structural Support	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.3.2-5
Control Area Chilled Water System
Summary of Aging Management Evaluation

Table 3.3.2-5 Control Area Chilled Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Fan Housing (TSC)	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F4-1	3.3.1-56	A
Fan Housing (TSC)	Structural Support	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-21	3.3.1-71	C
Flow Device	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Flow Device	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Flow Device	Leakage Boundary	Glass	Air - Indoor (External)	None	None	VII.J-8	3.3.1-93	A
Flow Device	Leakage Boundary	Glass	Closed Cycle Cooling Water (Internal)	None	None			G, 1
Flow Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Heat Exchanger Components (1E Panel Room Cooling Coils)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			G, 2

Table 3.3.2-5 Control Area Chilled Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (1E Panel Room Cooling Coils)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (1E Panel Room Cooling Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 3
Heat Exchanger Components (1E Panel Room Cooling Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice, and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.F1-8	3.3.1-51	B
Heat Exchanger Components (Condenser)	Evaluated with the Closed Cycle Cooling Water System	Not Applicable	Not applicable	Not Applicable	Not Applicable			
Heat Exchanger Components (Conrol Equipment Room Cooling Coil)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			G, 2
Heat Exchanger Components (Conrol Equipment Room Cooling Coil)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (Conrol Equipment Room Cooling Coil)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/General, Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 3
Heat Exchanger Components (Conrol Equipment Room Cooling Coil)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice, and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.F1-8	3.3.1-51	B

Table 3.3.2-5 Control Area Chilled Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Contol Room Supply Cooling Coils)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			G, 2
Heat Exchanger Components (Contol Room Supply Cooling Coils)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (Contol Room Supply Cooling Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 3
Heat Exchanger Components (Contol Room Supply Cooling Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice, and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.F1-8	3.3.1-51	B
Heat Exchanger Components (Evaporator AK 400, BK 400, AK 403, BK 403)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Dry (External)	None	None	VII.J-4	3.3.1-97	C
Heat Exchanger Components (Evaporator AK 400, BK 400, AK 403, BK 403)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (Evaporator AK 400, BK 400, AK 403, BK 403)	Pressure Boundary	Carbon Steel (Shell Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A

Table 3.3.2-5 Control Area Chilled Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Evaporator AK 400, BK 400, AK 403, BK 403)	Pressure Boundary	Carbon Steel (Shell Side Components)	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	C
Heat Exchanger Components (Evaporator AK 400, BK 400, AK 403, BK 403)	Pressure Boundary	Carbon Steel (Tubesheet)	Air/Gas - Dry (External)	None	None	VII.J-23	3.3.1-97	C
Heat Exchanger Components (Evaporator AK 400, BK 400, AK 403, BK 403)	Pressure Boundary	Carbon Steel (Tubesheet)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (Evaporator AK 400, BK 400, AK 403, BK 403)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Dry (External)	None	None	VII.J-4	3.3.1-97	C
Heat Exchanger Components (Evaporator AK 400, BK 400, AK 403, BK 403)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice, and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.F1-8	3.3.1-51	B
Heat Exchanger Components (RSP Room Cooling Coils)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas Wetted (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			G, 2
Heat Exchanger Components (RSP Room Cooling Coils)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (RSP Room Cooling Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 3

Table 3.3.2-5 Control Area Chilled Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (RSP Room Cooling Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice, and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.F1-8	3.3.1-51	B
Heat Exchanger Components (SACS Room Cooling Coils)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			G, 2
Heat Exchanger Components (SACS Room Cooling Coils)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (SACS Room Cooling Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 3
Heat Exchanger Components (SACS Room Cooling Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice, and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.F1-8	3.3.1-51	B
Heat Exchanger Components (Switchgear Room Cooling Coils)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Reduction of Heat Transfer/Fouling	Periodic Inspection			G, 2
Heat Exchanger Components (Switchgear Room Cooling Coils)	Heat Transfer	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System	VII.C2-2	3.3.1-52	B
Heat Exchanger Components (Switchgear Room Cooling Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 3
Heat Exchanger Components (Switchgear Room Cooling Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc (Tubes)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.F1-8	3.3.1-51	B

Table 3.3.2-5 Control Area Chilled Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (TSC Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 3
Heat Exchanger Components (TSC Coils)	Pressure Boundary	Copper Alloy with less than 15% Zinc	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting, Crevice, and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.F1-8	3.3.1-51	B
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Piping and Fittings	Structural Support	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A

Table 3.3.2-5 Control Area Chilled Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Structural Support	Copper Alloy with less than 15% Zinc	Air/Gas - Dry (Internal)	None	None	VII.J-3	3.3.1-98	A
Pump Casing (Chilled Water Pump AP 400, BP 400, AP 414, BP 414)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Pump Casing (Chilled Water Pump AP 400, BP 400, AP 414, BP 414)	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Rupture Disks	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Rupture Disks	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-18	3.3.1-98	A
Rupture Disks	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Rupture Disks	Structural Support	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-18	3.3.1-98	A
Sight Glasses	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Sight Glasses	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Sight Glasses	Leakage Boundary	Glass	Air - Indoor (External)	None	None	VII.J-8	3.3.1-93	A
Sight Glasses	Leakage Boundary	Glass	Closed Cycle Cooling Water (Internal)	None	None			G, 1
Sight Glasses	Pressure Boundary	Glass	Air - Indoor (External)	None	None	VII.J-8	3.3.1-93	A
Sight Glasses	Pressure Boundary	Glass	Air/Gas - Dry (Internal)	None	None	VII.J-7	3.3.1-93	A
Strainer	Filter	Stainless Steel	Closed Cycle Cooling Water (External)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Strainer	Filter	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Strainer Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.3.2-5 Control Area Chilled Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer Body	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Tanks (Chem Feed AT 401, BT 401, AT 414, BT 414))	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (Chem Feed AT 401, BT 401, AT 414, BT 414))	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Tanks (Head Tank AT 410, BT 410, AT413, BT 413)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Tanks (Head Tank AT 410, BT 410, AT413, BT 413)	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	D
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Thermowell	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	A
Thermowell	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E4-14	3.3.1-24	A

Table 3.3.2-5 Control Area Chilled Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E4-14	3.3.1-24	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-14	3.3.1-47	B
Valve Body	Structural Support	Copper Alloy with 15% Zinc or More	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Valve Body	Structural Support	Copper Alloy with 15% Zinc or More	Air/Gas - Dry (Internal)	None	None	VII.J-3	3.3.1-98	A

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. There are no aging effects for glass in a closed cooling water environment, based on other NUREG-1801 items for glass, such as VII.J-13 for glass in a treated water environment.

2. External surfaces of coils inside the HVAC system will be inspected as part of the Periodic Inspection Program.

3. NUREG-1801 specifies a plant-specific program. The Periodic Inspection Program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.3.2-6
Control Rod Drive System
Summary of Aging Management Evaluation

Table 3.3.2-6 Control Rod Drive System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Accumulator	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Accumulator	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	A
Accumulator	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Accumulator	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Accumulator	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Accumulator	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	A
Accumulator	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Accumulator	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Filter Housing	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Filter Housing	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Filter Housing	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Flow Device	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A

Table 3.3.2-6 Control Rod Drive System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flow Device	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Flow Device	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Flow Element	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Flow Element	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Gearbox	Leakage Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Gearbox	Leakage Boundary	Gray Cast Iron	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	B
Gearbox	Leakage Boundary	Gray Cast Iron	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	A
Heat Exchanger Components (CRD Pump Gear Oil Cooler)	Leakage Boundary	Carbon Steel (Shell Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (CRD Pump Gear Oil Cooler)	Leakage Boundary	Carbon Steel (Shell Side Components)	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	D
Heat Exchanger Components (CRD Pump Gear Oil Cooler)	Leakage Boundary	Carbon Steel (Shell Side Components)	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	C
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	B

Table 3.3.2-6 Control Rod Drive System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Leakage Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A

Table 3.3.2-6 Control Rod Drive System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Pump Casing (CRD)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Pump Casing (CRD)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Pump Casing (CRD)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Restricting Orifices	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Restricting Orifices	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Restricting Orifices	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Rupture Disks	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Rupture Disks	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	A
Sensor Element	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Sensor Element	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Sensor Element	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Strainer Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Strainer Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A

Table 3.3.2-6 Control Rod Drive System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Strainer Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Strainer Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Strainer Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Thermowell	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Thermowell	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Thermowell	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A

Table 3.3.2-6 Control Rod Drive System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

None

Table 3.3.2-7
Control Room and Control Area HVAC Systems
Summary of Aging Management Evaluation

Table 3.3.2-7 Control Room and Control Area HVAC Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bird Screen	Filter	Aluminum	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 1
Bolting	Mechanical Closure	Aluminum Bolting	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 1
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-4	3.3.1-55	A
Bolting	Mechanical Closure	Stainless Steel Bolting	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 1
Damper Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-2	3.3.1-56	A
Damper Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Door Seal	Pressure Boundary	Elastomer	Air - Indoor (External)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F1-7	3.3.1-11	E, 2
Door Seal	Pressure Boundary	Elastomer	Air/Gas - Wetted (Internal)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F1-7	3.3.1-11	E, 2
Drain Traps	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Drain Traps	Pressure Boundary	Gray Cast Iron	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	C

Table 3.3.2-7 Control Room and Control Area HVAC Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Ducting and Components	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	C
Ducting and Components	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Ducting and Components	Pressure Boundary	Polymer	Air - Indoor (External)	None	None			F, 3
Ducting and Components	Pressure Boundary	Polymer	Air/Gas - Wetted (Internal)	None	None			F, 3
Ducting and Components	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Ducting and Components	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Electric Heaters (Housing)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Electric Heaters (Housing)	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Fan Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-2	3.3.1-56	A
Fan Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Filter Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-2	3.3.1-56	A
Filter Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Flexible Connection	Pressure Boundary	Elastomer	Air - Indoor (External)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F1-7	3.3.1-11	E, 4

Table 3.3.2-7 Control Room and Control Area HVAC Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flexible Connection	Pressure Boundary	Elastomer	Air/Gas - Wetted (Internal)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F1-7	3.3.1-11	E, 4
Flow Element	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	A
Flow Element	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-21	3.3.1-71	A
Flow Element	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2, 5
Flow Element	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Heat Exchanger Components (Control Room Supply)	Evaluated with the Control Area Chilled Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Louver	Pressure Boundary	Aluminum	Air - Indoor (External)	None	None	V.F-2	3.2.1-50	C
Louver	Pressure Boundary	Aluminum	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-14	3.3.1-27	E, 2
Louver	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	C
Louver	Pressure Boundary	Galvanized Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	C
Louver	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Nozzle	Spray	Copper Alloy with 15% Zinc or More	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2, 5
Nozzle	Spray	Copper Alloy with 15% Zinc or More	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.3.2-7 Control Room and Control Area HVAC Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (External)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-21	3.3.1-71	A, 5
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-21	3.3.1-71	A
Piping and Fittings	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Piping and Fittings	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Sensor Element (In-Duct Radiation Detector)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Sensor Element (In-Duct Radiation Detector)	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-21	3.3.1-71	A
Sensor Element (In-Duct Radiation Detector)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Sensor Element (In-Duct Radiation Detector)	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Thermowell	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A

Table 3.3.2-7 Control Room and Control Area HVAC Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

2. NUREG-1801 specifies a plant-specfic program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment.

3. The polymer (plexiglass) material located indoors and subject to an air-indoor or air-gas (wetted) environment is not subject to significant aging effects. Polymer materials do not experience aging effects unless exposed to temperatures, radiation or chemicals capable of attacking the specific polymer chemical composition. Polymer materials are selected for compatibility with the environment during the design, and if properly selected will not experience significant degradation. Polymer (plexiglass) material in this non-aggressive air environment is not expected to experience significant aging effects. This is consistent with plant operating experience.

4. NUREG-1801 specifies a plant-specfic program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination. Inspections of the flexible connections require physical manipulation; therefore, internal and external inspections, which include physical manipulation of elastomers, will be performed at the same time under the Periodic Inspection program.

5. The environment of Air/Gas - Wetted is applicable to the external surfaces during normal operation. This component is located within the HVAC ductwork and the external surfaces of this component are exposed to the HVAC Air/Gas - Wetted evironment.

Table 3.3.2-8
Cranes & Hoists
Summary of Aging Management Evaluation

Table 3.3.2-8 **Cranes & Hoists**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.I-4	3.3.1-43	E, 1
Bolting	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Self-Loosening	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.I-5	3.3.1-45	E, 1, 2
Bolting	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.I-1	3.3.1-43	E, 1
Bolting	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor (External)	Loss of Preload/Self-Loosening	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	IV.C1-10	3.1.1-52	E, 1, 2
Crane/Hoist (Bridge / Trolley / Girders)	Structural Support	Carbon Steel	Air - Indoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA	VII.B-2	3.3.1-1	A, 3
Crane/Hoist (Bridge / Trolley / Girders)	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.B-3	3.3.1-73	A

Table 3.3.2-8 Cranes & Hoists (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Crane/Hoist (Bridge / Trolley / Girders)	Structural Support	Carbon Steel	Air - Outdoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA			G, 3
Crane/Hoist (Bridge / Trolley / Girders)	Structural Support	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.H1-8	3.3.1-60	E, 1
Crane/Hoist (Jib Crane Columns / Beams / Plates / Anchorage)	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.B-3	3.3.1-73	A
Crane/Hoist (Jib Crane Columns / Beams / Plates / Anchorage)	Structural Support	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.H1-8	3.3.1-60	E, 1
Crane/Hoist (Monorail Beams / Lifting Devices / Plates)	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.B-3	3.3.1-73	A
Crane/Hoist (Monorail Beams / Lifting Devices / Plates)	Structural Support	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.H1-8	3.3.1-60	E, 1
Crane/Hoist (Rail System)	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.B-3	3.3.1-73	C

Table 3.3.2-8 Cranes & Hoists (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Crane/Hoist (Rail System)	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/Wear	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.B-1	3.3.1-74	A
Crane/Hoist (Rail System)	Structural Support	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.H1-8	3.3.1-60	E, 1
Crane/Hoist (Rail System)	Structural Support	Carbon Steel	Air - Outdoor (External)	Loss of Material/Wear	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems			G

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

2. The aging mechanisms of Thermal Effects and Gasket Creep are not applicable to this component type, material, and environment combination.

3. The TLAA designation in the Aging Management Program column indicates fatigue of this component is evaluated in Section 4.7.

Table 3.3.2-9
Equipment and Floor Drainage System
Summary of Aging Management Evaluation

Table 3.3.2-9 Equipment and Floor Drainage System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Drum Traps	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Drum Traps	Leakage Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 1
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1-5	3.3.1-77	E, 1
Piping and Fittings	Leakage Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Piping and Fittings	Leakage Boundary	Copper Alloy with less than 15% Zinc	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Periodic Inspection	VII.C1-9	3.3.1-81	E, 2
Piping and Fittings	Leakage Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	A

Table 3.3.2-9 Equipment and Floor Drainage System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Leakage Boundary	Galvanized Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 1
Piping and Fittings	Leakage Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 1
Piping and Fittings	Leakage Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.C1-11	3.3.1-85	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Periodic Inspection	V.C-3	3.2.1-38	E, 2
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1-5	3.3.1-77	E, 1
Piping and Fittings	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	A
Piping and Fittings	Pressure Boundary	Galvanized Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 1
Piping and Fittings	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.3.2-9 Equipment and Floor Drainage System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 1
Piping and Fittings	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.C1-11	3.3.1-85	A
Tanks (Neutralizers and Oil Interceptor)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (Neutralizers and Oil Interceptor)	Leakage Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 1
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 1
Valve Body	Leakage Boundary	Ductile Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Ductile Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 1
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Periodic Inspection	V.C-3	3.2.1-38	E, 2

Table 3.3.2-9 Equipment and Floor Drainage System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 1
Valve Body	Pressure Boundary	Ductile Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Ductile Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 1

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Inspection of internal Surfaces in Miscellaneous Piping and Ducting Components program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

2. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.3.2-10
Fire Protection System
Summary of Aging Management Evaluation

Table 3.3.2-10 Fire Protection System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bird Screen (Fire Water Tank Vents)	Filter	Aluminum	Air - Outdoor	Loss of Material/Pitting and Crevice Corrosion	Fire Protection	III.B2-7	3.5.1-50	E, 1
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-1	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Outdoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Soil (External)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Bolting Integrity			G, 3
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Soil (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity			G, 3
Concrete Curbs	Direct Flow (Contains Oil Spills)	Concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete Curbs	Direct Flow (Contains Oil Spills)	Concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete Curbs	Direct Flow (Contains Oil Spills)	Concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete Curbs	Direct Flow (Contains Oil Spills)	Concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete Curbs	Direct Flow (Contains Oil Spills)	Concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete Curbs	Direct Flow (Contains Oil Spills)	Concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Damper Housing	Fire Barrier	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	A
Damper Housing	Fire Barrier	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Protection	VII.F1-3	3.3.1-72	E, 1
Damper Housing	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	A
Damper Housing	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Protection	VII.F1-3	3.3.1-72	E, 1
Doors	Fire Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Fire Protection	VII.I-8	3.3.1-58	E, 1
Doors	Fire Barrier	Carbon Steel	Air - Indoor	Loss of Material/Wear	Fire Protection	VII.G-3	3.3.1-63	B
Doors	Fire Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Fire Protection	VII.H1-8	3.3.1-60	E, 1

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Doors	Fire Barrier	Carbon Steel	Air - Outdoor	Loss of Material/Wear	Fire Protection	VII.G-4	3.3.1-63	B
Electric Heaters (Fire Water Storage Tank Heaters)	Pressure Boundary	Stainless Steel	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Aboveground Steel Tanks	III.B2-7	3.5.1-50	E, 4
Electric Heaters (Fire Water Storage Tank Heaters)	Pressure Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	V.C-3	3.2.1-38	E, 5
Filter Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Protection	VII.D-3	3.3.1-57	E, 1
Filter Housing	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fuel Oil Chemistry	VII.H1-10	3.3.1-20	B
Filter Housing	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	One-Time Inspection	VII.H1-10	3.3.1-20	A
Fire Barriers (Masonry Walls: Interior)	Fire Barrier	Concrete block	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Fire Protection	III.A3-9	3.5.1-23	E, 6
Fire Barriers (Masonry Walls: Interior)	Fire Barrier	Concrete block	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Fire Barriers (Masonry Walls: Interior)	Fire Barrier	Concrete block	Air - Indoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Fire Protection	III.A3-11	3.5.1-43	E, 6

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fire Barriers (Masonry Walls: Interior)	Fire Barrier	Concrete block	Air - Indoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 7
Fire Barriers (Masonry Walls: Interior)	Fire Barrier	Concrete block	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Fire Protection	III.A3-3	3.5.1-28	E, 6
Fire Barriers (Masonry Walls: Interior)	Fire Barrier	Concrete block	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Fire Barriers (Penetration Seals)	Fire Barrier	Elastomer	Air - Indoor	Increased Hardness, Shrinkage and Loss of Strength/Weathering	Fire Protection	VII.G-1	3.3.1-61	B
Fire Barriers (Penetration Seals)	Fire Barrier	Elastomer	Air - Outdoor	Increased Hardness, Shrinkage and Loss of Strength/Weathering	Fire Protection	VII.G-2	3.3.1-61	B
Fire Barriers (Penetration Seals)	Fire Barrier	Grout	Air - Indoor	Cracking/Shrinkage	Fire Protection			F, 8
Fire Barriers (Penetration Seals)	Fire Barrier	Grout	Air - Indoor	Cracking/Shrinkage	Structures Monitoring Program			F, 8
Fire Barriers (Penetration Seals)	Fire Barrier	Grout	Air - Outdoor	Cracking/Shrinkage	Fire Protection			F, 8
Fire Barriers (Penetration Seals)	Fire Barrier	Grout	Air - Outdoor	Cracking/Shrinkage	Structures Monitoring Program			F, 8
Fire Barriers (Penetration Seals)	Fire Barrier	Grout	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Fire Protection			F, 9
Fire Barriers (Penetration Seals)	Fire Barrier	Grout	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program			F, 9

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fire Barriers (Walls, Ceilings and Floors)	Fire Barrier	Reinforced Concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Fire Barriers (Walls, Ceilings and Floors)	Fire Barrier	Reinforced Concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Fire Protection	III.A3-3	3.5.1-28	E, 6
Fire Barriers (Walls, Ceilings and Floors)	Fire Barrier	Reinforced Concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Fire Barriers (Walls, Ceilings and Floors)	Fire Barrier	Reinforced Concrete	Air - Indoor	Loss of Material/Corrosion of Embedded Steel	Fire Protection	VII.G-29	3.3.1-67	B
Fire Barriers (Walls, Ceilings and Floors)	Fire Barrier	Reinforced Concrete	Air - Indoor	Loss of Material/Corrosion of Embedded Steel	Structures Monitoring Program	VII.G-29	3.3.1-67	A
Fire Barriers (Walls, Ceilings and Floors)	Fire Barrier	Reinforced Concrete	Air - Outdoor	Concrete Cracking and Spalling/Freeze-thaw	Fire Protection	VII.G-30	3.3.1-66	B, 10
Fire Barriers (Walls, Ceilings and Floors)	Fire Barrier	Reinforced Concrete	Air - Outdoor	Concrete Cracking and Spalling/Freeze-thaw	Structures Monitoring Program	VII.G-30	3.3.1-66	A, 10
Fire Barriers (Walls, Ceilings and Floors)	Fire Barrier	Reinforced Concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Fire Barriers (Walls, Ceilings and Floors)	Fire Barrier	Reinforced Concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Fire Protection	III.A3-3	3.5.1-28	E, 6

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fire Barriers (Walls, Ceilings and Floors)	Fire Barrier	Reinforced Concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Fire Barriers (Walls, Ceilings and Floors)	Fire Barrier	Reinforced Concrete	Air - Outdoor	Loss of Material/Corrosion of Embedded Steel	Fire Protection	VII.G-31	3.3.1-67	B
Fire Barriers (Walls, Ceilings and Floors)	Fire Barrier	Reinforced Concrete	Air - Outdoor	Loss of Material/Corrosion of Embedded Steel	Structures Monitoring Program	VII.G-31	3.3.1-67	A
Fire Barriers (Wraps)	Fire Barrier	Alumina Silicate	Air - Indoor	Change in Material Properties	Fire Protection			F, 11
Fire Barriers (Wraps)	Fire Barrier	Alumina Silicate	Air - Indoor	Cracking	Fire Protection			F, 11
Fire Hydrant	Pressure Boundary	Gray Cast Iron	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A
Fire Hydrant	Pressure Boundary	Gray Cast Iron	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Water System	VII.H1-8	3.3.1-60	E, 12
Fire Hydrant	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	A
Fire Hydrant	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-14	3.3.1-85	A
Fire Hydrant	Pressure Boundary	Gray Cast Iron	Soil (External)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Buried Piping Inspection	VII.G-25	3.3.1-19	A
Fire Hydrant	Pressure Boundary	Gray Cast Iron	Soil (External)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-15	3.3.1-85	A
Flame Arrestor	Pressure Boundary	Aluminum	Air - Outdoor	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 13

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flow Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Pressure Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	V.C-3	3.2.1-38	E, 5
Gas Bottles (Halon)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Gas Bottles (Halon)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Protection	VII.I-8	3.3.1-58	E, 15
Gas Bottles (Halon)	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	C
Hose Manifold	Pressure Boundary	Gray Cast Iron	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A
Hose Manifold	Pressure Boundary	Gray Cast Iron	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Water System	VII.H1-8	3.3.1-60	E, 12
Hose Manifold	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	A
Hose Manifold	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-14	3.3.1-85	A
Hoses	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Fire Protection			G, 11
Hoses	Pressure Boundary	Copper Alloy with less than 15% Zinc	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Fuel Oil Chemistry	VII.G-10	3.3.1-32	B
Hoses	Pressure Boundary	Copper Alloy with less than 15% Zinc	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	One-Time Inspection	VII.G-10	3.3.1-32	A

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Hoses	Pressure Boundary	Polymer	Air - Indoor (External)	None	None			F, 18
Hoses	Pressure Boundary	Polymer	Air/Gas - Wetted (Internal)	None	None			F, 18
Odorizer	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Odorizer	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Protection	VII.D-3	3.3.1-57	E, 15
Odorizer	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Protection	VII.G-23	3.3.1-71	E, 1
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Protection	VII.D-3	3.3.1-57	E, 15
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Water System	VII.D-3	3.3.1-57	E, 12
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Protection	VII.H1-8	3.3.1-60	E, 15
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Water System	VII.H1-8	3.3.1-60	E, 12
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Protection	VII.G-23	3.3.1-71	E, 1
Piping and Fittings	Pressure Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.C1-5	3.3.1-77	E, 5

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Soil (External)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Buried Piping Inspection	VII.G-25	3.3.1-19	A
Piping and Fittings	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Piping and Fittings	Pressure Boundary	Copper Alloy with 15% Zinc or More	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-12	3.3.1-70	A
Piping and Fittings	Pressure Boundary	Copper Alloy with 15% Zinc or More	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-13	3.3.1-84	A
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Fire Protection			G, 11
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Fuel Oil Chemistry	VII.G-10	3.3.1-32	B
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	One-Time Inspection	VII.G-10	3.3.1-32	A
Piping and Fittings	Pressure Boundary	Ductile Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Ductile Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Water System	VII.D-3	3.3.1-57	E, 12
Piping and Fittings	Pressure Boundary	Ductile Cast Iron	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Ductile Cast Iron	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Water System	VII.H1-8	3.3.1-60	E, 12
Piping and Fittings	Pressure Boundary	Ductile Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	A
Piping and Fittings	Pressure Boundary	Ductile Cast Iron	Soil (External)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Buried Piping Inspection	VII.G-25	3.3.1-19	A
Piping and Fittings	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	A
Piping and Fittings	Pressure Boundary	Galvanized Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A
Piping and Fittings	Pressure Boundary	Galvanized Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Water System	VII.H1-8	3.3.1-60	E, 12
Piping and Fittings	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Protection	VII.G-23	3.3.1-71	E, 1
Piping and Fittings	Pressure Boundary	Galvanized Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fuel Oil Chemistry	VII.H1-10	3.3.1-20	B
Piping and Fittings	Pressure Boundary	Galvanized Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	One-Time Inspection	VII.H1-10	3.3.1-20	A

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Galvanized Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	A
Piping and Fittings	Pressure Boundary	Galvanized Steel	Soil (External)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Buried Piping Inspection	VII.G-25	3.3.1-19	A
Piping and Fittings	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Water System	VII.D-3	3.3.1-57	E, 12
Piping and Fittings	Pressure Boundary	Gray Cast Iron	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A
Piping and Fittings	Pressure Boundary	Gray Cast Iron	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Water System	VII.H1-8	3.3.1-60	E, 12
Piping and Fittings	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	A
Piping and Fittings	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-14	3.3.1-85	A
Piping and Fittings	Pressure Boundary	Gray Cast Iron	Soil (External)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Buried Piping Inspection	VII.G-25	3.3.1-19	A
Piping and Fittings	Pressure Boundary	Gray Cast Iron	Soil (External)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-15	3.3.1-85	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	V.C-3	3.2.1-38	E, 5
Piping and Fittings	Pressure Boundary	Stainless Steel	Soil (External)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Buried Non-Steel Piping Inspection			H, 16
Pump Casing (Jockey Pump)	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Pump Casing (Jockey Pump)	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Water System	VII.D-3	3.3.1-57	E, 12
Pump Casing (Jockey Pump)	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	A
Pump Casing (Jockey Pump)	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-14	3.3.1-85	A
Pump Casing (Motor and Diesel Driven Fire Pumps)	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Pump Casing (Motor and Diesel Driven Fire Pumps)	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Water System	VII.D-3	3.3.1-57	E, 12
Pump Casing (Motor and Diesel Driven Fire Pumps)	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	A
Pump Casing (Motor and Diesel Driven Fire Pumps)	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-14	3.3.1-85	A

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restricting Orifices	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Restricting Orifices	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Fire Protection	VII.G-9	3.3.1-28	E, 2
Restricting Orifices	Throttle	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Restricting Orifices	Throttle	Copper Alloy with less than 15% Zinc	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Fire Protection	VII.G-9	3.3.1-28	E, 2
Spray Nozzles (Carbon Dioxide)	Spray	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Spray Nozzles (Carbon Dioxide)	Spray	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Fire Protection	VII.D-4	3.3.1-54	E, 1
Spray Nozzles (Foam)	Spray	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A
Spray Nozzles (Foam)	Spray	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Protection	VII.H1-8	3.3.1-60	E, 15
Spray Nozzles (Foam)	Spray	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Protection	VII.G-23	3.3.1-71	E, 1
Spray Nozzles (Halon)	Spray	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Spray Nozzles (Halon)	Spray	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Fire Protection	VII.D-4	3.3.1-54	E, 1
Sprinkler Heads	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Sprinkler Heads	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Fire Water System			G, 17
Sprinkler Heads	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas - Dry (Internal)	None	None	VII.J-3	3.3.1-98	A
Sprinkler Heads	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Fire Water System	VII.G-9	3.3.1-28	E, 14
Sprinkler Heads	Pressure Boundary	Copper Alloy with less than 15% Zinc	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-12	3.3.1-70	A
Sprinkler Heads	Spray	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Sprinkler Heads	Spray	Copper Alloy with less than 15% Zinc	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Fire Water System			G, 17
Sprinkler Heads	Spray	Copper Alloy with less than 15% Zinc	Air/Gas - Dry (Internal)	None	None	VII.J-3	3.3.1-98	A
Sprinkler Heads	Spray	Copper Alloy with less than 15% Zinc	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Fire Water System	VII.G-9	3.3.1-28	E, 14
Sprinkler Heads	Spray	Copper Alloy with less than 15% Zinc	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-12	3.3.1-70	A
Strainer	Filter	Copper Alloy with 15% Zinc or More	Raw Water (External)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-12	3.3.1-70	A

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer	Filter	Copper Alloy with 15% Zinc or More	Raw Water (External)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-13	3.3.1-84	A
Strainer	Filter	Copper Alloy with 15% Zinc or More	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-12	3.3.1-70	A
Strainer	Filter	Copper Alloy with 15% Zinc or More	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-13	3.3.1-84	A
Strainer (Fire Pump Suction Strainers)	Filter	Stainless Steel	Raw Water (External)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	V.C-3	3.2.1-38	E, 5
Strainer (Fire Pump Suction Strainers)	Filter	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	V.C-3	3.2.1-38	E, 5
Strainer (Fire Water Tank Silt Stop)	Filter	Carbon Steel	Raw Water (External)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	A
Strainer (Fire Water Tank Silt Stop)	Filter	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	A
Strainer Body	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Strainer Body	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Water System	VII.D-3	3.3.1-57	E, 12

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer Body	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	A
Strainer Body	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-14	3.3.1-85	A
Tanks (CO2- 17 Ton)	Pressure Boundary	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Aboveground Steel Tanks	VII.H1-11	3.3.1-40	A
Tanks (CO2- 17 Ton)	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	C
Tanks (CO2- 4 Ton)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (CO2- 4 Ton)	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	C
Tanks (Fire Diesel Fuel Oil)	Pressure Boundary	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Aboveground Steel Tanks	VII.H1-11	3.3.1-40	A
Tanks (Fire Diesel Fuel Oil)	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fuel Oil Chemistry	VII.H1-10	3.3.1-20	B
Tanks (Fire Diesel Fuel Oil)	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	One-Time Inspection	VII.H1-10	3.3.1-20	A
Tanks (Fire Water)	Pressure Boundary	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Aboveground Steel Tanks	VII.H1-11	3.3.1-40	A

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tanks (Fire Water)	Pressure Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	C
Tanks (Fire Water)	Pressure Boundary	Carbon Steel	Soil (External)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Aboveground Steel Tanks	VII.G-25	3.3.1-19	E, 4
Tanks (Retarding Chambers)	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (Retarding Chambers)	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Water System	VII.I-8	3.3.1-58	E, 12
Tanks (Retarding Chambers)	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	C
Tanks (Retarding Chambers)	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-14	3.3.1-85	C
Thermowell	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	A
Thermowell	Pressure Boundary	Galvanized Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A
Thermowell	Pressure Boundary	Galvanized Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Water System	VII.H1-8	3.3.1-60	E, 12
Thermowell	Pressure Boundary	Galvanized Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	A
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Protection	VII.D-3	3.3.1-57	E, 15
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Water System	VII.D-3	3.3.1-57	E, 12
Valve Body	Pressure Boundary	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A
Valve Body	Pressure Boundary	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Protection	VII.H1-8	3.3.1-60	E, 15
Valve Body	Pressure Boundary	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Water System	VII.H1-8	3.3.1-60	E, 12
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	None	VII.J-23	3.3.1-97	A
Valve Body	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fuel Oil Chemistry	VII.H1-10	3.3.1-20	B
Valve Body	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	One-Time Inspection	VII.H1-10	3.3.1-20	A
Valve Body	Pressure Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	A
Valve Body	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Copper Alloy with 15% Zinc or More	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-12	3.3.1-70	A
Valve Body	Pressure Boundary	Copper Alloy with 15% Zinc or More	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-13	3.3.1-84	A
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Fire Protection			G, 11
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Fire Water System			G, 17
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Fuel Oil Chemistry	VII.G-10	3.3.1-32	B
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	One-Time Inspection	VII.G-10	3.3.1-32	A
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-12	3.3.1-70	A
Valve Body	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	Fire Water System	VII.D-3	3.3.1-57	E, 12

Table 3.3.2-10 Fire Protection System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Gray Cast Iron	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A
Valve Body	Pressure Boundary	Gray Cast Iron	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Fire Water System	VII.H1-8	3.3.1-60	E, 12
Valve Body	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	VII.G-24	3.3.1-68	A
Valve Body	Pressure Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-14	3.3.1-85	A
Valve Body	Pressure Boundary	Gray Cast Iron	Soil (External)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Buried Piping Inspection	VII.G-25	3.3.1-19	A
Valve Body	Pressure Boundary	Gray Cast Iron	Soil (External)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.G-15	3.3.1-85	A
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fire Water System	V.C-3	3.2.1-38	E, 5

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Fire Protection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

2. NUREG-1801 specifies a plant-specific program. The Fire Protection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

3. The aging effects for closure bolting in a soil environment include loss of material and loss of preload. External inspections of buried bolting will occur in accordance with the frequency outlined in the Buried Piping Inspection Program and the Buried Non-Steel Piping Inspection Program.

4. The Aboveground Steel Tanks program is substituted to manage the aging effect(s) applicable to this component, material and environment combination.

5. The Fire Water System program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

6. The Fire Protection aging management program will be used in addition to the Structures Monitoring Program.

7. Masonry walls are inspected as a part of the Structures Monitoring Program, which includes the ten attributes of NUREG-1801 Masonry Wall Program (XI.S5).

8. Based on industry standards and guidelines, grout is susceptible to cracking due to shrinkage in this environment. Even though shrinkage cracking occurs early in plant life and is not expected to be significant for the extended period of operation, the aging effect will be monitored and managed with the Fire Protection and Structures Monitoring Programs.

9. The aging effects and Aging Management program identified for this material/environment combination are consistent with industry guidance.

10. The aging mechanisms of aggressive chemical attack and reaction with aggregate for this component, material and environment combination are not applicable.

11. The Fire Protection aging management program will be used to manage the identified aging effects for this component, material and environment combination.

12. The Fire Water System aging management program will be used in addition to the External Surfaces Monitoring aging management program.

13. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

14. NUREG-1801 specifies a plant-specific program. The Fire Water System aging management program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

15. The Fire Protection aging management program will be used in addition to the External Surfaces Monitoring aging management program.

16. The Buried Non-Steel Piping Inspection aging management program will be used to manage the identified aging effects for this component, material and environment combination.

17. The Fire Water System aging management program will be used to manage the identified aging effects for this component, material and environment combination.

18. The polymer (plexiglass) material located indoors and subject to an indoor air or air-gas (wetted) environment is not subject to significant aging effects. Polymer materials do not experience aging effects unless exposed to temperatures, radiation or chemicals capable of attacking the specific polymer chemical composition. Polymer materials are selected for compatibility with the environment during the design, and if properly selected will not experience significant degradation. Polymer (teflon) material in this non-aggressive air environment is not expected to experience significant aging effects. This is consistent with plant operating experience.

Table 3.3.2-11
Fire Pump House Ventilation System
Summary of Aging Management Evaluation

Table 3.3.2-11 Fire Pump House Ventilation System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fan Housing	Pressure Boundary	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	C
Fan Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Louver	Pressure Boundary	Aluminum	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-7	3.5.1-50	C
Louver	Pressure Boundary	Aluminum	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-14	3.3.1-27	E, 1

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. NUREG-1801 specifies a plant-specific program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.3.2-12
Fresh Water Supply System
Summary of Aging Management Evaluation

Table 3.3.2-12 Fresh Water Supply System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1-5	3.3.1-77	E, 1
Piping and Fittings	Leakage Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Piping and Fittings	Leakage Boundary	Copper Alloy with less than 15% Zinc	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Periodic Inspection	VII.C1-9	3.3.1-81	E, 2
Piping and Fittings	Leakage Boundary	Ductile Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Ductile Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.C1-5	3.3.1-77	E, 1
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A

Table 3.3.2-12 Fresh Water Supply System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Leakage Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Periodic Inspection	VIII.E-3	3.4.1-33	E, 2
Valve Body	Leakage Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Valve Body	Leakage Boundary	Copper Alloy with less than 15% Zinc	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Periodic Inspection	VII.C1-9	3.3.1-81	E, 2
Valve Body	Leakage Boundary	Gray Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 1
Valve Body	Leakage Boundary	Gray Cast Iron	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials	VII.C1-11	3.3.1-85	A

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

2. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination

Table 3.3.2-13
Fuel Handling and Storage System
Summary of Aging Management Evaluation

Table 3.3.2-13 Fuel Handling and Storage System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.I-4	3.3.1-43	E, 1
Bolting	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Self-Loosening	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.I-5	3.3.1-45	E, 1, 2
Bolting	Structural Support	Stainless Steel Bolting	Air - Indoor (External)	Loss of Preload/Self-Loosening	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	IV.C2-8	3.1.1-52	E, 1, 2
Crane/hoist (Fuel Preparation Machine and New Fuel Inspection Stand)	Structural Support	Aluminum	Air - Indoor (External)	None	None	V.F-2	3.2.1-50	C
Crane/hoist (Fuel Preparation Machine and New Fuel Inspection Stand)	Structural Support	Aluminum	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-5	3.3.1-24	C
Crane/hoist (Fuel Preparation Machine and New Fuel Inspection Stand)	Structural Support	Aluminum	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-5	3.3.1-24	D

Table 3.3.2-13 Fuel Handling and Storage System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Crane/hoist (Fuel Preparation Machine and New Fuel Inspection Stand)	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Crane/hoist (Fuel Preparation Machine and New Fuel Inspection Stand)	Structural Support	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	C
Crane/hoist (Fuel Preparation Machine and New Fuel Inspection Stand)	Structural Support	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	D
Crane/hoist (Grapple/Mast for all bridges)	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.B-3	3.3.1-73	C
Crane/hoist (Grapple/Mast for all bridges)	Structural Support	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	C
Crane/hoist (Grapple/Mast for all bridges)	Structural Support	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	D
Crane/hoist (Grapple/Mast for all bridges)	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Crane/hoist (Grapple/Mast for all bridges)	Structural Support	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	C
Crane/hoist (Grapple/Mast for all bridges)	Structural Support	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	D

Table 3.3.2-13 Fuel Handling and Storage System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Crane/hoist (Rail System)	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.B-3	3.3.1-73	C
Crane/hoist (Rail System)	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/Wear	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.B-1	3.3.1-74	A
Crane/hoist (Refueling Platform and Jib Crane Columns / Beams / Plates / Anchorage)	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	VII.B-3	3.3.1-73	C
Fuel Storage Racks (irradiated fuel)	Absorb Neutrons	Boral	Treated Water (External)	Reduction of Neutron-Absorbing Capacity and Loss of Material/General Corrosion	Boral Monitoring	VII.A2-3	3.3.1-13	E, 3
Fuel Storage Racks (irradiated fuel)	Absorb Neutrons	Boral	Treated Water (External)	Reduction of Neutron-Absorbing Capacity and Loss of Material/General Corrosion	Water Chemistry	VII.A2-3	3.3.1-13	E, 4
Fuel Storage Racks (irradiated fuel)	Structural Support	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	III.A5-13	3.5.1-46	D
Fuel Storage Racks (new fuel racks)	Structural Support	Aluminum	Air - Indoor (External)	None	None	V.F-2	3.2.1-50	C

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

2. The aging mechanism(s) of Thermal Effects and Gasket Creep for this component, material and environment combination are not applicable.

3. NUREG-1801 specifies a plant-specific program. The Boral Monitoring Program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

4. NUREG-1801 specifies a plant-specific program. The Water Chemistry Program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.3.2-14
Fuel Pool Cooling and Cleanup System
Summary of Aging Management Evaluation

Table 3.3.2-14 Fuel Pool Cooling and Cleanup System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Bolting	Mechanical Closure	Stainless Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C2-8	3.1.1-52	B
Diffuser	Direct Flow	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Diffuser	Direct Flow	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Diffuser	Direct Flow	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Diffuser	Direct Flow	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Flow Element	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Flow Element	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Flow Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B

Table 3.3.2-14 Fuel Pool Cooling and Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Fuel Pool Cooling and Cleanup)	Evaluated with the Closed Cycle Cooling Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-21	3.3.1-71	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Concrete (Embedded)	None	None	VII.J-21	3.3.1-96	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D

Table 3.3.2-14 Fuel Pool Cooling and Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Concrete (Embedded)	None	None	VII.J-17	3.3.1-96	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Pump Casing (Fuel Pool Cooling Pump)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Pump Casing (Fuel Pool Cooling Pump)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Pump Casing (Fuel Pool Cooling Pump)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Restricting Orifices	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Restricting Orifices	Throttle	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Spray Nozzles (Fuel Storage Pool)	Spray	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A

Table 3.3.2-14 Fuel Pool Cooling and Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Spray Nozzles (Fuel Storage Pool)	Spray	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Spray Nozzles (Fuel Storage Pool)	Spray	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Spray Nozzles (Fuel Storage Pool)	Spray	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Thermowell	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Thermowell	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-21	3.3.1-71	A
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A

Table 3.3.2-14 Fuel Pool Cooling and Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Weir	Direct Flow	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Weir	Direct Flow	Stainless Steel	Concrete (Embedded)	None	None	VII.J-17	3.3.1-96	C
Weir	Direct Flow	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Weir	Direct Flow	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

None.

Table 3.3.2-15
Hardened Torus Vent System
Summary of Aging Management Evaluation

Table 3.3.2-15 Hardened Torus Vent System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Piping and Fittings	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Structural Support	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.3.2-16
Hydrogen Water Chemistry System
Summary of Aging Management Evaluation

Table 3.3.2-16 Hydrogen Water Chemistry System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Flow Element	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Flow Element	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Heat Exchanger Components (Sample Cooler 433)	Leakage Boundary	Stainless Steel (Shell)	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Heat Exchanger Components (Sample Cooler 433)	Leakage Boundary	Stainless Steel (Shell)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-2	3.3.1-23	A
Heat Exchanger Components (Sample Cooler 433)	Leakage Boundary	Stainless Steel (Shell)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-2	3.3.1-23	B
Heat Exchanger Components (Sample Cooler 433)	Leakage Boundary	Stainless Steel (Tubes)	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-2	3.3.1-23	A

Table 3.3.2-16 Hydrogen Water Chemistry System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Sample Cooler 433)	Leakage Boundary	Stainless Steel (Tubes)	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-2	3.3.1-23	B
Heat Exchanger Components (Sample Cooler 433)	Leakage Boundary	Stainless Steel (Tubes)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-2	3.3.1-23	A
Heat Exchanger Components (Sample Cooler 433)	Leakage Boundary	Stainless Steel (Tubes)	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-2	3.3.1-23	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Tanks (CAV)	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Tanks (CAV)	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	C
Tanks (CAV)	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	D
Tanks (ECP)	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Tanks (ECP)	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	C
Tanks (ECP)	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	D
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

None.

Table 3.3.2-17
Leak Detection and Radiation Monitoring System
Summary of Aging Management Evaluation

Table 3.3.2-17 Leak Detection and Radiation Monitoring System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Flow Element	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Leakage Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-21	3.3.1-71	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Piping and Fittings	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Structural Support	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.3.2-17 Leak Detection and Radiation Monitoring System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Leakage Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-21	3.3.1-71	A
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.3.2-18
Makeup Demineralizer System
Summary of Aging Management Evaluation

Table 3.3.2-18 Makeup Demineralizer System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Air/Gas Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 1
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Air/Gas Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 1
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. NUREG-1801 specifies a plant-specific program. The Periodic Inspection program is used to manage the aging effects applicable to this components, material and environment combination. The component is located within HVAC ducting, and the external surfaces are subject to the HVAC environment of Air/Gas - Wetted during normal operation.

Table 3.3.2-19
Primary Containment Instrument Gas System
Summary of Aging Management Evaluation

Table 3.3.2-19 Primary Containment Instrument Gas System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Accumulator	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Accumulator	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Compressor	Structural Support	Ductile Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Compressor	Structural Support	Ductile Cast Iron	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F3-3	3.3.1-72	A
Drain Traps	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Drain Traps	Structural Support	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Compressed Air Monitoring	VII.D-2	3.3.1-53	A
Filter Housing (Inlet, Outlet, Prefilter, Intake Screen)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Filter Housing (Inlet, Outlet, Prefilter, Intake Screen)	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Compressed Air Monitoring	VII.D-4	3.3.1-54	A

Table 3.3.2-19 Primary Containment Instrument Gas System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Filter Housing (Inlet, Outlet, Prefilter, Intake Screen)	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Filter Housing (Inlet, Outlet, Prefilter, Intake Screen)	Structural Support	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Compressed Air Monitoring	VII.D-4	3.3.1-54	A
Flow Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Compressed Air Monitoring	VII.D-4	3.3.1-54	A
Heat Exchanger Components (PCIG Compressor Inter & After coolers)	Evaluated with the Closed Cycle Cooling Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Heat Exchanger Components (Thermo-Siphon)	Evaluated with the Closed Cycle Cooling Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Hoses	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Hoses	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-22	3.3.1-98	E, 1
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Compressed Air Monitoring	VII.D-2	3.3.1-53	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Compressed Air Monitoring	VII.D-4	3.3.1-54	A

Table 3.3.2-19 Primary Containment Instrument Gas System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Structural Support	Carbon Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-22	3.3.1-98	E, 1
Piping and Fittings	Structural Support	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Compressed Air Monitoring	VII.D-2	3.3.1-53	A
Piping and Fittings	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Structural Support	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1
Piping and Fittings	Structural Support	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Compressed Air Monitoring	VII.D-4	3.3.1-54	A
Tanks (Gas Dryer)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (Gas Dryer)	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Compressed Air Monitoring	VII.D-2	3.3.1-53	C
Tanks (Moisture Separator)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (Moisture Separator)	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Compressed Air Monitoring	VII.D-2	3.3.1-53	C
Tanks (Receiver)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (Receiver)	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-22	3.3.1-98	E, 1
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-22	3.3.1-98	E, 1
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Compressed Air Monitoring	VII.D-2	3.3.1-53	A

Table 3.3.2-19 Primary Containment Instrument Gas System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Compressed Air Monitoring	VII.D-4	3.3.1-54	A
Valve Body	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Structural Support	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The internal environment for this component is Air/Gas-Dry. The Compressed Air Monitoring program is applied to these Primary Containment Instrument Gas System Components to confirm the internal environment remains sufficiently dry to preclude aging effects.

Table 3.3.2-20
Primary Containment Leakage Rate Testing System
Summary of Aging Management Evaluation

Table 3.3.2-20 Primary Containment Leakage Rate Testing System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas - Dry (Internal)	None	None	VII.J-4	3.3.1-97	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Piping and Fittings	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Structural Support	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A

Table 3.3.2-20 Primary Containment Leakage Rate Testing System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Structural Support	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	A
Piping and Fittings	Structural Support	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas - Dry (Internal)	None	None	VII.J-4	3.3.1-97	A
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-19	3.3.1-97	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.3.2-21
Process and Post-Accident Sampling Systems
Summary of Aging Management Evaluation

Table 3.3.2-21 Process and Post-Accident Sampling Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B

Table 3.3.2-21 Process and Post-Accident Sampling Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Restricting Orifices	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Restricting Orifices	Throttle	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Restricting Orifices	Throttle	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B

Table 3.3.2-21 Process and Post-Accident Sampling Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination

Table 3.3.2-22
Radwaste System
Summary of Aging Management Evaluation

Table 3.3.2-22 Radwaste System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 2
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Periodic Inspection	V.C-3	3.2.1-38	E, 1
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 2
Pump Casing	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A

Table 3.3.2-22 Radwaste System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump Casing	Leakage Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Periodic Inspection	V.C-3	3.2.1-38	E, 1
Tanks	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Tanks	Leakage Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Periodic Inspection	V.C-3	3.2.1-38	E, 1
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 2
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Periodic Inspection	V.C-3	3.2.1-38	E, 1
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-24	3.3.1-68	E, 2
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A

Table 3.3.2-22 Radwaste System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Periodic Inspection	V.C-3	3.2.1-38	E, 1

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

2. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.3.2-23

Reactor Building Ventilation System

Summary of Aging Management Evaluation

Table 3.3.2-23 Reactor Building Ventilation System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Accumulator	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Accumulator	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-4	3.3.1-55	A
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	C
Damper Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-2	3.3.1-56	A
Damper Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Damper Housing	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	C
Damper Housing	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Door Seal	Pressure Boundary	Elastomer	Air - Indoor (External)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F1-7	3.3.1-11	E, 2

Table 3.3.2-23 Reactor Building Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Door Seal	Pressure Boundary	Elastomer	Air/Gas - Wetted (Internal)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F1-7	3.3.1-11	E, 2
Ducting and Components	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	C
Ducting and Components	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Electric Heaters (Housing)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Electric Heaters (Housing)	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Fan Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-2	3.3.1-56	A
Fan Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Flow Device	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Flow Device	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Heat Exchanger Components (RBVS Supply System)	Evaluated with the Chilled Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Heat Exchanger Components (Room Unit Coolers)	Evaluated with the Closed Cycle Cooling Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			

Table 3.3.2-23 Reactor Building Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (SACs Room Unit Coolers)	Evaluated with the Control Area Chilled Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Louver	Pressure Boundary	Aluminum	Air - Indoor (External)	None	None	V.F-2	3.2.1-50	C
Louver	Pressure Boundary	Aluminum	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-14	3.3.1-27	E, 2
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Piping and Fittings	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Structural Support	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Piping and Fittings	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Structural Support	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1

Table 3.3.2-23 Reactor Building Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Sensor Element (Temperature)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Sensor Element (Temperature)	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Sensor Element (radiation detector)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Sensor Element (radiation detector)	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Sensor Element (radiation detector)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Sensor Element (radiation detector)	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Thermowell	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.G-23	3.3.1-71	A
Valve Body	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Valve Body	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-3	3.3.1-98	E, 1
Valve Body	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 2
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	Compressed Air Monitoring	VII.J-18	3.3.1-98	E, 1

Table 3.3.2-23 Reactor Building Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The environment of dry gas used for the compressed air supply to the accumulator, valves, piping and fittings. The Compressed Air Monitoring Program is applied to confirm the internal environment remains sufficiently dry to preclude aging effects.

2. NUREG-1801 specifies a plant-specfic program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.3.2-24
Reactor Water Cleanup System
Summary of Aging Management Evaluation

Table 3.3.2-24 Reactor Water Cleanup System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-11	3.1.1-4	A, 1
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 2

Table 3.3.2-24 Reactor Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	IV.C1-7	3.1.1-45	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A

Table 3.3.2-24 Reactor Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Filter Housing	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Filter Housing	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Filter Housing	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Flow Element	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Flow Element	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Flow Element	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Flow Element	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B

Table 3.3.2-24 Reactor Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flow Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Flow Element	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Flow Element (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Flow Element (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	BWR Stress Corrosion Cracking	VII.E4-15	3.3.1-38	A
Flow Element (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VII.E4-15	3.3.1-38	B
Flow Element (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Flow Element (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Heat Exchanger Components (Non-Regen)	Leakage Boundary	Carbon Steel (Tube Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (Non-Regen)	Leakage Boundary	Carbon Steel (Tube Side Components)	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	C
Heat Exchanger Components (Non-Regen)	Leakage Boundary	Carbon Steel (Tube Side Components)	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	D
Heat Exchanger Components (Non-Regen)	Leakage Boundary	Carbon Steel (Tube Side Components)	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.D2-8	3.4.1-29	D

Table 3.3.2-24 Reactor Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Non-Regen)	Shell Side components evaluated with the Closed Cycle Cooling Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Heat Exchanger Components (Pump HX)	Leakage Boundary	Stainless Steel (Tube Side Components)	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Heat Exchanger Components (Pump HX)	Leakage Boundary	Stainless Steel (Tube Side Components)	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VII.E3-3	3.3.1-5	E, 3
Heat Exchanger Components (Pump HX)	Leakage Boundary	Stainless Steel (Tube Side Components)	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VII.E3-3	3.3.1-5	E, 3
Heat Exchanger Components (Pump HX)	Leakage Boundary	Stainless Steel (Tube Side Components)	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-2	3.3.1-23	A
Heat Exchanger Components (Pump HX)	Leakage Boundary	Stainless Steel (Tube Side Components)	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-2	3.3.1-23	B
Heat Exchanger Components (Regen)	Leakage Boundary	Carbon Steel (Shell Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (Regen)	Leakage Boundary	Carbon Steel (Shell Side Components)	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	C
Heat Exchanger Components (Regen)	Leakage Boundary	Carbon Steel (Shell Side Components)	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	D
Heat Exchanger Components (Regen)	Leakage Boundary	Carbon Steel (Shell Side Components)	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.D2-8	3.4.1-29	D

Table 3.3.2-24 Reactor Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Regen)	Leakage Boundary	Carbon Steel (Tube Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (Regen)	Leakage Boundary	Carbon Steel (Tube Side Components)	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	C
Heat Exchanger Components (Regen)	Leakage Boundary	Carbon Steel (Tube Side Components)	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	D
Heat Exchanger Components (Regen)	Leakage Boundary	Carbon Steel (Tube Side Components)	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.D2-8	3.4.1-29	D
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.D2-8	3.4.1-29	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A

Table 3.3.2-24 Reactor Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	VIII.D2-6	3.4.1-1	A, 1
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.D2-8	3.4.1-29	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cumulative Fatigue Damage/Fatigue	TLAA	VII.E3-14	3.3.1-2	A, 1
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1

Table 3.3.2-24 Reactor Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	IV.C1-7	3.1.1-45	B
Pump Casing (Holding)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Pump Casing (Holding)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Pump Casing (Holding)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Pump Casing (Precoat)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Pump Casing (Precoat)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Pump Casing (Precoat)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Pump Casing (Recirculation)	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Pump Casing (Recirculation)	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Pump Casing (Recirculation)	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B

Table 3.3.2-24 Reactor Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump Casing (Recirculation)	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Pump Casing (Recirculation)	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Restricting Orifices	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Restricting Orifices	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Restricting Orifices	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Restricting Orifices	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Restricting Orifices	Throttle	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Restricting Orifices	Throttle	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 4
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 4
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A

Table 3.3.2-24 Reactor Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 4
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 4
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Sensor Element	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Sensor Element	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Sensor Element	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Sensor Element	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Sensor Element	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Sight Glasses	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Sight Glasses	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Sight Glasses	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Sight Glasses	Leakage Boundary	Glass	Air - Indoor (External)	None	None	VII.J-7	3.3.1-93	A
Sight Glasses	Leakage Boundary	Glass	Treated Water (Internal)	None	None	VII.J-13	3.3.1-93	A
Strainer Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.3.2-24 Reactor Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Strainer Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Tanks (Autoclave)	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Tanks (Autoclave)	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	C
Tanks (Autoclave)	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	D
Tanks (Demineralizer)	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Tanks (Demineralizer)	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	C
Tanks (Demineralizer)	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	D
Tanks (Precoat)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (Precoat)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	C
Tanks (Precoat)	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	D
Thermowell	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Thermowell	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Thermowell	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Thermowell	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A

Table 3.3.2-24 Reactor Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Thermowell (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Thermowell (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Thermowell (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.D2-8	3.4.1-29	B
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.E-31	3.4.1-14	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.E-31	3.4.1-14	B
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A

Table 3.3.2-24 Reactor Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.D2-8	3.4.1-29	B
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	IV.C1-7	3.1.1-45	B
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The TLAA designation in the Aging Management Program column indicates fatigue of this component is evaluated in Section 4.3.

2. The NUREG-1801 "One-Time Inspection of ASME Code Class 1 Small-Bore Piping" aging management program is applicable only to plants that have not experienced cracking of ASME Code Class 1 small-bore piping. Based on previous Hope Creek operating experience with Class 1 small-bore pipe cracking, a new plant-specific periodic inspection program will be used. The "Small-Bore Class 1 Piping Inspection" aging management program is a plant-specific periodic program that will be implemented to manage cracking by periodic volumetric examinations of small-bore Class 1 piping.

3. NUREG-1801 specifies a plant-specific program. The Water Chemistry program is used to manage the aging effect(s) applicable to this component type, material, and environment combination. The One-Time Inspection program is used to confirm the effectiveness of the Water Chemistry program to manage the identified aging effects.

4. The Water Chemistry and ASME Section XI In-service Inspection, Subsections IWB, IWC, and IWD aging management programs will be used to manage the aging effect of cracking in restricting orifices < NPS 4".

Table 3.3.2-25
Remote Shutdown Panel Room HVAC System
Summary of Aging Management Evaluation

Table 3.3.2-25 Remote Shutdown Panel Room HVAC System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-4	3.3.1-55	A
Damper Housing	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	C
Damper Housing	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Door Seal	Pressure Boundary	Elastomer	Air - Indoor (External)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F1-7	3.3.1-11	E, 1
Door Seal	Pressure Boundary	Elastomer	Air/Gas - Wetted (Internal)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F1-7	3.3.1-11	E, 1
Ducting and Components	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	C
Ducting and Components	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Electric Heaters (Housing)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Electric Heaters (Housing)	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 1
Fan Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-2	3.3.1-56	A

Table 3.3.2-25 Remote Shutdown Panel Room HVAC System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fan Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Filter Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-2	3.3.1-56	A
Filter Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Flexible Connection	Pressure Boundary	Elastomer	Air - Indoor (External)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F2-7	3.3.1-11	E, 2
Flexible Connection	Pressure Boundary	Elastomer	Air/Gas - Wetted (Internal)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F2-7	3.3.1-11	E, 2
Heat Exchanger Components	Evaluated with the Control Area Chilled Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Louver	Pressure Boundary	Aluminum	Air - Indoor (External)	None	None	V.F-2	3.2.1-50	C
Louver	Pressure Boundary	Aluminum	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 3
Louver	Pressure Boundary	Aluminum	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-14	3.3.1-27	E, 1
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (External)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	C
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-21	3.3.1-71	A

Table 3.3.2-25 Remote Shutdown Panel Room HVAC System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 1
Sensor Element	Pressure Boundary	Aluminum	Air - Indoor (External)	None	None	V.F-2	3.2.1-50	A
Sensor Element	Pressure Boundary	Aluminum	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-14	3.3.1-27	E, 1
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Valve Body	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-16	3.3.1-25	E, 1

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. NUREG-1801 specifies a plant-specfic program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

2. NUREG-1801 specifies a plant-specfic program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination. Inspections of the flexible connections require physical manipulation; therefore, internal and external inspections, which include physical manipulation of elastomers, will be performed at the same time under the Periodic Inspection program.

3. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.3.2-26
Service Water Intake Ventilation System
Summary of Aging Management Evaluation

Table 3.3.2-26 Service Water Intake Ventilation System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bird Screen	Filter	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	C
Bird Screen	Filter	Galvanized Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	C
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-4	3.3.1-55	A
Bolting	Mechanical Closure	Galvanized Steel Bolting	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-4	3.3.1-55	A
Damper Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-2	3.3.1-56	A
Damper Housing	Pressure Boundary	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	C
Damper Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Damper Housing	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	C
Damper Housing	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Ducting and Components	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	C

Table 3.3.2-26 Service Water Intake Ventilation System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Ducting and Components	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Fan Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F1-2	3.3.1-56	A
Fan Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F1-3	3.3.1-72	A
Flexible Connection	Pressure Boundary	Elastomer	Air - Indoor (External)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F1-7	3.3.1-11	E, 1
Flexible Connection	Pressure Boundary	Elastomer	Air/Gas - Wetted (Internal)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F1-7	3.3.1-11	E, 1
Louver	Pressure Boundary	Aluminum	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 2
Louver	Pressure Boundary	Aluminum	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-14	3.3.1-27	E, 3
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 3
Sensor Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Sensor Element	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 3
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 3

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. NUREG-1801 specifies a plant-specfic program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination. Inspections of the flexible connections require physical manipulation; therefore, internal and external inspections, which include physical manipulation of elastomers, will be performed at the same time under the Periodic Inspection program.

2. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

3. NUREG-1801 specifies a plant-specific program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.3.2-27

Service Water System

Summary of Aging Management Evaluation

Table 3.3.2-27 Service Water System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Aluminum Bronze Bolting with 8% Al or more	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity			F
Bolting	Mechanical Closure	Aluminum Bronze Bolting with 8% Al or more	Air - Outdoor (External)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Bolting Integrity			F
Bolting	Mechanical Closure	Aluminum Bronze Bolting with 8% Al or more	Air - Outdoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity			F
Bolting	Mechanical Closure	Aluminum Bronze Bolting with 8% Al or more	Raw Water (External)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Bolting Integrity			F, 1
Bolting	Mechanical Closure	Aluminum Bronze Bolting with 8% Al or more	Raw Water (External)	Loss of Material/Selective Leaching	Selective Leaching of Materials			F, 8
Bolting	Mechanical Closure	Aluminum Bronze Bolting with 8% Al or more	Raw Water (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity			F, 1
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-1	3.3.1-43	B

Table 3.3.2-27 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Outdoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Soil (External)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Bolting Integrity			G, 2
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Soil (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity			G, 2
Bolting	Mechanical Closure	Nickel Alloy Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity			G
Bolting	Mechanical Closure	Stainless Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C2-8	3.1.1-52	B
Diffuser	Direct Flow	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A
Diffuser	Direct Flow	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VII.C1-19	3.3.1-76	A, 3
Heat Exchanger Components (RACS)	Leakage Boundary	Carbon Steel (Tube Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (RACS)	Leakage Boundary	Carbon or Low Alloy Steel with Nickel Alloy Cladding (Tube Side Components)	Raw Water (Internal)	Loss of Material/Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System			H, 4
Heat Exchanger Components (RACS)	Leakage Boundary	Nickel Alloy (Tube Side Components)	Air - Indoor (External)	None	None	VII.J-14	3.3.1-94	C

Table 3.3.2-27 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (RACS)	Leakage Boundary	Nickel Alloy (Tube Side Components)	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System			H, 5
Heat Exchanger Components (SACS)	Heat Transfer	Titanium Alloy (Tubes)	Closed Cycle Cooling Water (External)	Reduction of Heat Transfer/Fouling	Closed-Cycle Cooling Water System			F
Heat Exchanger Components (SACS)	Heat Transfer	Titanium Alloy (Tubes)	Raw Water (Internal)	Reduction of Heat Transfer/Fouling	Open-Cycle Cooling Water System			F
Heat Exchanger Components (SACS)	Pressure Boundary	Carbon Steel (Shell Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (SACS)	Pressure Boundary	Carbon Steel (Shell Side Components)	Closed Cycle Cooling Water (External)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (SACS)	Pressure Boundary	Carbon Steel (Tube Sheet)	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting, Crevice and Galvanic Corrosion	Closed-Cycle Cooling Water System	VII.C2-1	3.3.1-48	B
Heat Exchanger Components (SACS)	Pressure Boundary	Carbon Steel (Tube Side Components)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Heat Exchanger Components (SACS)	Pressure Boundary	Carbon or Low Alloy Steel with Nickel Alloy Cladding (Tube Sheet)	Raw Water (Internal)	Loss of Material/Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System			H, 4
Heat Exchanger Components (SACS)	Pressure Boundary	Carbon or Low Alloy Steel with Nickel Alloy Cladding (Tube Side Components)	Raw Water (Internal)	Loss of Material/Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System			H, 4

Table 3.3.2-27 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (SACS)	Pressure Boundary	Nickel Alloy (Tube Side Components)	Air - Indoor (External)	None	None	VII.J-14	3.3.1-94	C
Heat Exchanger Components (SACS)	Pressure Boundary	Nickel Alloy (Tube Side Components)	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System			H, 5
Heat Exchanger Components (SACS)	Pressure Boundary	Titanium Alloy (Tubes)	Closed Cycle Cooling Water (External)	None	None			F, 10
Heat Exchanger Components (SACS)	Pressure Boundary	Titanium Alloy (Tubes)	Raw Water (Internal)	Loss of Material/Fouling	Open-Cycle Cooling Water System			F
Piping and Fittings	Leakage Boundary	Carbon Steel (Concrete lined)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Carbon Steel (Concrete lined)	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VII.C1-19	3.3.1-76	A, 3
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VIII.E-3	3.4.1-33	C
Piping and Fittings	Pressure Boundary	Carbon Steel (Epoxy lined)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel (Epoxy lined)	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A
Piping and Fittings	Pressure Boundary	Carbon Steel (Epoxy lined)	Concrete (Embedded)	None	None	VII.J-21	3.3.1-96	A

Table 3.3.2-27 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel (Epoxy lined)	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VII.C1-19	3.3.1-76	A, 3
Piping and Fittings	Pressure Boundary	Carbon Steel (Epoxy lined)	Soil (External)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Buried Piping Inspection	VII.C1-18	3.3.1-19	A
Piping and Fittings	Pressure Boundary	Carbon Steel (Concrete lined)	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel (Concrete lined)	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VII.C1-19	3.3.1-76	A, 3
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Air - Indoor (External)	None	None	V.F-3	3.2.1-53	A
Piping and Fittings	Pressure Boundary	Copper Alloy with less than 15% Zinc	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VII.C1-9	3.3.1-81	A
Piping and Fittings	Pressure Boundary	Elastomer	Raw Water (Internal)	Hardening and Loss of Strength/Elastomer Degradation	Open-Cycle Cooling Water System	VII.C1-1	3.3.1-75	A, 6
Piping and Fittings	Pressure Boundary	Reinforced Concrete	Groundwater/Soil (External)	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Buried Non-Steel Piping Inspection	III.A3-4	3.5.1-31	E, 7

Table 3.3.2-27 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Reinforced Concrete	Groundwater/Soil (External)	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Buried Non-Steel Piping Inspection	III.A6-3	3.5.1-34	E, 7
Piping and Fittings	Pressure Boundary	Reinforced Concrete	Raw Water (Internal)	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Open-Cycle Cooling Water System			J, 7
Piping and Fittings	Pressure Boundary	Reinforced Concrete	Raw Water (Internal)	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Open-Cycle Cooling Water System			J, 7
Piping and Fittings	Pressure Boundary	Reinforced Concrete	Raw Water (Internal)	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Open-Cycle Cooling Water System	III.A6-6	3.5.1-37	E, 7
Piping and Fittings	Pressure Boundary	Reinforced Concrete	Raw Water (Internal)	Loss of Material/ Abrasion; Cavitation	Open-Cycle Cooling Water System	III.A6-7	3.5.1-45	E, 7
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VIII.E-3	3.4.1-33	C
Pump Casing (SW Dewatering)	Leakage Boundary	Ductile Cast Iron	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Pump Casing (SW Dewatering)	Leakage Boundary	Ductile Cast Iron	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VII.C1-19	3.3.1-76	A, 3

Table 3.3.2-27 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump Casing (SW main pump)	Pressure Boundary	Aluminum Bronze with 8% Al or more	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Pump Casing (SW main pump)	Pressure Boundary	Aluminum Bronze with 8% Al or more	Air - Outdoor (External)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Open-Cycle Cooling Water System			G
Pump Casing (SW main pump)	Pressure Boundary	Aluminum Bronze with 8% Al or more	Raw Water (External)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VII.C1-9	3.3.1-81	A
Pump Casing (SW main pump)	Pressure Boundary	Aluminum Bronze with 8% Al or more	Raw Water (External)	Loss of Material/Selective Leaching	Selective Leaching of Materials			H, 8
Pump Casing (SW main pump)	Pressure Boundary	Aluminum Bronze with 8% Al or more	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VII.C1-9	3.3.1-81	A
Pump Casing (SW main pump)	Pressure Boundary	Aluminum Bronze with 8% Al or more	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials			H, 8
Pump Casing (SW main pump)	Pressure Boundary	Stainless Steel	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Open-Cycle Cooling Water System	III.B2-7	3.5.1-50	E, 9
Pump Casing (SW main pump)	Pressure Boundary	Stainless Steel	Raw Water (External)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VIII.E-3	3.4.1-33	C
Pump Casing (SW main pump)	Pressure Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VIII.E-3	3.4.1-33	C

Table 3.3.2-27 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump Casing (Spray Water Booster)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Pump Casing (Spray Water Booster)	Pressure Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VIII.E-3	3.4.1-33	C
Rupture Disks	Pressure Boundary	Stainless Steel	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Open-Cycle Cooling Water System	III.B2-7	3.5.1-50	E, 9
Rupture Disks	Pressure Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VIII.E-3	3.4.1-33	C
Spray Nozzles	Spray	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Spray Nozzles	Spray	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VIII.E-3	3.4.1-33	C
Strainer Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Strainer Body	Pressure Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VII.C1-19	3.3.1-76	A, 3
Strainer Body	Pressure Boundary	Carbon or Low Alloy Steel with Nickel Alloy Cladding	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.3.2-27 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer Body	Pressure Boundary	Carbon or Low Alloy Steel with Nickel Alloy Cladding	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System			H, 5
Tanks (Drain)	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Tanks (Drain)	Leakage Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VIII.E-3	3.4.1-33	C
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Thermowell	Pressure Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VIII.E-3	3.4.1-33	C
Traveling Water Screen Support Structure	Evaluated with the Service Water Intake Structures	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Valve Body	Leakage Boundary	Aluminum Bronze with 8% Al or more	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Valve Body	Leakage Boundary	Aluminum Bronze with 8% Al or more	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VII.C1-9	3.3.1-81	A
Valve Body	Leakage Boundary	Aluminum Bronze with 8% Al or more	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials			H, 8
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.3.2-27 Service Water System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Leakage Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VII.C1-19	3.3.1-76	A, 3
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VIII.E-3	3.4.1-33	C
Valve Body	Pressure Boundary	Aluminum Bronze with 8% Al or more	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Valve Body	Pressure Boundary	Aluminum Bronze with 8% Al or more	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VII.C1-9	3.3.1-81	A
Valve Body	Pressure Boundary	Aluminum Bronze with 8% Al or more	Raw Water (Internal)	Loss of Material/Selective Leaching	Selective Leaching of Materials			H, 8
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Raw Water (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VII.C1-19	3.3.1-76	A, 3
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Raw Water (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Open-Cycle Cooling Water System	VIII.E-3	3.4.1-33	C

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The aging effects for closure bolting in a raw water environment include loss of material and loss of preload. Inspection activities for bolting in a submerged environment are performed in conjunction with associated component maintenance activities.

2. The aging effects for closure bolting in a soil environment include loss of material and loss of preload. External inspections of buried bolting will occur in accordance with the frequency outlined in the Buried Piping Inspection program.

3. The aging mechanism of lining/coating degradation is not applicable for this component type, material, and environment. If a lining/coating exists it is not being credited.

4. The aging effects/mechanisms for carbon steel with nickel alloy clad in a raw water environment include Loss of Material/Pitting, Crevice, Galvanic, and Microbiologically Influenced Corrosion, and Fouling.

5. The aging effects/mechanisms for nickel alloy in a raw water environment include Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling.

6. Configuration of the pipe joint is such that the outside o-ring is enclosed in a metal channel, therefore there is no external environment.

7. The Open-Cycle Cooling Water System aging management program activities are adequate for managing the aging effects of the internal surfaces of reinforced concrete service water piping. The Buried Non-Steel Piping Inspection aging management program activities are adequate for managing the aging effects of the external surfaces of reinforced concrete service water piping.

8. The aging effects/mechanisms for Aluminum Bronze with 8% Al or more in a raw water environment also includes Loss of Material/Selective Leaching.

9. The Open-Cycle Cooling Water System program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

10.Titanium material located in water environments is not subject to aging effects. Titanium metal is corrosion resistant due to a protective oxide film. Titanium resists all forms of corrosive attack in water enviroments up to 500 degrees Fahrenheit. This is consistent with plant operating experience.

Table 3.3.2-28
Standby Diesel Generator Area Ventilation Systems
Summary of Aging Management Evaluation

Table 3.3.2-28 Standby Diesel Generator Area Ventilation Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F4-3	3.3.1-55	A
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	C
Bolting	Mechanical Closure	Stainless Steel Bolting	Air - Indoor (External)	None	None	III.B2-8	3.5.1-59	A
Bolting	Mechanical Closure	Stainless Steel Bolting	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 1
Damper Housing	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	C
Damper Housing	Pressure Boundary	Galvanized Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	C
Damper Housing	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F4-2	3.3.1-72	A
Door Seal	Pressure Boundary	Elastomer	Air - Indoor (External)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F4-6	3.3.1-11	E, 2
Door Seal	Pressure Boundary	Elastomer	Air/Gas - Wetted (Internal)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F4-6	3.3.1-11	E, 2
Ducting and Components	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	C

Table 3.3.2-28 Standby Diesel Generator Area Ventilation Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Ducting and Components	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F4-2	3.3.1-72	A
Ducting and Components	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Ducting and Components	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Electric Heaters (Housing)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Electric Heaters (Housing)	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Fan Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F4-1	3.3.1-56	A
Fan Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F4-2	3.3.1-72	A
Filter Housing	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.F4-1	3.3.1-56	A
Filter Housing	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F4-2	3.3.1-72	A
Flexible Connection	Pressure Boundary	Elastomer	Air - Indoor (External)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F4-6	3.3.1-11	E, 3
Flexible Connection	Pressure Boundary	Elastomer	Air/Gas - Wetted (Internal)	Hardening and Loss of Strength/Elastomer Degradation	Periodic Inspection	VII.F4-6	3.3.1-11	E, 3
Flow Device	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Device	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2, 4

Table 3.3.2-28 Standby Diesel Generator Area Ventilation Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flow Device	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Flow Element	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	A
Flow Element	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F4-2	3.3.1-72	A
Flow Element	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2, 4
Flow Element	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Heat Exchanger Components (Class 1E Diesel Area Panel Room Supply System)	Evaluated with the Control Area Chilled Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Heat Exchanger Components (Diesel Generator Room Recirc System)	Evaluated with the Closed Cycle Cooling Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Louver	Pressure Boundary	Aluminum	Air - Indoor (External)	None	None	V.F-2	3.2.1-50	C
Louver	Pressure Boundary	Aluminum	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F4-10	3.3.1-27	E, 2
Louver	Pressure Boundary	Galvanized Steel	Air - Indoor (External)	None	None	VII.J-6	3.3.1-92	C
Louver	Pressure Boundary	Galvanized Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.F4-2	3.3.1-72	A
Piping and Fittings	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air - Indoor (External)	None	None	VIII.I-2	3.4.1-41	A
Piping and Fittings	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F4-12	3.3.1-25	E, 2, 4

Table 3.3.2-28 Standby Diesel Generator Area Ventilation Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Copper Alloy with 15% Zinc or More	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F4-12	3.3.1-25	E, 2
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2, 4
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Thermowell	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F1-1	3.3.1-27	E, 2

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

2. NUREG-1801 specifies a plant-specfic program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

3. NUREG-1801 specifies a plant-specfic program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination. Inspections of the flexible connections require physical manipulation; therefore, internal and external inspections, which include physical manipulation of elastomers, will be performed at the same time under the Periodic Inspection program.

4. The environment of Air/Gas - Wetted is applicable to the external surfaces during normal operation. This component is located within the HVAC ductwork and the external surfaces of this component are exposed to the HVAC Air/Gas - Wetted environment.

Table 3.3.2-29

Standby Diesel Generators and Auxiliary Systems

Summary of Aging Management Evaluation

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Bolting	Mechanical Closure	Copper Alloy Bolting with 15% Zinc or More	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity			F
Bolting	Mechanical Closure	Stainless Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C2-8	3.1.1-52	B
Electric Heaters (Jacket Water)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Electric Heaters (Jacket Water)	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.H2-23	3.3.1-47	B
Electric Heaters (Lube Oil)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Electric Heaters (Lube Oil)	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	B
Electric Heaters (Lube Oil)	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	A
Expansion Joints	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Expansion Joints	Pressure Boundary	Stainless Steel	Diesel Exhaust (Internal)	Cracking/Stress Corrosion Cracking	Periodic Inspection	VII.H2-1	3.3.1-6	E, 1

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Expansion Joints	Pressure Boundary	Stainless Steel	Diesel Exhaust (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.H2-2	3.3.1-18	E, 1
Filter Housing (Combustion Intake)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Filter Housing (Combustion Intake)	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-21	3.3.1-71	C
Filter Housing (Fuel Oil)	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Filter Housing (Fuel Oil)	Leakage Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fuel Oil Chemistry	VII.H1-10	3.3.1-20	B
Filter Housing (Fuel Oil)	Leakage Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	One-Time Inspection	VII.H1-10	3.3.1-20	A
Filter Housing (Fuel Oil)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Filter Housing (Fuel Oil)	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fuel Oil Chemistry	VII.H1-10	3.3.1-20	B
Filter Housing (Fuel Oil)	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	One-Time Inspection	VII.H1-10	3.3.1-20	A
Filter Housing (Lube Oil)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Filter Housing (Lube Oil)	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	B
Filter Housing (Lube Oil)	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	A
Filter Housing (Start Air)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Filter Housing (Start Air)	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-18	3.3.1-98	A
Flame Arrestor (Conservation Vent)	Pressure Boundary	Aluminum	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 2
Flame Arrestor (Conservation Vent)	Pressure Boundary	Aluminum	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.F4-10	3.3.1-27	E, 1
Flame Arrestor (Conservation Vent)	Pressure Boundary	Stainless Steel	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B4-7	3.5.1-50	E, 2
Flow Element	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Pressure Boundary	Stainless Steel	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Fuel Oil Chemistry	VII.H1-6	3.3.1-32	B
Flow Element	Pressure Boundary	Stainless Steel	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	One-Time Inspection	VII.H1-6	3.3.1-32	A
Heat Exchanger Components (Intercooler)	Evaluated with the Closed Cycle Cooling Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Heat Exchanger Components (Jacket Water)	Evaluated with the Closed Cycle Cooling Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Heat Exchanger Components (Lube Oil)	Evaluated with the Closed Cycle Cooling Water System	Not Applicable	Not Applicable	Not Applicable	Not Applicable			
Hoses	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Hoses	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Closed-Cycle Cooling Water System	VII.E4-11	3.3.1-46	B
Hoses	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Hoses	Pressure Boundary	Stainless Steel	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Fuel Oil Chemistry	VII.H1-6	3.3.1-32	B
Hoses	Pressure Boundary	Stainless Steel	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	One-Time Inspection	VII.H1-6	3.3.1-32	A
Hoses	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-17	3.3.1-33	B, 3
Hoses	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-17	3.3.1-33	A, 3
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fuel Oil Chemistry	VII.H1-10	3.3.1-20	B

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Leakage Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	One-Time Inspection	VII.H1-10	3.3.1-20	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	B
Piping and Fittings	Leakage Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-21	3.3.1-71	A

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.H2-23	3.3.1-47	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Diesel Exhaust (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-2	3.3.1-18	E, 4
Piping and Fittings	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fuel Oil Chemistry	VII.H1-10	3.3.1-20	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	One-Time Inspection	VII.H1-10	3.3.1-20	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-18	3.3.1-98	A

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Closed-Cycle Cooling Water System	VII.E4-11	3.3.1-46	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Fuel Oil Chemistry	VII.H1-6	3.3.1-32	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	One-Time Inspection	VII.H1-6	3.3.1-32	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-17	3.3.1-33	B, 3
Piping and Fittings	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-17	3.3.1-33	A, 3
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Piping and Fittings	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Structural Support	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-18	3.3.1-98	A
Pump Casing (Fuel Oil - Motor)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Pump Casing (Fuel Oil - Motor)	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fuel Oil Chemistry	VII.H1-10	3.3.1-20	B
Pump Casing (Fuel Oil - Motor)	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	One-Time Inspection	VII.H1-10	3.3.1-20	A

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump Casing (Fuel Oil - Storage Transfer)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Pump Casing (Fuel Oil - Storage Transfer)	Pressure Boundary	Stainless Steel	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Fuel Oil Chemistry	VII.H1-6	3.3.1-32	B
Pump Casing (Fuel Oil - Storage Transfer)	Pressure Boundary	Stainless Steel	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	One-Time Inspection	VII.H1-6	3.3.1-32	A
Pump Casing (Lube Oil - Keepwarm)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Pump Casing (Lube Oil - Keepwarm)	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	B
Pump Casing (Lube Oil - Keepwarm)	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	A
Pump Casing (Rocker Lube Oil - Motor)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Pump Casing (Rocker Lube Oil - Motor)	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	B
Pump Casing (Rocker Lube Oil - Motor)	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	A
Pump Casing (Water Jacket - Keepwarm Motor)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Pump Casing (Water Jacket - Keepwarm Motor)	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Closed-Cycle Cooling Water System	VII.E4-11	3.3.1-46	B

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump Casing (Water Jacket - Keepwarm Motor)	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Silencer/ Muffler	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Silencer/ Muffler	Pressure Boundary	Carbon Steel	Diesel Exhaust (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-2	3.3.1-18	E, 4
Strainer Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Strainer Body	Leakage Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	B
Strainer Body	Leakage Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	A
Strainer Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Strainer Body	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	B
Strainer Body	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	A
Tanks (Air Receiver)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Tanks (Air Receiver)	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-18	3.3.1-98	C
Tanks (Fuel Oil Day)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tanks (Fuel Oil Day)	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fuel Oil Chemistry	VII.H1-10	3.3.1-20	B
Tanks (Fuel Oil Day)	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	One-Time Inspection	VII.H1-10	3.3.1-20	A
Tanks (Fuel Oil Storage)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (Fuel Oil Storage)	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fuel Oil Chemistry	VII.H1-10	3.3.1-20	B
Tanks (Fuel Oil Storage)	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	One-Time Inspection	VII.H1-10	3.3.1-20	A
Tanks (Jacket Water Expansion)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (Jacket Water Expansion)	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.H2-23	3.3.1-47	B
Tanks (Lube Oil)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.I-8	3.3.1-58	A
Tanks (Lube Oil)	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	D
Tanks (Lube Oil)	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	C

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Thermowell	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 2
Thermowell	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Closed-Cycle Cooling Water System	VII.E4-11	3.3.1-46	B
Thermowell	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Thermowell	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-17	3.3.1-33	B, 3
Thermowell	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-17	3.3.1-33	A, 3
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.H2-23	3.3.1-47	B
Valve Body	Leakage Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fuel Oil Chemistry	VII.H1-10	3.3.1-20	B
Valve Body	Leakage Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	One-Time Inspection	VII.H1-10	3.3.1-20	A
Valve Body	Leakage Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	B
Valve Body	Leakage Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	A
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Carbon Steel	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	External Surfaces Monitoring	VII.H1-8	3.3.1-60	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VII.H2-21	3.3.1-71	A
Valve Body	Pressure Boundary	Carbon Steel	Closed Cycle Cooling Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.H2-23	3.3.1-47	B
Valve Body	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	Fuel Oil Chemistry	VII.H1-10	3.3.1-20	B
Valve Body	Pressure Boundary	Carbon Steel	Fuel Oil (Internal)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Fouling	One-Time Inspection	VII.H1-10	3.3.1-20	A
Valve Body	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-20	3.3.1-14	B
Valve Body	Pressure Boundary	Carbon Steel	Lubricating Oil (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-20	3.3.1-14	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-18	3.3.1-98	A

Table 3.3.2-29 Standby Diesel Generators and Auxiliary Systems (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Closed-Cycle Cooling Water System	VII.E4-11	3.3.1-46	B
Valve Body	Pressure Boundary	Stainless Steel	Closed Cycle Cooling Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Closed-Cycle Cooling Water System	VII.C2-10	3.3.1-50	B
Valve Body	Pressure Boundary	Stainless Steel	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Fuel Oil Chemistry	VII.H1-6	3.3.1-32	B
Valve Body	Pressure Boundary	Stainless Steel	Fuel Oil (Internal)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	One-Time Inspection	VII.H1-6	3.3.1-32	A
Valve Body	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	Lubricating Oil Analysis	VII.H2-17	3.3.1-33	B, 3
Valve Body	Pressure Boundary	Stainless Steel	Lubricating Oil (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.H2-17	3.3.1-33	A, 3
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Valve Body	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Structural Support	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-18	3.3.1-98	A

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. NUREG-1801 specifies a plant-specific program. The Periodic Inspection program is used to manage the aging effects(s) applicable to this component type, material, and environment combination.

2. The Periodic Inspection program is substituted to manage the aging effects(s) applicable to this component type, material, and environment combination.

3. Loss of material due to microbiologically influenced corrosion is not applicable for stainless steel components in a Lubricating Oil environment. Industry and plant operating experience indicates that the potential for significant degradation of lubricating oil systems due to microbiologically influenced corrosion is minimal. Lubricating oil systems are maintained to high cleanliness standards by design. Lubricating oil formulations include corrosion inhibitors, and the potential for water and contaminant intrusion is low compared to fuel oil systems; where the bulk storage, delivery and transport of the fuel oil increases the likelihood of moisture and microorganism contamination.

4. NUREG-1801 specifies a plant-specific program. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program is used to manage the aging effects(s) applicable to this component type, material, and environment combination.

Table 3.3.2-30
Standby Liquid Control System
Summary of Aging Management Evaluation

Table 3.3.2-30 Standby Liquid Control System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 1
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B

Table 3.3.2-30 Standby Liquid Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Electric Heater (Housing)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Electric Heater (Housing)	Pressure Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E2-1	3.3.1-30	A
Electric Heater (Housing)	Pressure Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E2-1	3.3.1-30	B
Flow Element	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Flow Element	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Flow Element	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E2-1	3.3.1-30	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E2-1	3.3.1-30	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A

Table 3.3.2-30 Standby Liquid Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Sodium Pentaborate (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E2-1	3.3.1-30	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Sodium Pentaborate (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E2-1	3.3.1-30	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E2-1	3.3.1-30	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E2-1	3.3.1-30	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Pump Casing (SLC Injection)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Pump Casing (SLC Injection)	Pressure Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E2-1	3.3.1-30	A
Pump Casing (SLC Injection)	Pressure Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E2-1	3.3.1-30	B
Tank (Standby Liquid Control)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Tank (Standby Liquid Control)	Pressure Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E2-1	3.3.1-30	C
Tank (Standby Liquid Control)	Pressure Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E2-1	3.3.1-30	D
Tank (Test)	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	C
Tank (Test)	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	C
Tank (Test)	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	D

Table 3.3.2-30 Standby Liquid Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Thermowell	Pressure Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E2-1	3.3.1-30	A
Thermowell	Pressure Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E2-1	3.3.1-30	B
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E2-1	3.3.1-30	A
Valve Body	Pressure Boundary	Stainless Steel	Sodium Pentaborate (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E2-1	3.3.1-30	B
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-15	3.3.1-24	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.E3-15	3.3.1-24	B
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 2

Table 3.3.2-30 Standby Liquid Control System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 2
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The NUREG-1801 "One-Time Inspection of ASME Code Class 1 Small-Bore Piping" aging management program is applicable only to plants that have not experienced cracking of ASME Code Class 1 small-bore piping. Based on previous Hope Creek operating experience with Class 1 small-bore pipe cracking, a new plant-specific periodic inspection program will be used. The "Small-Bore Class 1 Piping Inspection" aging management program is a plant-specific periodic program that will be implemented to manage cracking by periodic volumetric examinations of small-bore Class 1 piping.

2. The Water Chemistry and ASME Section XI In-service Inspection, Subsections IWB, IWC, and IWD aging management programs will be used to manage the aging effect of cracking in valve bodies < NPS 4".

Table 3.3.2-31
Torus Water Cleanup System
Summary of Aging Management Evaluation

Table 3.3.2-31 Torus Water Cleanup System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A

Table 3.3.2-31 Torus Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Piping and Fittings	Structural Support	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Piping and Fittings	Structural Support	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Structural Support	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Piping and Fittings	Structural Support	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Piping and Fittings	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Structural Support	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	VII.D-4	3.3.1-54	E, 1
Piping and Fittings	Structural Support	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Piping and Fittings	Structural Support	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Piping and Fittings	Structural Support	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Piping and Fittings	Structural Support	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Pump Casing (Torus Water Clean-up)	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A

Table 3.3.2-31 Torus Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Pump Casing (Torus Water Clean-up)	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Pump Casing (Torus Water Clean-up)	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Strainer	Structural Support	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Strainer	Structural Support	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E3-18	3.3.1-17	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E3-18	3.3.1-17	B
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A

Table 3.3.2-31 Torus Water Cleanup System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination

Table 3.3.2-32
Traversing Incore Probe System
Summary of Aging Management Evaluation

Table 3.3.2-32 Traversing Incore Probe System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VII.I-4	3.3.1-43	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VII.I-5	3.3.1-45	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-18	3.3.1-98	A
Piping and Fittings	Structural Support	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Piping and Fittings	Structural Support	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-18	3.3.1-98	A
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Dry (Internal)	None	None	VII.J-22	3.3.1-98	A
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VII.J-15	3.3.1-94	A
Valve Body	Pressure Boundary	Stainless Steel	Air/Gas - Dry (Internal)	None	None	VII.J-18	3.3.1-98	A

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

None.

3.4 AGING MANAGEMENT OF STEAM AND POWER CONVERSION SYSTEM

3.4.1 INTRODUCTION

This section provides the results of the aging management review for those components identified in Section 2.3.4, Steam and Power Conversion System, as being subject to aging management review. The systems, or portions of systems, which are addressed in this section are described in the indicated sections.

- Condensate Storage and Transfer System (2.3.4.1)
- Feedwater System (2.3.4.2)
- Main Condenser (2.3.4.3)
- Main Steam System (2.3.4.4)

3.4.2 RESULTS

The following tables summarize the results of the aging management review for Steam and Power Conversion System.

Table 3.4.2-1 Summary of Aging Management Evaluation – Condensate Storage and Transfer System

Table 3.4.2-2 Summary of Aging Management Evaluation – Feedwater System

Table 3.4.2-3 Summary of Aging Management Evaluation – Main Condenser System

Table 3.4.2-4 Summary of Aging Management Evaluation – Main Steam System

3.4.2.1 Materials, Environments, Aging Effects Requiring Management And Aging Managements Programs

3.4.2.1.1 Condensate Storage and Transfer System

Materials

The materials of construction for the Condensate Storage and Transfer System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Stainless Steel

Environments

The Condensate Storage and Transfer System components are exposed to the following environments:

- Air - Indoor
- Air – Outdoor
- Air/Gas Wetted
- Soil
- Treated Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Condensate Storage and Transfer System components require management:

- Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion
- Loss of Material/Galvanic Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening

Aging Management Programs

The following aging management programs manage the aging effects for the Condensate Storage and Transfer System components:

- Aboveground Non-Steel Tanks (B.2.2.3)
- Bolting Integrity (B.2.1.12)
- Buried Non-Steel Piping Inspection (B.2.2.4)
- Buried Piping Inspection (B.2.1.24)
- External Surfaces Monitoring (B.2.1.25)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Water Chemistry (B.2.1.2)

Table 3.4.2-1, Summary of Aging Management Evaluation – Condensate Storage and Transfer System summarizes the results of the aging management review for the Condensate Storage and Transfer System.

3.4.2.1.2 Feedwater System

Materials

The materials of construction for the Feedwater System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel

Environments

The Feedwater System components are exposed to the following environments:

- Air - Indoor
- Treated Water

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Feedwater System components require management:

- Cracking/Thermal and Mechanical Loading
- Cumulative Fatigue Damage/Fatigue
- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening
- Wall Thinning/Flow Accelerated Corrosion

Aging Management Programs

The following aging management programs manage the aging effects for the Feedwater System components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1.1)
- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Flow-Accelerated Corrosion (B.2.1.11)
- One-Time Inspection (B.2.1.22)
- Small-Bore Class 1 Piping Inspection (B.2.2.6)
- TLAA
- Water Chemistry (B.2.1.2)

Table 3.4.2-2, Summary of Aging Management Evaluation – Feedwater System summarizes the results of the aging management review for the Feedwater System.

3.4.2.1.3 Main Condenser System

Materials

The materials of construction for the Main Condenser System components are:

- Aluminum Bronze
- Carbon Steel
- Titanium Alloy

Environments

The Main Condenser System components are exposed to the following environments:

- Air - Indoor
- Raw Water
- Steam

Aging Effects/Mechanisms Requiring Management

The following aging effects associated with the Main Condenser System components require management:

- None

Aging Management Programs

The following aging management programs manage the aging effects for the Main Condenser System components:

- None

Table 3.4.2-3, Summary of Aging Management Evaluation – Main Condenser System summarizes the results of the aging management review for the Main Condenser System.

3.4.2.1.4 Main Steam System

Materials

The materials of construction for the Main Steam System components are:

- Carbon and Low Alloy Steel Bolting
- Carbon Steel
- Cast Austenitic Stainless Steel
- Stainless Steel

Environments

The Main Steam System components are exposed to the following environments:

- Air - Indoor
- Air/Gas – Wetted
- Steam
- Treated Water
- Treated Water > 140 ^{o}F
- Treated Water > 482 ^{o}F

Aging Effects Requiring Management

The following aging effects associated with the Main Steam System components require management:

- Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading
- Cumulative Fatigue Damage/Fatigue
- Loss of Material/Galvanic Corrosion
- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening
- Wall Thinning/Flow Accelerated Corrosion

Aging Management Programs

The following aging management programs manage the aging effects for the Main Steam System components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (B.2.1.1)
- Bolting Integrity (B.2.1.12)
- External Surfaces Monitoring (B.2.1.25)
- Flow-Accelerated Corrosion (B.2.1.11)
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (B.2.1.26)
- One-Time Inspection (B.2.1.22)
- Periodic Inspection (B.2.2.2)
- Small-bore Class 1 Piping Inspection (B.2.2.6)
- TLAA
- Water Chemistry (B.2.1.2)

Table 3.4.2-4, Summary of Aging Management Evaluation – Main Steam System summarizes the results of the aging management review for the Main Steam System.

3.4.2.2 AMR Results for Which Further Evaluation is Recommended by the GALL Report

NUREG-1801 provides the basis for identifying those programs that warrant further evaluation by the reviewer in the license renewal application. For the Steam and Power Conversion System, those programs are addressed in the following subsections.

3.4.2.2.1 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of metal fatigue as a TLAA for the Feedwater, Main Steam System, and Reactor Water Cleanup System is discussed in Section 4.3.

3.4.2.2.2 Loss of Material due to General, Pitting, and Crevice Corrosion

1. *Loss of material due to general, pitting and crevice corrosion could occur for steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water and for steel piping, piping components, and piping elements exposed to steam. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the water chemistry control program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.*

   Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, piping elements, and turbine casings exposed to treated water or steam in the Condensate Storage and Transfer System, Feedwater System, and Main Steam System. The Water Chemistry and One-Time Inspection programs are described in Appendix B.

2. *Loss of material due to general, pitting and crevice corrosion could occur for steel piping, piping components, and piping elements exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been*

adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

Item Number 3.4.1-7 is not applicable to Hope Creek. There are no steel piping, piping components, or piping elements exposed to lubricating oil environment in the Steam and Power Conversion System.

3.4.2.2.3 Loss of Material due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion (MIC), and Fouling

Loss of material due to general, pitting, crevice, and MIC, and fouling could occur in steel piping, piping components, and piping elements exposed to raw water. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

Item Number 3.4.1-8 is not applicable to Hope Creek. There are no steel piping, piping components, and piping elements exposed to raw water environment in the Steam and Power Conversion System.

3.4.2.2.4 Reduction of Heat Transfer due to Fouling

1. *Reduction of heat transfer due to fouling could occur for stainless steel and copper alloy heat exchanger tubes exposed to treated water. The existing aging management program relies on control of water chemistry to manage reduction of heat transfer due to fouling. However, control of water chemistry may not always have been adequate to preclude fouling. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that reduction of heat transfer due to fouling is not occurring. A one-time inspection is an acceptable method to ensure that reduction of heat transfer is not occurring and that the component's intended function will be maintained during the period of extended operation.*

   Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the reduction of heat transfer due to fouling in copper alloy heat exchanger tubes exposed to treated water in the High Pressure Coolant Injection System and Reactor Core Isolation Cooling System. The Water Chemistry and One-Time Inspection programs are described in Appendix B.

2. *Reduction of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil. The*

existing aging management program relies on monitoring and control of lube oil chemistry to mitigate reduction of heat transfer due to fouling. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that fouling is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of lube oil chemistry control program. A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

Item Number 3.4.1-10 is not applicable to Hope Creek. There are no steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil environment in the Steam and Power Conversion System.

3.4.2.2.5 Loss of Material due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion

1. *Loss of material due to general, pitting and crevice corrosion, and MIC could occur in steel (with or without coating or wrapping) piping, piping components, piping elements and tanks exposed to soil. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general corrosion, pitting and crevice corrosion, and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.*

   Hope Creek will implement the Buried Piping Inspection program, B.2.1.24, to manage Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion in buried steel piping, piping components, and piping elements exposed to soil in the Condensate Storage and Transfer System. The Buried Piping Inspection Program is described in Appendix B.

   There are no steel tanks exposed to soil in the Steam and Power Conversion System.

2. *Loss of material due to general, pitting and crevice corrosion, and MIC could occur in steel heat exchanger components exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring*

and that the component's intended function will be maintained during the period of extended operation.

Item Number 3.4.1-12 is not applicable to Hope Creek. There are no steel heat exchanger components exposed to lubricating oil in the Steam and Power Conversion System.

3.4.2.2.6 Cracking due to Stress Corrosion Cracking (SCC)

Cracking due to SCC could occur in the stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 60°C (>140°F), and for stainless steel piping, piping components, and piping elements exposed to steam. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of cracking due to SCC. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause SCC. Therefore, the GALL Report recommends that the effectiveness of the water chemistry control program should be verified to ensure that SCC is not occurring. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that SCC is not occurring and that the component's intended function will be maintained during the period of extended operation.

Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage cracking due to stress corrosion cracking in stainless steel piping, piping components, piping elements, and heat exchanger components exposed to steam and treated water greater than 60 deg C (140 deg F) in the Control Rod Drive System, High Pressure Cooling Injection System, Main Steam System, Reactor Core Isolation Cooling System, and Reactor Water Cleanup System. The Water Chemistry and One-Time Inspection programs are described in Appendix B.

3.4.2.2.7 Loss of Material due to Pitting and Crevice Corrosion

1. *Loss of material due to pitting and crevice corrosion could occur for stainless steel, aluminum, and copper alloy piping, piping components and piping elements and for stainless steel tanks and heat exchanger components exposed to treated water. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of loss of material due to pitting, and crevice corrosion. However, control of water chemistry does not preclude corrosion at locations of stagnant flow conditions. Therefore, the GALL Report recommends that the effectiveness of the water chemistry program should be verified to ensure that corrosion is not occurring. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.*

   Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to pitting and crevice corrosion in copper alloy heat exchanger components exposed to treated water in the High Pressure Injection and Reactor Core Isolation Cooling System. The Water Chemistry and One-Time Inspection programs are described in Appendix B.

Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, piping elements, and tanks exposed to treated water in the Condensate Storage and Transfer System and Main Steam System. The Water Chemistry and One-Time Inspection programs are described in Appendix B.

2. *Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil. The GALL Report recommends further evaluation of a plant-specific aging management to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.*

   Item Number 3.4.1-17 is not applicable to Hope Creek. The AMR methodology for stainless steel piping, piping components, and piping elements exposed to soil predicts microbiologically influenced corrosion in addition to pitting, and crevice corrosion. There are no NUREG-1801 AMR lines available for stainless steel components exposed to soil that include all of these mechanisms.

3. *Loss of material due to pitting and crevice corrosion could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.*

   Item Number 3.4.1-18 is not applicable to Hope Creek. There are no copper alloy piping, piping components, and piping elements exposed to lubricating oil in the Steam and Power Conversion System.

3.4.2.2.8 Loss of Material due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

Loss of material due to pitting, crevice, and MIC could occur in stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil. The existing aging management program relies on the periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to *corrosion. However, control of lube oil contaminants may not always have been adequate to preclude corrosion. Therefore, the effectiveness of lubricating oil contaminant control should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion to verify the effectiveness of the lube oil chemistry control program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.*

Item Number 3.4.1-19 is not applicable to Hope Creek. There are no stainless steel piping, piping components, piping elements, or heat exchanger components exposed to lubricating oil in the Steam and Power Conversion System.

3.4.2.2.9 Loss of Material due to General, Pitting, Crevice, and Galvanic Corrosion

Loss of material due to general, pitting, crevice, and galvanic corrosion can occur for steel heat exchanger components exposed to treated water. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the water chemistry control program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

Hope Creek will implement a One-Time Inspection program, B.2.1.22, for susceptible locations to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to general, pitting, crevice, and galvanic corrosion in steel heat exchanger components, piping, piping components, piping elements, exposed to treated water in the Closed Cycle Cooling Water System, Condensate Storage and Transfer System, Containment Hydrogen Recombiner System, Control Rod Drive System, Core Spray System, Fuel Pool Cooling and Cleanup System, High Pressure Coolant Injection System, Main Steam System, Nuclear Boiler Instrumentation, Reactor Core Isolation Cooling (RCIC) System, Reactor Recirculation System, Reactor Water Cleanup System, Residual Heat Removal System, Standby Diesel Generators and Auxiliary Systems, and Torus Water Cleanup System. The Water Chemistry and One-Time Inspection programs are described in Appendix B.

3.4.2.2.10 Quality Assurance for Aging Management of NonSafety Related Components

QA provisions applicable to license renewal are discussed in Section B.1.3.

3.4.2.3 Time-Limited Aging Analysis

The time-limited aging analyses identified below are associated with the Steam and Power Conversion System components:

- Section 4.3, Metal Fatigue of the Reactor Pressure Vessel, Internals, and Reactor Coolant Pressure Boundary Piping and Components.

3.4.3 CONCLUSION

The Steam and Power Conversion System piping, fittings, and components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Steam and Power Conversion System components are identified in the summaries in Section 3.4.2.1 above.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the conclusions provided in Appendix B, the effects of aging associated with the Steam and Power Conversion System components will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-1	Steel piping, piping components, and piping elements exposed to steam or treated water	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue is a TLAA; further evaluation is documented in Subsection 3.4.2.2.1.
3.4.1-2	Steel piping, piping components, and piping elements exposed to steam	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, and piping elements exposed to steam. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See Subsection 3.4.2.2.2.1.
3.4.1-3	PWR Only				

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-4	Steel piping, piping components, and piping elements exposed to treated water	Loss of material due to general, pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, and piping elements exposed to treated water. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See Subsection 3.4.2.2.2.1.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-5	Steel heat exchanger components exposed to treated water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to general, pitting, crevice, and galvanic (when applicable) corrosion in steel heat exchanger components, piping, piping components, and piping elements exposed to treated water. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See Subsection 3.4.2.2.9.
3.4.1-6	Steel and stainless steel tanks exposed to treated water	Loss of material due to general (steel only) pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to general pitting, and crevice corrosion in stainless steel tanks exposed to treated water.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See Subsection 3.4.2.2.7.1.
3.4.1-7	Steel piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to general, pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not Applicable. See Subsection 3.4.2.2.2.2.
3.4.1-8	Steel piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling	Plant specific	Yes, plant specific	Not Applicable. See Subsection 3.4.2.2.3.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-9	Stainless steel and copper alloy heat exchanger tubes exposed to treated water	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the reduction of heat transfer due to fouling in copper alloy heat exchanger components exposed to treated water. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See Subsection 3.4.2.2.4.1.
3.4.1-10	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil	Reduction of heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not Applicable. See Subsection 3.4.2.2.4.2.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-11	Buried steel piping, piping components, piping elements, and tanks (with or without coating or wrapping) exposed to soil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes, detection of aging effects and operating experience are to be further evaluated	Consistent with NUREG-1801. The Buried Piping Inspection Program, B.2.1.24, will be used to manage the loss of material due to general, pitting, crevice, and microbiologically influenced corrosion in steel piping, piping components, and piping elements exposed to soil. See Subsection 3.4.2.2.5.1.
3.4.1-12	Steel heat exchanger components exposed to lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not Applicable. See Subsection 3.4.2.2.5.2.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-13	Stainless steel piping, piping components, piping elements exposed to steam	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage cracking due to stress corrosion cracking in stainless steel piping, piping components, piping elements exposed to steam. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See subsection 3.4.2.2.6.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-14	Stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage cracking due to stress corrosion cracking in stainless steel piping, piping components, piping elements, and heat exchanger components exposed to treated water > 60 deg C (> 140 deg F). Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See Subsection 3.4.2.2.6.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-15	Aluminum and copper alloy piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to pitting and crevice corrosion in copper alloy heat exchanger components exposed to treated water. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See Subsection 3.4.2.2.7.1.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-16	Stainless steel piping, piping components, and piping elements; tanks, and heat exchanger components exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801 with exceptions. The One-Time Inspection program, B.2.1.22, will be used to verify the effectiveness of the Water Chemistry program, B.2.1.2, to manage the loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements exposed to treated water. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation. See Subsection 3.4.2.2.7.1.
3.4.1-17	Stainless steel piping, piping components, and piping elements exposed to soil	Loss of material due to pitting and crevice corrosion	Plant specific	Yes, plant specific	Not Applicable. See Subsection 3.4.2.2.7.2.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-18	Copper alloy piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not Applicable. See Subsection 3.4.2.2.7.3.
3.4.1-19	Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not Applicable. See Subsection 3.4.2.2.8.
3.4.1-20	Steel tanks exposed to air – outdoor (external)	Loss of material/ general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	Not applicable. There are no steel tanks exposed to air outdoor (external) in the Steam and Power Conversion System.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-21	High-strength steel closure bolting exposed to air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Not applicable. There is no high-strength steel closure bolting exposed to air with steam or water leakage in the Steam and Power Conversion System.
3.4.1-22	Steel bolting and closure bolting exposed to air with steam or water leakage, air – outdoor (external), or air – indoor uncontrolled (external);	Loss of material due to general, pitting and crevice corrosion; loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Consistent with NUREG-1801 with exceptions. The Bolting Integrity program, B.2.1.12, will be used to manage the loss of material due to general, pitting, and crevice corrosion, and, the loss of preload due to thermal effects, gasket creep, and self-loosening in steel bolting exposed to indoor air and outdoor air in the Condensate Storage and Transfer System, Feedwater System, and Main Steam System. Exceptions apply to the NUREG-1801 recommendations for the Bolting Integrity program implementation.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-23	Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water >60°C (>140°F)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	Not applicable. There are no stainless steel piping, piping components, or piping elements exposed to closed-cycle cooling water >60°C in the Steam and Power Conversion System.
3.4.1-24	Steel heat exchanger components exposed to closed cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable. There are no steel heat exchanger components exposed to closed cycle cooling water in the Steam and Power Conversion System.
3.4.1-25	Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable. There are no stainless steel piping, piping components, piping elements, or heat exchanger components exposed to closed cycle cooling water in the Steam and Power Conversion System.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-26	Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable. There are no copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water in the Steam and Power Conversion System.
3.4.1-27	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Not applicable. There are no steel, stainless steel, or copper alloy heat exchanger tubes exposed to closed cycle cooling water in the Steam and Power Conversion System.
3.4.1-28	Steel external surfaces exposed to air – indoor uncontrolled (external), condensation (external), or air outdoor (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. The External Surfaces Monitoring program, B.2.1.25, will be used to manage the loss of material due to general corrosion on the external surfaces of steel piping, piping components, piping elements, and turbine casings exposed to indoor air in the Condensate Storage and Transfer System, Feedwater System, and Main Steam System.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-29	Steel piping, piping components, and piping elements exposed to steam or treated water	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Consistent with NUREG-1801 with exceptions. The Flow-Accelerated Corrosion program, B.2.1.11 will be used to manage wall thinning due to flow-accelerated corrosion in steel piping, piping components, piping elements, and heat exchanger elements exposed to steam or treated water in the Feedwater System, Main Steam System, and Reactor Water Cleanup System. Exceptions apply to the NUREG-1801 recommendations for Flow-Accelerated Corrosion program implementation.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-30	Steel piping, piping components, and piping elements exposed to air outdoor (internal) or condensation (internal)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Consistent with NUREG-1801. The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program, B.2.1.26, will be used to manage the loss of material due to general, pitting, and crevice corrosion in steel piping, piping components, and piping elements, exposed to Air/Gas wetted in the Condensate Storage and Transfer System and the Main Steam System.
3.4.1-31	Steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable. There are no steel heat exchanger components exposed to raw water in the Steam and Power Conversion System.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-32	Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Open-Cycle Cooling Water System	No	Not applicable. There are no stainless steel or copper alloy piping, piping components, and piping elements exposed to raw water in the Steam and Power Conversion System.
3.4.1-33	Stainless steel heat exchanger components exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The Open-Cycle Cooling Water System program, B.2.1.13, will be used to manage the loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling in stainless steel piping, piping components, piping elements, and tanks exposed to raw water in the Service Water System. Components in the Fresh Water Supply System have been aligned to this item number based on material, environment, and aging effect. The Periodic Inspection program, B.2.2.2, will be substituted to manage loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling in stainless piping and piping components for this system.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-34	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water	Reduction of heat transfer due to fouling	Open-Cycle Cooling Water System	No	Not applicable. There are no steel, stainless steel, or copper alloy heat exchanger tubes exposed to raw water in the Steam and Power Conversion System.
3.4.1-35	Copper alloy >15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable. There are no copper alloy >15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water, raw water, or treated water in the Steam and Power Conversion System.
3.4.1-36	Gray cast iron piping, piping components, and piping elements exposed to soil, treated water, or raw water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable. There are no gray cast iron piping, piping components, and piping elements exposed to soil, treated water, or raw water in the Steam and Power Conversion System.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-37	Steel, stainless steel, and nickel-based alloy piping, piping components, and piping elements exposed to steam	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Consistent with NUREG-1801 with exceptions. The Water Chemistry program, B.2.1.2, will be used to manage the loss of material due to pitting and crevice corrosion in stainless steel piping, piping components, and piping elements exposed to steam and treated water > 140 °F in the Main Steam System. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation.
3.4.1-38	PWR Only				
3.4.1-39	PWR Only				
3.4.1-40	Glass piping elements exposed to air, lubricating oil, raw water, and treated water	None	None	NA - No AEM or AMP	Not applicable. There are no glass piping elements exposed to air, lubricating oil, raw water, or treated water in the Steam and Power Conversion System.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-41	Stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external)	None	None	NA - No AEM or AMP	Consistent with NUREG-1801.
3.4.1-42	Steel piping, piping components, and piping elements exposed to air – indoor controlled (external)	None	None	NA - No AEM or AMP	Not applicable. All indoor air environments at Hope Creek are assumed to be uncontrolled for license renewal.
3.4.1-43	Steel and stainless steel piping, piping components, and piping elements in concrete	None	None	NA - No AEM or AMP	Not applicable. There are no steel and stainless steel piping, piping components, and piping elements in concrete in the Steam and Power Conversion System.

Table 3.4.1 Summary of Aging Management Evaluations for the Steam and Power Conversion System

Item Number	Component	Aging Effect/Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.4.1-44	Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas	None	None	NA - No AEM or AMP	Not applicable. There are no steel, stainless steel, aluminum, or copper alloy piping, piping components, and piping elements exposed to gas in the Steam and Power Conversion System.

Table 3.4.2-1
Condensate Storage and Transfer System
Summary of Aging Management Evaluation

Table 3.4.2-1 **Condensate Storage and Transfer System**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bird Screen	Filter	Stainless Steel	Air - Outdoor	Loss of Material/Pitting and Crevice Corrosion	Aboveground Non-Steel Tanks	III.B2-7	3.5.1-50	E, 1
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VIII.H-4	3.4.1-22	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VIII.H-5	3.4.1-22	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Outdoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VIII.H-1	3.4.1-22	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Outdoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Expansion Joints	Structural Support	Stainless Steel	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 2
Expansion Joints	Structural Support	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.E-29	3.4.1-16	A
Expansion Joints	Structural Support	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.E-29	3.4.1-16	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D

Table 3.4.2-1 Condensate Storage and Transfer System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.E-33	3.4.1-4	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.E-33	3.4.1-4	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VIII.I-10	3.4.1-41	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.E-29	3.4.1-16	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.E-29	3.4.1-16	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.E-33	3.4.1-4	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.E-33	3.4.1-4	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VIII.I-10	3.4.1-41	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 2
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.E-29	3.4.1-16	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.E-29	3.4.1-16	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.E-29	3.4.1-16	A

Table 3.4.2-1 Condensate Storage and Transfer System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.E-29	3.4.1-16	B
Piping and Fittings	Structural Support	Stainless Steel	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 2
Piping and Fittings	Structural Support	Stainless Steel	Soil (External)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Buried Non-Steel Piping Inspection			H, 4
Piping and Fittings	Structural Support	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.E-29	3.4.1-16	A
Piping and Fittings	Structural Support	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.E-29	3.4.1-16	B
Piping and Fittings (Pipe Sleeve)	Shelter, Protection	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VIII.B1-7	3.4.1-30	A
Piping and Fittings (Pipe Sleeve)	Shelter, Protection	Carbon Steel	Soil (External)	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Buried Piping Inspection	VIII.E-1	3.4.1-11	A
Tanks (CST)	Pressure Boundary	Stainless Steel	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Aboveground Non-Steel Tanks	III.B2-7	3.5.1-50	E, 1
Tanks (CST)	Pressure Boundary	Stainless Steel	Soil (External)	Loss of Material/Pitting, Crevice, and Microbiologically Influenced Corrosion	Aboveground Non-Steel Tanks			G, 3
Tanks (CST)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.E-40	3.4.1-6	A
Tanks (CST)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.E-40	3.4.1-6	B
Thermowell	Pressure Boundary	Stainless Steel	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 2
Thermowell	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.E-29	3.4.1-16	A

Table 3.4.2-1 Condensate Storage and Transfer System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Thermowell	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.E-29	3.4.1-16	B
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.E-33	3.4.1-4	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.E-33	3.4.1-4	B
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VIII.I-10	3.4.1-41	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.E-29	3.4.1-16	A
Valve Body	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.E-29	3.4.1-16	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.E-33	3.4.1-4	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.E-33	3.4.1-4	B
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VIII.I-10	3.4.1-41	A
Valve Body	Pressure Boundary	Stainless Steel	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 2
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.E-29	3.4.1-16	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.E-29	3.4.1-16	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The Aboveground Non-Steel Tanks program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

2. The Periodic Inspection program is substituted to manage the aging effect(s) applicable to this component type, material, and environment combination.

3. The Aboveground Non-Steel Tanks program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

4. The Buried Non-Steel Piping Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

Table 3.4.2-2
Feedwater System
Summary of Aging Management Evaluation

Table 3.4.2-2 Feedwater System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VIII.H-4	3.4.1-22	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VIII.H-5	3.4.1-22	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-11	3.1.1-4	A, 1
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 2

Table 3.4.2-2 Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cracking/Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	IV.C1-7	3.1.1-45	B
Flow Element	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Flow Element	Structural Support	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.D2-7	3.4.1-4	A
Flow Element	Structural Support	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.D2-7	3.4.1-4	B
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.D2-7	3.4.1-4	A

Table 3.4.2-2 Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.D2-7	3.4.1-4	B
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.D2-8	3.4.1-29	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	VIII.D2-6	3.4.1-1	A, 1
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.D2-7	3.4.1-4	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.D2-7	3.4.1-4	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.D2-8	3.4.1-29	B
Piping and Fittings	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Piping and Fittings	Structural Support	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.D2-7	3.4.1-4	A
Piping and Fittings	Structural Support	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.D2-7	3.4.1-4	B
Piping and Fittings	Structural Support	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.D2-8	3.4.1-29	B
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C

Table 3.4.2-2 Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	IV.C1-7	3.1.1-45	B
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.D2-7	3.4.1-4	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.D2-7	3.4.1-4	B
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.D2-8	3.4.1-29	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.D2-7	3.4.1-4	A
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.D2-7	3.4.1-4	B
Valve Body	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.D2-8	3.4.1-29	B
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C

Table 3.4.2-2 Feedwater System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	IV.C1-7	3.1.1-45	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The TLAA designation in the Aging Management Program column indicates fatigue of this component is evaluated in Section 4.3.

2. The NUREG-1801 "One-Time Inspection of ASME Code Class 1 Small-Bore Piping" aging management program is applicable only to plants that have not experienced cracking of ASME Code Class 1 small-bore piping. Based on previous Hope Creek operating experience with Class 1 small-bore pipe cracking, a new plant-specific periodic inspection program will be used. The "Small-Bore Class 1 Piping Inspection" aging management program is a plant-specific periodic program that will be implemented to manage cracking by periodic volumetric examinations of small-bore Class 1 piping.

Table 3.4.2-3
Main Condenser System
Summary of Aging Management Evaluation

Table 3.4.2-3 Main Condenser System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Main Condenser Shell	Holdup	Carbon Steel	Air - Indoor (External)	None	None			J, 1
Main Condenser Shell	Holdup	Carbon Steel	Steam (Internal)	None	None			J, 1
Main Condenser Tubes	Holdup	Titanium Alloy	Raw Water (Internal)	None	None			J, 1
Main Condenser Tubes	Holdup	Titanium Alloy	Steam (External)	None	None			J, 1
Main Condenser Tubesheet	Holdup	Aluminum Bronze	Raw Water (Internal)	None	None			J, 1
Main Condenser Tubesheet	Holdup	Aluminum Bronze	Steam (External)	None	None			J, 1

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. Aging management of the main condenser is not based on analysis of materials, environments and aging effects. Condenser integrity required to perform the post accident intended function (holdup) is continuously confirmed by normal plant operation. No traditional aging management review or aging management program is required. The main condenser must perform a significant pressure boundary function (maintain vacuum) to allow continued plant operation. The post-accident intended function of the main condenser is to provide a holdup volume. This intended function does not require the condenser to be leak- tight, and the radiological analysis assumes the condenser is isolated and vacuum is lost, with 1.0 percent per day leakage. These conditions do not challenge the pressure boundary integrity of the condenser. Since normal plant operation assures adequate condenser pressure boundary integrity, the post-accident intended function to provide holdup volume is assured. Based on past precedence (NUREG-1796, Dresden and Quad Cities SER, Section 3.4.2.4.4 and NUREG-1769, Peach Bottom SER, Section 3.4.2.3), the staff concluded that the main condenser integrity is continually verified during normal plant operation and no aging management program is required to assure the post-accident intended function.

Table 3.4.2-4
Main Steam System
Summary of Aging Management Evaluation

Table 3.4.2-4 Main Steam System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	VIII.H-4	3.4.1-22	B
Bolting	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	VIII.H-5	3.4.1-22	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-11	3.1.1-4	A, 1
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Material/General, Pitting and Crevice Corrosion	Bolting Integrity	V.E-4	3.2.1-23	B
Bolting (Class 1)	Mechanical Closure	Carbon and Low Alloy Steel Bolting	Air - Indoor (External)	Loss of Preload/Thermal Effects, Gasket Creep, and Self-Loosening	Bolting Integrity	IV.C1-10	3.1.1-52	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cracking/Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cracking/Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 2

Table 3.4.2-4 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cracking/Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	IV.C1-7	3.1.1-45	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A

Table 3.4.2-4 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Small-Bore Class 1 Piping Inspection	IV.C1-1	3.1.1-48	E, 2
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking, Thermal and Mechanical Loading	Water Chemistry	IV.C1-1	3.1.1-48	B
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1

Table 3.4.2-4 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Class 1 Piping, Fittings and Branch Connections < NPS 4"	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Condensing Chamber (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Flow Element (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Flow Element (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C

Table 3.4.2-4 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Flow Element (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Flow Element (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Flow Element (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Flow Element (Class 1)	Throttle	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Flow Element (Class 1)	Throttle	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Flow Element (Class 1)	Throttle	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Flow Element (Class 1)	Throttle	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Flow Element (Class 1)	Throttle	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-9	3.1.1-41	E, 4
Flow Element (Class 1)	Throttle	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Flow Element (Class 1)	Throttle	Cast Austenitic Stainless Steel (CASS)	Treated Water (Internal) > 482 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Piping and Fittings	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D

Table 3.4.2-4 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-15	3.4.1-2	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.A-15	3.4.1-2	B
Piping and Fittings	Leakage Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.B2-4	3.4.1-29	B
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.B2-6	3.4.1-4	A
Piping and Fittings	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.B2-6	3.4.1-4	B
Piping and Fittings	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VIII.I-10	3.4.1-41	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.D2-4	3.4.1-16	A
Piping and Fittings	Leakage Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.D2-4	3.4.1-16	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VIII.B1-7	3.4.1-30	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.B1-7	3.4.1-30	E, 7
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	VIII.B2-5	3.4.1-1	A, 1

Table 3.4.2-4 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-15	3.4.1-2	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.A-15	3.4.1-2	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.B2-4	3.4.1-29	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.B2-6	3.4.1-4	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (External)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.B2-6	3.4.1-4	B
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	One-Time Inspection	VIII.E-7	3.4.1-5	C
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/Galvanic Corrosion	Water Chemistry	VIII.E-7	3.4.1-5	D
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.B2-6	3.4.1-4	A
Piping and Fittings	Pressure Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.B2-6	3.4.1-4	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VIII.I-10	3.4.1-41	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Air/Gas - Wetted (Internal)	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	V.D2-35	3.2.1-8	E, 5
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.B2-1	3.4.1-13	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.B2-1	3.4.1-13	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	VII.E3-14	3.3.1-2	A, 1

Table 3.4.2-4 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.B2-2	3.4.1-37	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.B2-1	3.4.1-13	A
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.B2-1	3.4.1-13	B
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cumulative Fatigue Damage/Fatigue	TLAA	VII.E3-14	3.3.1-2	A, 1
Piping and Fittings	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.B2-2	3.4.1-37	B
Piping and Fittings	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Piping and Fittings	Structural Support	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-15	3.4.1-2	A
Piping and Fittings	Structural Support	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.A-15	3.4.1-2	B
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Piping and Fittings (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	IV.C1-7	3.1.1-45	B
Piping and Fittings (Head Seal Leak Detection)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A

Table 3.4.2-4 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piping and Fittings (Head Seal Leak Detection)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.A1-10	3.1.1-19	E, 6
Piping and Fittings (Head Seal Leak Detection)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.A1-10	3.1.1-19	E, 6
Piping and Fittings (Head Seal Leak Detection)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Piping and Fittings (Head Seal Leak Detection)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Restricting Orifices	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VIII.I-10	3.4.1-41	A
Restricting Orifices	Leakage Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.B2-1	3.4.1-13	A
Restricting Orifices	Leakage Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.B2-1	3.4.1-13	B
Restricting Orifices	Leakage Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.B2-2	3.4.1-37	B
Restricting Orifices	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VIII.I-10	3.4.1-41	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.B2-1	3.4.1-13	A
Restricting Orifices	Pressure Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.B2-1	3.4.1-13	B
Restricting Orifices	Pressure Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.B2-2	3.4.1-37	B
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3

Table 3.4.2-4 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	IV.C1-1	3.1.1-48	E, 3
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Cracking/Stress Corrosion Cracking	Water Chemistry	IV.C1-1	3.1.1-48	E, 3
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Restricting Orifices (Class 1)	Throttle	Stainless Steel	Treated Water (Internal) > 140 F	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B
Sparger (T-quencher)	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.D2-4	3.4.1-16	A
Sparger (T-quencher)	Pressure Boundary	Stainless Steel	Treated Water (External)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.D2-4	3.4.1-16	B
Sparger (T-quencher)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.D2-4	3.4.1-16	A
Sparger (T-quencher)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.D2-4	3.4.1-16	B
Strainer Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Strainer Body	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-15	3.4.1-2	A
Strainer Body	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.A-15	3.4.1-2	B

Table 3.4.2-4 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Strainer Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Strainer Body	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-15	3.4.1-2	A
Strainer Body	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.A-15	3.4.1-2	B
Thermowell	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Thermowell	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-15	3.4.1-2	A
Thermowell	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.A-15	3.4.1-2	B
Thermowell	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Thermowell	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VIII.B1-7	3.4.1-30	A
Thermowell	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-15	3.4.1-2	A
Thermowell	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.A-15	3.4.1-2	B
Turbine Casing	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Turbine Casing	Structural Support	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-15	3.4.1-2	A

Table 3.4.2-4 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Turbine Casing	Structural Support	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.A-15	3.4.1-2	B
Valve Body	Leakage Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Valve Body	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-15	3.4.1-2	A
Valve Body	Leakage Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.A-15	3.4.1-2	B
Valve Body	Leakage Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.B2-4	3.4.1-29	B
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.B2-6	3.4.1-4	A
Valve Body	Leakage Boundary	Carbon Steel	Treated Water (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.B2-6	3.4.1-4	B
Valve Body	Leakage Boundary	Stainless Steel	Air - Indoor (External)	None	None	VIII.I-10	3.4.1-41	A
Valve Body	Leakage Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	One-Time Inspection	VIII.B2-1	3.4.1-13	A
Valve Body	Leakage Boundary	Stainless Steel	Steam (Internal)	Cracking/Stress Corrosion Cracking	Water Chemistry	VIII.B2-1	3.4.1-13	B
Valve Body	Leakage Boundary	Stainless Steel	Steam (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.B2-2	3.4.1-37	B
Valve Body	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Valve Body	Pressure Boundary	Carbon Steel	Air/Gas - Wetted (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	VIII.B1-7	3.4.1-30	A

Table 3.4.2-4 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-15	3.4.1-2	A
Valve Body	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.A-15	3.4.1-2	B
Valve Body	Pressure Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	VIII.B2-4	3.4.1-29	B
Valve Body	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	VIII.I-10	3.4.1-41	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VIII.D2-4	3.4.1-16	A
Valve Body	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VIII.D2-4	3.4.1-16	B
Valve Body	Structural Support	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VIII.H-7	3.4.1-28	A
Valve Body	Structural Support	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VIII.A-15	3.4.1-2	A
Valve Body	Structural Support	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VIII.A-15	3.4.1-2	B
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Air - Indoor (External)	Loss of Material/General Corrosion	External Surfaces Monitoring	VII.D-3	3.3.1-57	A
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Cumulative Fatigue Damage/Fatigue	TLAA	IV.C1-15	3.1.1-3	A, 1
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-6	3.1.1-13	C
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	IV.C1-6	3.1.1-13	D
Valve Body (Class 1)	Pressure Boundary	Carbon Steel	Steam (Internal)	Wall Thinning/Flow Accelerated Corrosion	Flow-Accelerated Corrosion	IV.C1-7	3.1.1-45	B

Table 3.4.2-4 Main Steam System (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Air - Indoor (External)	None	None	IV.E-2	3.1.1-86	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	IV.C1-14	3.1.1-15	A
Valve Body (Class 1)	Pressure Boundary	Stainless Steel	Treated Water (Internal)	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	IV.C1-14	3.1.1-15	B

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. The TLAA designation in the Aging Management Program column indicates fatigue of this component is evaluated in Section 4.3.

2. The NUREG-1801 "One-Time Inspection of ASME Code Class 1 Small-Bore Piping" aging management program is applicable only to plants that have not experienced cracking of ASME Code Class 1 small-bore piping. Based on previous Hope Creek operating experience with Class 1 small-bore pipe cracking, a new plant-specific periodic inspection program will be used. The "Small-Bore Class 1 Piping Inspection" aging management

program is a plant-specific periodic program that will be implemented to manage cracking by periodic volumetric examinations of small-bore Class 1 piping.

3. The Water Chemistry and ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD aging management programs will be used to manage the aging effect of cracking in condensing chambers, restricting orifices, and valve bodies <NPS 4".

4. The Main Steam flow element consists of a carbon steel venturi inserted inside a section of carbon steel piping. The carbon steel venturi includes a cast austenitic steel (CASS) insert to form the venturi nozzle. The carbon steel venturi and CASS nozzle are located entirely within the pipe and therefore do not perform a Pressure Boundary function. The carbon steel pipe performs the Pressure Boundary function. The venturi and nozzle perform a Throttle intended function. This CASS nozzle is not susceptible to thermal embrittlement because the nozzles were cast by a centrifugal casting method using low molybdenum stainless material (SA 351 CF8). In accordance with the guidance provided in the NUREG-1801, Volume 2, Section XI.M12, the centrifugally-cast, low molybdenum CASS portion of the flow restrictors is not susceptible to thermal embrittlement. The Water Chemistry aging management program will be used to manage the aging effects for the CASS material in this application.

5. NUREG-1801 specifies a plant-specific program. The Periodic Inspection program is used to manage the aging effect(s) applicable to this component type, material, and environment combination.

6. The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program includes inspection of this component; therefore the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD and Water Chemistry programs are credited here for managing the effects of cracking for this component.

7. One-time inspection will also be used for loss of material for safety relief valve dischage line at point of entry into the torus based upon recent industry operating experience. The line is carbon steel in an air/gas wetted (internal) environment.

3.5 AGING MANAGEMENT OF CONTAINMENTS, STRUCTURES, AND COMPONENT SUPPORTS

3.5.1 INTRODUCTION

This section provides the results of the aging management review for those components identified in Section 2.4, Scoping and Screening Results: Structures as being subject to aging management review. The structures or portions of structures and commodities, which are addressed in this section, are described in the indicated sections.

- Auxiliary Boiler Building (2.4.1)
- Auxiliary Building Control/Diesel Generator Area (2.4.2)
- Auxiliary Building Service/Radwaste Area (2.4.3)
- Component Supports Commodity Group (2.4.4)
- Fire Water Pump House (2.4.5)
- Piping and Component Insulation Commodity Group (2.4.6)
- Primary Containment (2.4.7)
- Reactor Building (2.4.8)
- Service Water Intake Structures (2.4.9)
- Shoreline Protection and Dike (2.4.10)
- Switchyard (2.4.11)
- Turbine Building (2.4.12)
- Yard Structures (2.4.13)

3.5.2 RESULTS

The following tables summarize the results of the aging management review for Structures and Component Supports.

Table 3.5.2-1 Summary of Aging Management Evaluation - Auxiliary Boiler Building

Table 3.5.2-2 Summary of Aging Management Evaluation - Auxiliary Building Control/ Diesel Generator Area

Table 3.5.2-3 Summary of Aging Management Evaluation - Auxiliary Building Service/ Radwaste Area Auxiliary Building Service/Radwaste Area

Table 3.5.2-4 Summary of Aging Management Evaluation - Component Supports Commodity Group

Table 3.5.2-5 Summary of Aging Management Evaluation - Fire Water Pump House

Table 3.5.2-6 Summary of Aging Management Evaluation - Piping and Component Insulation Commodity Group

Table 3.5.2-7 Summary of Aging Management Evaluation - Primary Containment

Table 3.5.2-8 Summary of Aging Management Evaluation - Reactor Building

Table 3.5.2-9 Summary of Aging Management Evaluation - Service Water Intake Structures

Table 3.5.2-10 Summary of Aging Management Evaluation - Shoreline Protection and Dike

Table 3.5.2-11 Summary of Aging Management Evaluation - Switchyard

Table 3.5.2-12 Summary of Aging Management Evaluation - Turbine Building

Table 3.5.2-13 Summary of Aging Management Evaluation - Yard Structures

3.5.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

3.5.2.1.1 Auxiliary Boiler Building

Materials

The materials of construction for the Auxiliary Boiler Building components are:

- Aluminum
- Aluminum Bolting
- Carbon Steel
- Carbon and Low Alloy Steel Bolting
- Concrete
- Concrete Block
- Elastomers
- Galvanized Steel
- Galvanized Steel Bolting
- Reinforced Concrete

Environments

The Auxiliary Boiler Building components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Concrete
- Encased in Steel
- Groundwater/Soil

Aging Effects Requiring Management

The following aging effects associated with the Auxiliary Boiler Building components require management:

- Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel
- Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment
- Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack
- Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion
- Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw
- Loss of Preload/Self-Loosening
- Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)

Aging Management Programs

The following aging management program manages the aging effects for the Auxiliary Boiler Building components:

- Structures Monitoring Program (B.2.1.32)

Table 3.5.2-1, Summary of Aging Management Evaluation – Auxiliary Boiler Building summarizes the results of the aging management review for the Auxiliary Boiler Building.

3.5.2.1.2 Auxiliary Building Control/Diesel Generator Area

Materials

The materials of construction for the Auxiliary Building Control/Diesel Generator Area components are:

- Aluminum
- Aluminum Bolting

- Carbon Steel
- Carbon and Low Alloy Steel Bolting
- Concrete
- Elastomers
- Galvanized Steel
- Galvanized Steel Bolting
- Grout
- Reinforced Concrete

Environments

The Auxiliary Building Control/Diesel Generator Area components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Concrete
- Groundwater/Soil
- Water - Flowing

Aging Effects Requiring Management

The following aging effects associated with the Auxiliary Building Control/Diesel Generator Area components require management:

- Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel
- Cracking/Shrinkage
- Cracks and Distortion/Increased Stress Levels from Settlement
- Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack
- Increase in Porosity and Permeability, Loss of Strength /Leaching of Calcium Hydroxide
- Increased Hardness, Shrinkage and Loss of Strength/Weathering
- Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion
- Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw
- Loss of Preload/Self-Loosening
- Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)

Aging Management Programs

The following aging management program manages the aging effects for the Auxiliary Building Control/Diesel Generator Area components:

- Structures Monitoring Program (B.2.1.32)

Table 3.5.2-2, Summary of Aging Management Evaluation – Auxiliary Building Control/Diesel Generator Area summarizes the results of the aging management review for the Auxiliary Building Control/Diesel Generator Area.

3.5.2.1.3 Auxiliary Building Service/Radwaste Area

Materials

The materials of construction for the Auxiliary Building Service/Radwaste Area components are:

- Aluminum
- Aluminum Bolting
- Carbon Steel
- Carbon and Low Alloy Steel Bolting
- Concrete
- Elastomers
- Galvanized Steel
- Galvanized Steel Bolting
- Grout
- Lead Blocks
- Reinforced Concrete

Environments

The Auxiliary Building Service/Radwaste Area components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Concrete
- Groundwater/Soil
- Water - Flowing

Aging Effects Requiring Management

The following aging effects associated with the Auxiliary Building Service/Radwaste Area components require management:

- Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel
- Cracking/Shrinkage
- Cracks and Distortion/Increased Stress Levels from Settlement
- Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack
- Increase in Porosity and Permeability, Loss of Strength /Leaching of Calcium Hydroxide
- Increased Hardness, Shrinkage and Loss of Strength/Weathering
- Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion
- Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw
- Loss of Preload/Self-Loosening
- Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)

Aging Management Programs

The following aging management program manages the aging effects for the Auxiliary Building Service/Radwaste Area components:

- Structures Monitoring Program (B.2.1.32)

Table 3.5.2-3, Summary of Aging Management Evaluation – Auxiliary Building Service/Radwaste Area summarizes the results of the aging management review for the Auxiliary Building Service/Radwaste Area.

3.5.2.1.4 Component Supports Commodity Group

Materials

The materials of construction for the Component Supports Commodity Group components are:

- Carbon Steel
- Carbon and Low Alloy Steel Bolting
- Elastomers
- Galvanized Steel
- Galvanized Steel Bolting

- Grout
- High Strength Low Alloy Steel Bolting with Yield Strength >150 ksi
- Lubrite®
- Nickel Alloy Bolting
- Reinforced concrete
- Stainless Steel
- Stainless Steel Bolting

Environments

The Component Supports Commodity Group components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Treated Water
- Water - Flowing

Aging Effects Requiring Management

The following aging effects associated with the Component Supports Commodity Group components require management:

- Loss of Material/Galvanic, General, Pitting and Crevice Corrosion
- Loss of Mechanical Function/Corrosion, Distortion, Dirt, Overload, Fatigue due to Vibratory and Cyclic Thermal Loads
- Loss of Preload/Self-Loosening
- Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms
- Reduction or Loss of Isolation Function/Radiation Hardening, Temperature, Humidity, Sustained Vibratory Loading

Aging Management Programs

The following aging management programs manage the aging effects for the Component Supports Commodity Group components:

- ASME Section XI, Subsection IWF (B.2.1.29)
- Structures Monitoring Program (B.2.1.32)
- Water Chemistry (B.2.1.2)

Table 3.5.2-4, Summary of Aging Management Evaluation – Component Supports Commodity Group summarizes the results of the aging management review for the Component Supports Commodity Group.

3.5.2.1.5 Fire Water Pump House

Materials

The materials of construction for the Fire Water Pump House components are:

- Aluminum
- Carbon Steel
- Carbon and Low Alloy Steel Bolting
- Concrete
- Concrete Block
- Elastomers
- Fiberglass
- Galvanized Steel
- Galvanized Steel Bolting
- Grout
- Reinforced Concrete

Environments

The Fire Water Pump House components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Concrete
- Encased in Steel
- Groundwater/Soil

Aging Effects Requiring Management

The following aging effects associated with the Fire Water Pump House components require management:

- Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel
- Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment
- Cracking/Shrinkage
- Cracks and Distortion/Increased Stress Levels from Settlement
- Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack

- Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion
- Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw
- Loss of Preload/Self-Loosening
- Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)

Aging Management Programs

The following aging management program manages the aging effects for the Fire Water Pump House components:

- Structures Monitoring Program (B.2.1.32)

Table 3.5.2-5, Summary of Aging Management Evaluation – Fire Water Pump House summarizes the results of the aging management review for the Fire Water Pump House.

3.5.2.1.6 Piping and Component Insulation Commodity Group

Materials

The materials of construction for the Piping and Component Insulation Commodity Group components are:

- Aluminum
- Calcium Silicate
- Cellular glass
- Ceramic Fiber
- Fiberglass
- Fiberglass (Molded)
- Fiberglass cloth
- Galvanized Steel
- "Min-K"
- NUKON
- Stainless Steel
- Stainless Steel (Mirror Insulation)

Environments

The Piping and Component Insulation Commodity Group components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor

Aging Effects Requiring Management

The following aging effects associated with the Piping and Component Insulation Commodity Group components require management:

- Loss of Material/Pitting and Crevice Corrosion

Aging Management Programs

The following aging management program manages the aging effects for the Piping and Component Insulation Commodity Group components:

- Periodic Inspection (B.2.2.2)

Table 3.5.2-6, Summary of Aging Management Evaluation – Piping and Component Insulation Commodity Group summarizes the results of the aging management review for the Piping and Component Insulation Commodity Group.

3.5.2.1.7 Primary Containment

Materials

The materials of construction for the Primary Containment components are:

- Boron Concrete
- Carbon Steel
- Carbon Steel; Dissimilar Metal Welds
- Carbon and Low Alloy Steel Bolting
- Concrete
- Concrete (High Density)
- Elastomers
- Galvanized Steel
- Galvanized Steel Bolting
- Grout (High Density)
- Lubrite®
- Paint
- Reinforced concrete

- Stainless Steel
- Stainless Steel Bolting
- Stainless Steel; Dissimilar Metal Welds

Environments

The Primary Containment components are exposed to the following environments:

- Air - Indoor
- Concrete
- Encased in Steel
- Raw Water
- Treated Water

Aging Effects Requiring Management

The following aging effects associated with the Primary Containment components require management:

- Cracking, Blistering, Flaking, Peeling and Delamination
- Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel
- Cumulative Fatigue Damage/Fatigue
- Fretting or Lockup/Mechanical Wear
- Lock-up/ wear
- Loss of Leaktightness/ Mechanical Wear of Locks, Hinges and Closure Mechanisms
- Loss of Material/General, Pitting and Crevice Corrosion
- Loss of Preload/Self-Loosening
- Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)

Aging Management Programs

The following aging management programs manage the aging effects for the Primary Containment components:

- 10 CFR Part 50, Appendix J (B.2.1.30)
- ASME Section XI, Subsection IWE (B.2.1.28)
- One-Time Inspection (B.2.1.22)
- Protective Coating Monitoring and Maintenance Program (B.2.1.34)
- Structures Monitoring Program (B.2.1.32)

- TLAA
- Water Chemistry (B.2.1.2)

Table 3.5.2-7, Summary of Aging Management Evaluation – Primary Containment summarizes the results of the aging management review for the Primary Containment.

3.5.2.1.8 Reactor Building

Materials

The materials of construction for the Reactor Building components are:

- Aluminum
- Aluminum Bolting
- Carbon Steel
- Carbon and Low Alloy Steel Bolting
- Concrete
- Concrete Block
- Elastomers
- Galvanized Steel
- Galvanized Steel Bolting
- Grout
- Reinforced Concrete
- Stainless Steel

Environments

The Reactor Building components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Air/Gas - Dry (Internal)
- Concrete
- Encased in Steel
- Groundwater/Soil
- Raw Water
- Treated Water
- Water - Flowing

Aging Effects Requiring Management

The following aging effects associated with the Reactor Building components require management:

- Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel
- Cracking/Shrinkage
- Cracks and Distortion/Increased Stress Levels from Settlement
- Cumulative Fatigue Damage/Fatigue
- Hardening and Loss of Strength/Elastomer Degradation
- Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack
- Increase in Porosity and Permeability, Loss of Strength /Leaching of Calcium Hydroxide
- Increased Hardness, Shrinkage and Loss of Strength/Weathering
- Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion
- Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw
- Loss of Preload/Self-Loosening
- Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Building components:

- One-Time Inspection (B.2.1.22)
- Structures Monitoring Program (B.2.1.32)
- TLAA
- Water Chemistry (B.2.1.2)

Table 3.5.2-8, Summary of Aging Management Evaluation – Reactor Building summarizes the results of the aging management review for the Reactor Building.

3.5.2.1.9 Service Water Intake Structures

Materials

The materials of construction for the Service Water Intake Structures components are:

- Aluminum
- Aluminum Bolting
- Carbon Steel
- Carbon and Low Alloy Steel Bolting
- Concrete
- Elastomers
- Galvanized Steel
- Galvanized Steel Bolting
- Grout
- Reinforced Concrete
- Treated Wood

Environments

The Service Water Intake Structures components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Concrete
- Encased in Steel
- Groundwater/Soil
- Water - Flowing

Aging Effects Requiring Management

The following aging effects associated with the Service Water Intake Structures components require management:

- Change in Material Properties, Loss of Material/Moisture Damage, Insect Damage
- Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel
- Cracking/Shrinkage
- Cracks and Distortion/Increased Stress Levels from Settlement

- Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack
- Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide
- Loss of Material/Abrasion; Cavitation
- Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion
- Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw
- Loss of Preload/Self-Loosening
- Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)

Aging Management Programs

The following aging management programs manage the aging effects for the Service Water Intake Structures components:

- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants (B.2.1.33)
- Structures Monitoring Program (B.2.1.32)

Table 3.5.2-9, Summary of Aging Management Evaluation – Service Water Intake Structures summarizes the results of the aging management review for the Service Water Intake Structures.

3.5.2.1.10 Shoreline Protection and Dike

Materials

The materials of construction for the Shoreline Protection and Dike components are:

- Carbon Steel
- Soil, rip-rap, sand, gravel

Environments

The Shoreline Protection and Dike components are exposed to the following environments:

- Air - Outdoor
- Concrete
- Groundwater/Soil
- Water - Flowing

Aging Effects Requiring Management

The following aging effects associated with the Shoreline Protection and Dike components require management:

- Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion
- Loss of Material, Loss of Form/Erosion, Settlement, Sedimentation, Frost Action, Waves, Currents, Surface Runoff, Seepage

Aging Management Programs

The following aging management program manages the aging effects for the Shoreline Protection and Dike components:

- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants (B.2.1.33)

Table 3.5.2-10, Summary of Aging Management Evaluation – Shoreline Protection and Dike summarizes the results of the aging management review for the Shoreline Protection and Dike.

3.5.2.1.11 Switchyard

Materials

The materials of construction for the Switchyard components are:

- Aluminum
- Carbon Steel
- Carbon and Low Alloy Steel Bolting
- Concrete
- Concrete Block
- Elastomers
- Galvanized Steel
- Galvanized Steel Bolting
- PVC
- Reinforced concrete

Environments

The Switchyard components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Concrete

- Encased in Steel
- Groundwater/Soil
- Water - Flowing
- Water - Standing

Aging Effects Requiring Management

The following aging effects associated with the Switchyard components require management:

- Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel
- Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment
- Cracks and Distortion/Increased Stress Levels from Settlement
- Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack
- Increase in Porosity and Permeability, Loss of Strength /Leaching of Calcium Hydroxide
- Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion
- Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw
- Loss of Preload/Self-Loosening
- Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)

Aging Management Programs

The following aging management program manages the aging effects for the Switchyard components:

- Structures Monitoring Program (B.2.1.32)

Table 3.5.2.1.11, Summary of Aging Management Evaluation – Switchyard summarizes the results of the aging management review for the Switchyard.

3.5.2.1.12 Turbine Building

Materials

The materials of construction for the Turbine Building components are:

- Aluminum
- Aluminum Bolting
- Carbon Steel

- Carbon and Low Alloy Steel Bolting
- Concrete Block
- Elastomers
- Galvanized Steel
- Galvanized Steel Bolting
- Grout
- Reinforced concrete

Environments

The Turbine Building components are exposed to the following environments:

- Air - Indoor
- Air - Outdoor
- Concrete
- Groundwater/Soil
- Water - Flowing

Aging Effects Requiring Management

The following aging effects associated with the Turbine Building components require management:

- Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel
- Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment
- Cracking/Shrinkage
- Cracks and Distortion/Increased Stress Levels from Settlement
- Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack
- Increase in Porosity and Permeability, Loss of Strength /Leaching of Calcium Hydroxide
- Increased Hardness, Shrinkage and Loss of Strength/Weathering
- Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion
- Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw
- Loss of Preload/Self-Loosening
- Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)

Aging Management Programs

The following aging management program manages the aging effects for the Turbine Building components:

- Structures Monitoring Program (B.2.1.32)

Table 3.5.2-12, Summary of Aging Management Evaluation – Turbine Building summarizes the results of the aging management review for the Turbine Building.

3.5.2.1.13 Yard Structures

Materials

The materials of construction for the Yard Structures components are:

- Carbon Steel
- Carbon and Low Alloy Steel Bolting
- Cast Iron
- Concrete
- Elastomers
- Galvanized Steel
- Galvanized Steel Bolting
- PVC
- Reinforced Concrete
- Stainless Steel

Environments

The Yard Structures components are exposed to the following environments:

- Air - Outdoor
- Concrete
- Encased in Steel
- Groundwater/Soil
- Water - Flowing
- Water - Standing

Aging Effects Requiring Management

The following aging effects associated with the Yard Structures components require management:

- Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel

- Cracks and Distortion/Increased Stress Levels from Settlement
- Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack
- Increase in Porosity and Permeability, Loss of Strength /Leaching of Calcium Hydroxide
- Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion
- Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw
- Loss of Preload/Self-Loosening
- Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)

Aging Management Programs

The following aging management program manages the aging effects for the Yard Structures components:

- Structures Monitoring Program (B.2.1.32)

Table 3.5.2.1.13, Summary of Aging Management Evaluation – Yard Structures summarizes the results of the aging management review for the Yard Structures.

3.5.2.2 AMR Results for Which Further Evaluation is Recommended by the GALL Report

NUREG-1801 provides the basis for identifying those programs that warrant further evaluation by the reviewer in the LRA. For the Containments, Structures, and Component Supports, those programs are addressed in the following subsections.

3.5.2.2.1 PWR and BWR Containments

3.5.2.2.1.1 Aging of Inaccessible Concrete Areas

Increases in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack, and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in inaccessible areas of PWR and BWR concrete and steel containments. The existing program relies on ASME Section XI, Subsection IWL to manage these aging effects. However, the GALL Report recommends further evaluation of plant - specific programs to manage the aging effects for inaccessible areas if the environment is aggressive. Acceptance criteria are described in Branch Technical Position in RLSB-1.

Item Number 3.5.1-1 is not applicable to the Hope Creek Mark I steel containment. The containment is located in the Reactor Building. The indoor environment of the Reactor Building does not subject the containment to an aggressive environment.

The concrete is designed and constructed in accordance with ACI 318-71 and ACI 301-72. Materials used in the design conformed to ASTM specifications that ensure consistent, reliable concrete of the highest quality. The design provides for low permeability and adequate air entrainment (3% - 6%). Air entraining admixtures conform to ASTM C 260, and water reducing and retarding admixtures conform to ASTM C 494 for types A and D. The admixtures do not contain chlorides and mixing water was controlled so as not to contain more than 250 ppm of chlorides nor more than 1000 ppm of sulfates. The cement is Type II, Portland cement conforming to ASTM C-150, with alkali content limited to 0.6 percent by weight. Aggregates conform to the requirements of ASTM C-33 and were tested in accordance with ASTM specifications C 289, and C 295. These requirements meet the intent of ACI 201.2R, Guide to Durable Concrete. Therefore, increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack: and cracking loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel are insignificant and require no aging management. This applies to the concrete foundation for the containment structure and the concrete (i.e., floor slab, RPV pedestal) features within the containment structure.

3.5.2.2.1.2 Cracks and Distortion due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, Cracking and Differential Settlement due to Erosion of Porous Concrete Subfoundations, if Not Covered by Structures Monitoring Program

Cracks and distortion due to increased stress levels from settlement could occur in PWR and BWR concrete and steel containments. Also, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations could occur in all types of PWR and BWR containments. The existing program relies on structures monitoring program to manage these aging effects. Some plants may rely on a de-watering system to lower the site ground water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is within the scope of the applicant's structures monitoring program.

Item Number 3.5.1-2 is not applicable to the Hope Creek Mark I steel containment.

Item Number 3.5.1-3 is not applicable to the Hope Creek Mark I steel containment foundation.

The containment is supported from the Reactor Building foundation and its design does not incorporate porous concrete in the sub-foundation and a de-watering system is not used. The Structures Monitoring Program, B.2.1.32, will be used to manage cracks and distortion due to increase stress level from settlement for the Reactor Building. However this aging mechanism is insignificant for Hope Creek structures because the structures are founded on the Vincetown Formation. Also reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete sub-foundation is not applicable because porous concrete is not used in the foundation design. The Structures Monitoring Program is described in Appendix B.

3.5.2.2.1.3 Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature

Reduction of strength and modulus of concrete due to elevated temperatures could occur in PWR and BWR concrete and steel containments. The implementation of 10 CFR 50.55a and ASME Section XI, Subsection IWL would not be able to identify the reduction of strength and modulus of concrete due to elevated temperature. Subsection CC-3400 of ASME Section III, Division 2, specifies the concrete temperature limits for normal operation or any other long-term period. The GALL Report recommends further evaluation of a plant-specific aging management program if any portion of the concrete containment components exceeds specified temperature limits, i.e., general area temperature greater than 66°C (150°F) and local area temperature greater than 93°C (200°F). Acceptance criteria are described in Branch Technical Position in RLSB-1.

Item Number 3.5.1-4 is not applicable to the Hope Creek Mark I steel containment. The Technical Specification and UFSAR limit the bulk air temperature inside the drywell during normal plant operation to 135^o F, with a maximum local area air temperature of 194^o F above elevation 162'. The bulk air temperature is maintained within the Technical Specification limits by recirculating air through the Drywell Air Cooling System.

Therefore, concrete structural components located in the drywell are not subject to general area temperature greater than 150°F or local area temperature greater 200^o F. Process piping operating at temperatures greater than 200^o F are insulated through the penetrations. The insulation, in combination with compartment air circulation, reduces concrete local area temperature to less than 200^o F. Plant operating experience has not identified elevated general area and local area temperature as a concern for concrete structural components.

3.5.2.2.1.4 Loss of Material due to General, Pitting and Crevice Corrosion

Loss of material due to general, pitting and crevice corrosion could occur in steel elements of accessible and inaccessible areas for all types of PWR and BWR containments. The existing program relies on ASME Section XI, Subsection IWE, and 10 CFR Part 50, Appendix J, to manage this aging effect. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if corrosion is significant. Acceptance criteria are described in Branch Technical Position in RLSB-1.

Hope Creek relies on ASME Section XI, Subsection IWE, B.2.1.28, and 10 CFR Part 50, Appendix J, B.2.1.30, to manage aging of accessible and inaccessible areas of the BWR Mark I Primary Containment pressure retaining elements. Accessible areas are subject to periodic examinations to detect loss of material due to general, pitting and crevice corrosion. Inaccessible areas are examined when they become accessible, or if they are suspected of degradations based on examination of the corresponding accessible areas. As explained below, examinations conducted in accordance with ASME Section XI, Subsection

IWE have not identified significant corrosion in accessible or inaccessible areas of the Hope Creek Primary Containment.

The concrete in contact with the embedded drywell shell and the drywell support skirts meets the specifications of ACI 318-71 and the guidance of ACI 201.2R. Accessible portions of the drywell floor concrete is monitored under the Structures Monitoring Program, B.2.1.32, to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the embedded drywell shell. Water ponding on the containment drywell concrete floor is not common and when detected it is cleaned up in a timely manner.

The current Hope Creek design does not require installation of a moisture barrier at the junction where the inner drywell shell becomes embedded in concrete. Visual inspection of this interface did not identify gaps, cracks, or separation of concrete from the drywell shell that would be a path for potential water leakage intrusion into the embedded shell. Visual examination conducted in accordance with ASME Section XI, Subsection IWE did not identify significant corrosion at the interface. The examiners noted only local surface rust in areas where the drywell shell coating is chipped or damaged as a result of maintenance activities. There were no indications that corrosion is occurring in the drywell shell below the concrete floor.

In 2007 and 2009 Hope Creek conducted ultrasonic testing (UT) measurements of the drywell shell thickness at sample locations above the junction of where the shell becomes embedded in concrete. This area was reported in NRC Information Notice (IN) 2004-01 as susceptible to loss of material due to corrosion. Also, measurements in this area would detect significant loss of material that could be occurring in inaccessible exterior surfaces of the drywell shell, specifically in the “sand-pocket region”. There is no “sand-pocket region” or sand in the concrete foundation transition zone of the drywell shell and the air gap at Hope Creek. UT measurement results showed that, in each case, the measured thickness was greater than the specified nominal drywell shell thickness. The minimum measured thickness was 1.51 inches as compared to the nominal design thickness of 1.5 inches.

However, during the 2009 refuel outage, water was found trickling out of a Reactor Building concrete wall penetration sleeve from the drywell air gap region and ponded on the torus room floor. Analysis of the ponded water identified it as reactor water/refueling water. A review of past UT reading on the upper region, taken in 2007, of the drywell shell in areas of reported water leakage indicates no loss of material of the drywell shell. The water leakage stopped after the refueling cavity was drained at the end of the refueling outage. The suspected source of the water was the refuel bellow or liner. The air gap drains were inspected; there was no blockage or standing water in the air gap region and the drywell shell showed no signs of corrosion. The water leakage issue was entered into the corrective action process to determine cause of the leakage and corrective actions to prevent reoccurrence.

In 2007, Hope Creek also conducted UT measurements of the drywell shell thickness at sample locations in the upper region of the drywell. Areas subject to UT examination include locations where two plates of different thicknesses are welded together to form the drywell shell. The condition of the drywell shell at the interface of the two plates has been of interest to the NRC staff because of the likelihood of moisture collection at the ledge that may be formed by the thicker of the two plates. UT measurement results showed that, in each case, the measured thickness was greater than the specified nominal drywell shell thickness. The results of the UT measurements, the nominal design thickness, and the available margins are tabulated below.

Location	**Nominal Thick. Inch**	**Minimum Measured Thick., Inch**	**Thickness used in ASME Code stress analysis (.063" corrosion allowance)**	**Maximum Ratio** **Design Load/Capacity**
Lower Cylinder	0.9375	0.982	0.875	0.96
Knuckle	2.875	2.911	2.813	0.60
Upper Sphere	1.50	1.580	1.438	0.75
Lower Sphere	1.50	1.511	1.438	0.75

In summary, loss of material due to corrosion is insignificant for Hope Creek drywell shell. Visual examinations conducted in accordance with ASME Section XI, Subsection IWE have not identified corrosion that reduces the shell thickness in accessible areas of the drywell. UT thickness measurements of the shell, at locations that have been identified in the industry as susceptible to corrosion, show that the measured thicknesses are greater than the nominal thickness. Also the conditions that led to significant loss of material in inaccessible areas of the drywell shell are not applicable to Hope Creek Mark I containment. That is, the containment has no "sand-pocket region". Potential leakage of water from the reactor cavity during refueling is removed by the reactor cavity seal rupture drain lines that are monitored by instrumentation designed to alarm in the Main Control Room in the event of leakage. A review of the alarm log for the past refueling outage showed no recorded initiation of the alarms during the refueling outage. There are also drains at the bottom of the air gap region at the junction of where the shell becomes embedded in concrete. In 2009, these drains were inspected; there was no blockage or standing water in the air gap region and the drywell shell showed no signs of corrosion.

In 2006 the NRC issued its final license renewal interim staff guidance LR-ISG-2006-01. This LR-ISG provides interim guidance to applicants for license renewal for a plant with a BWR Mark I steel containment to provide a plant-specific aging management program that addresses the potential loss of material due to corrosion in the inaccessible areas of their Mark I steel containment drywell shell for the period of extended operation. In conducting the aging management review and developing the plant-specific aging management program for the drywell shell, the LR-ISG-2006-01 requires the applicant to consider six (6) recommended actions based upon plant design and operating experience. Hope Creek conducted aging review of inaccessible areas of its Mark I containment considering plant design and operating experience, discussed above. Hope Creek concluded that the following plant-specific activities are required to ensure loss of material in inaccessible areas of the drywell shell is adequately managed or mitigated consistent with the LR-ISG-2006-01 guidance. The activities are:

- Implement a plant design change that installs the moisture barrier at the junction of the drywell concrete floor and the embedded drywell shell. The plant design change will be implemented prior to entering the period of extended operation.
- Monitor the moisture barrier for degradations in accordance with ASME Section XI, Subsection IWE during the period of extended operation.
- Verify that the reactor cavity seal rupture drain lines are clear from blockage once prior to the period of extended operation, and again as a one time inspection during the period of extended operation.
- Verify that drains at the bottom of the drywell air gap are clear from blockage once prior to the period of extended operation, and again as a one-time inspection during the period of extended operation.
- Investigate the source of any leakage detected by the reactor cavity seal rupture drain line instrumentation and to investigate and assess its impact on the drywell shell.
- Monitor the drains at the bottom of the drywell air gap for leakage in the event leakage is detected by the reactor cavity seal rupture drain line instrumentation.

The implementation of ASME Section XI, Subsection IWE, B.2.1.28, and 10 CFR Part 50, Appendix J, B.2.1.30, supplemented by the plant-specific activities describe above provide reasonable assurance that loss of material due to corrosion of the drywell shell will be adequately managed during the period of extended operation such that the intended functions of Mark I containment drywell are maintained consistent with the current licensing basis.

Miscellaneous steel components (catwalks, stairs, handrails, ladders, platforms, etc.) inside the Primary Containment suppression chamber aligned to this line item based on material, environment and aging effect do not perform a primary containment intended function. The components are therefore not in scope of ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J. The Structures Monitoring Program, B.2.1.32, will be substituted to manage loss of material due to general, pitting and crevice corrosion of these components.

The ASME Section XI, Subsection IWE Program, 10 CFR Part 50, Appendix J Program, and the Structures Monitoring Program are described in Appendix B.

Item Number 3.5.1-6 is not applicable to the Hope Creek Mark I steel containment. The Item Number is applicable only to the liner for PWR and BWR concrete containments.

3.5.2.2.1.5 Loss of Prestress due to Relaxation, Shrinkage, Creep, and Elevated Temperature

Loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature for PWR prestressed concrete containments and BWR Mark II prestressed concrete containments is a Time-Limited Aging Analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c).

Item Number 3.5.1-7 is not applicable to the Hope Creek Mark I steel containment. The Item Number is applicable only to PWR and BWR prestressed concrete containments.

3.5.2.2.1.6 Cumulative Fatigue Damage

If included in the current licensing basis, fatigue analyses of suppression pool steel shells (including welded joints) and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) for all types of PWR and BWR containments and BWR vent header, vent line bellows, and downcomers are TLAAs as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c).

At Hope Creek, cumulative fatigue damage of the suppression chamber (torus) shell (including welded joints), and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows), vent header, vent line bellows, and downcomers is a TLAA as defined in 10 CFR 54.3. The TLAA is evaluated in accordance with 10 CFR 54.21(c). Evaluation of this TLAA is discussed in Section 4.6.

3.5.2.2.1.7 Cracking due to Stress Corrosion Cracking (SCC)

Cracking due to stress corrosion cracking of stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds could occur in all types of PWR and BWR containments. Cracking due to SCC could also occur in stainless steel vent line bellows for BWR containments. The existing program relies on ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J to manage this aging effect. The GALL Report recommends further evaluation of additional appropriate examinations/evaluations implemented to detect these aging effects for stainless steel penetration sleeves, penetration bellows and dissimilar metal welds, and stainless steel vent line bellows.

Item Number 3.5.1-10 and Item Number 3.5.1-11 are not applicable to Hope Creek. Stress corrosion cracking (SCC) is not an applicable aging effect/mechanism for the Primary Containment stainless steel penetration sleeves, penetration bellows, vent line bellows, and dissimilar metal welds. The components are located in an Air-Indoor environment and are not subject to conditions that promote SCC. Aging management reviews concluded SCC of stainless steel is not considered credible because stainless steel SCC requires a concentration of chloride or sulfate contaminants, which is not present in significant quantities in this environment at Hope Creek

3.5.2.2.1.8 Cracking due to Cyclic Loading

Cracking due to cyclic loading of suppression pool steel and stainless steel shells (including welded joints) and penetrations (including penetration sleeves, dissimilar metal welds, and penetration bellows) could occur for all types of PWR and BWR containments and BWR vent header, vent line bellows and downcomers. The existing program relies on ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J to manage this aging effect. However, VT-3 visual inspection may not detect fine cracks. The GALL Report recommends further evaluation for detection of this aging effect.

Item Number 3.5.1-12 is not applicable to the Hope Creek containment components: steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers. Fatigue analysis exists in the Hope Creek CLB for these components, thus cracking due to cyclic loading is a TLAA addressed by Item Number 3.5.1-9 and evaluated in paragraph 3.5.2.2.1.6 above.

Item Number 3.5.1-13 is not applicable to the Hope Creek containment components: steel, stainless steel elements, dissimilar metal welds: torus; vent line; vent header; vent line bellows; downcomers. A fatigue analysis exists in the Hope Creek CLB for these components, thus cracking due to cyclic loading is a TLAA addressed by Item Number 3.5.1-8 and evaluated in paragraph 3.5.2.2.1.6 above.

Expansion bellows not associated with containment are located in the Reactor Building and Yard Structures. These bellows have a design specification requirement of 2000 normal cycles. Evaluation of fatigue due cyclic loading for these components shows the projected number of cycles for 60 years is approximately 600 cycles. The number of cycles is 10 cycles per year of operation including refueling operations. Thus, significant cracking of the bellows due to cyclic loading is not expected to occur through the period of extended operation. Furthermore plant operating experience has not identified cracking of bellows as a concern.

3.5.2.2.1.9 Loss of Material (Scaling, Cracking, and Spalling) due to Freeze-Thaw

Loss of material (scaling, cracking, and spalling) due to freeze-thaw could occur in PWR and BWR concrete containments. The existing program relies on ASME Section XI, Subsection IWL to manage this aging effect. The GALL Report recommends further evaluation of this aging effect for plants located in moderate to severe weathering conditions.

Item Number 3.5.1-14 is not applicable to the Hope Creek Mark I steel containment. The Item Number is applicable only to PWR and BWR concrete containments. The containment is supported from and located in the Reactor Building. Thus, repeated freeze-thaw is not applicable, and not subject to loss of material and cracking due to freeze-thaw.

3.5.2.2.1.10 Cracking due to Expansion and Reaction with Aggregate, and Increase in Porosity and Permeability due to Leaching of Calcium Hydroxide

Cracking due to expansion and reaction with aggregate, and increase in porosity and permeability due to leaching of calcium hydroxide could occur in concrete elements of PWR and BWR concrete and steel containments. The existing program relies on ASME Section XI, Subsection IWL to manage these aging effects. The GALL Report recommends further evaluation if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.

Item Number 3.5.1-15 is not applicable to the Hope Creek Mark I steel containment. The Item Number is applicable only to PWR and BWR concrete containments. Additionally, the Hope Creek containment reinforced concrete is designed and constructed to meet ACI and ASTM specifications that meet the intent of ACI 201.2R. The containment is also not subject to a flowing water environment, which would be conducive to leaching of calcium hydroxide. Therefore, managing the effects of cracking due to expansion and reaction with aggregate, and increase in porosity and permeability due to leaching of calcium hydroxide is not required.

3.5.2.2.2 <u>Safety-Related and Other Structures and Component Supports</u>

3.5.2.2.2.1 Aging of Structures Not Covered by Structures Monitoring Program

The GALL Report recommends further evaluation of certain structure/aging effect combinations if they are not covered by the structures monitoring program. This includes (1) cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for Groups 1-5, 7, 9 structures; (2) increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack for Groups 1-5, 7, 9 structures; (3) loss of material due to corrosion for Groups 1-5, 7, 8 structures; (4) loss of material (spalling, scaling) and cracking due to freeze-thaw for Groups 1-3, 5, 7-9 structures; (5) cracking due to expansion and reaction with aggregates for Groups 1-5, 7-9 structures; (6) cracks and distortion due to increased stress levels from settlement for Groups 1-3, 5-9 structures; and (7) reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation for Groups 1-3, 5-9 structures. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the structures monitoring program.

Lock up due to wear could occur for Lubrite® radial beam seats in BWR drywell, RPV support shoes for PWR with nozzle supports, steam generator supports, and other sliding support bearings and sliding support surfaces. The existing program relies on the structures monitoring program or ASME Section XI, Subsection IWF to manage this aging effect. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the ISI (IWF) or structures monitoring program.

At Hope Creek, the Structures Monitoring Program, B.2.1.32 is used to manage aging affects applicable to Groups 1, 3, and 4 structures as discussed below. Group 5, “Fuel Storage Facility”, is included with Group 1 structures. The GALL

Groups 2, 7, 8, and 9 structures do not exist at Hope Creek. The aging management reviews concluded certain concrete aging mechanisms identified in NUREG-1801 are not applicable to some of Group 1, 3, and 4 structures as explained below and require no aging management. However, accessible structures will be monitored for loss of material, cracking, increase in porosity and permeability, and loss of bond through the Structures Monitoring Program, B.2.1.32, regardless of aging mechanisms. The Structures Monitoring Program is described in Appendix B.

(1) *Cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for Groups 1-5, 7, 9 structures*.

At Hope Creek, cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for Groups 1, 3, and 4 structures are monitored by the Structures Monitoring Program, B.2.1.32, and thus further evaluation is not necessary. The Structures Monitoring Program is described in Appendix B.

(2) *Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack for Groups 1-5, 7, 9 structures.*

Item Number 3.5.1-24 is not applicable to Hope Creek interior and above grade exterior concrete of Groups 1, 3, and 4 structures because the structures are not exposed to aggressive chemical attack.

(3) *Loss of material due to corrosion for Groups 1-5, 7, 8 structures*.

At Hope Creek, loss of material due to corrosion for Groups 1, 3, and 4 structures and structural components is managed through the Structures Monitoring Program, B.2.1.32. The Structures Monitoring Program is described in Appendix B.

(4) *Loss of material (spalling, scaling) and cracking due to freeze-thaw for Groups 1-3, 5, 7-9 structures.*

At Hope Creek, loss of material and cracking due to freeze-thaw for Groups 1 and 3 structures are managed through the Structures Monitoring Program, B.2.1.32, and thus a further evaluation is not necessary. The Structures Monitoring Program is described in Appendix B.

(5) *Cracking due to expansion and reaction with aggregates for Groups 1-5, 7-9 structures.*

Item Number 3.5.1-27 is not applicable to Hope Creek Group 1 and 3 structures. Concrete specifications require the use of Type II, low alkali cement. Alkali content is limited to 0.6 percent total alkali and testing of aggregates was performed in accordance with ASTM C289 and C295 to demonstrate no potential for alkali reactivity with the aggregate. The Structures Monitoring Program, B.2.1.32, will be used to manage cracking of reinforced concrete in accessible areas of structures regardless of aging mechanisms. The Structures Monitoring Program is described in Appendix B.

(6) *Cracks and distortion due to increased stress levels from settlement for Groups 1-3, 5-9 structures.*

The Structures Monitoring Program, B.2.1.32, will be used to manage cracks and distortion due to increase stress level from settlement for Groups 1 and 3 structures. However this aging mechanism is insignificant for Hope Creek structures because the structures are founded on dense soil or the Vincetown Formation. Evaluation of pre-construction and post-construction soil explorations, predicted no more than 1.5 inches of settlement for safety-related structures and settlement leveled off soon after construction. The building foundations for the safety-related structures consist of reinforced concrete mats, which bear on dense soil or the Vincetown Formation. Nonsafety-related building foundations for structures that meet 10 CFR 54.4(a)(2) or (a)(3) consist of reinforced concrete slabs supported on piles. Since the magnitude of the total settlements is small, the differential settlements are expected to be smaller, thus settlement distortion is insignificant for Hope Creek structures. A de-watering system is not relied upon to control settlement and porous concrete is not used in the design of sub-foundations. The structures are monitored under the Structures Monitoring Program, B.2.1.32, and thus further evaluation is not necessary. The Structures Monitoring Program is described in Appendix B.

(7) *Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation for Groups 1-3, 5-9 structures*

Item Number 3.5.1-29 is not applicable to Hope Creek, Groups 1 and 3 structures. The structures are not subject to reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation because the structures are not founded on porous concrete subfoundation.

Lock up due to wear could occur for Lubrite® radial beam seats in BWR drywell, RPV support shoes for PWR with nozzle supports, steam generator supports, and other sliding support bearings and sliding support surfaces. The existing program relies on the structures monitoring program or ASME Section XI, Subsection IWF to manage this aging effect. The GALL Report recommends further evaluation only for structure/aging effect combinations that are not within the ISI (IWF) or structures monitoring program.

At Hope Creek, sliding surfaces are provided for supports for radial beam seats in the drywell. The Structures Monitoring Program, B.2.1.32, will be used to manage lock-up due to wear for these sliding surfaces. The Structures Monitoring Program is described in Appendix B.

3.5.2.2.2.2 Aging Management of Inaccessible Areas

1. *Loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas of these Groups of structures for plants located in moderate to severe weathering conditions.*

At Hope Creek, Groups 1 and 3 structures are located in a region where weathering conditions are considered severe as shown in ASTM C33-90, Figure 1. The GALL Groups 2, 5, 7, 8, and 9 structures do not exist at Hope Creek. The loss of material (spalling, scaling) and cracking due to freeze-thaw is applicable to Hope Creek structures. However, these concrete structures are designed and constructed in accordance with ACI 318-71 and ACI 301-72. The design provides for low permeability and adequate air entrainment (3% - 6%) such that the concrete is not susceptible to freeze-thaw aging effects. Concrete mixes have approximately 15 to 30 percent pozzolan by weight as cement replacement. Air entraining admixtures conform to ASTM C 260, and water reducing and retarding admixtures conform to ASTM C 494 for types A and D. The admixtures do not contain chlorides and mixing water was controlled so as not to contain more than 250 ppm of chlorides nor more than 1000 ppm of sulfates. Concrete mix and proportions of ingredients provide required concrete strength, durability, and unit weight while maintaining adequate workability and proper consistency to permit required consolidation without excessive segregation or bleeding. Compression tests conform to ASTM Specifications C 39, C 138, and C 143. These measures provide a concrete with good freeze-thaw resistance.

As described above, the design and construction of reinforced concrete for Group 1 and 3 structures is in accordance with ACI specifications that preclude significant loss of material (spallng, scaling) and cracking due to freeze-thaw. Operating experience review has not identified significant loss of material and cracking due to freeze-thaw of reinforced concrete structures.

Therefore, loss of material (spalling, scaling), and cracking due to freeze-thaw of inaccessible reinforced concrete are insignificant and require no aging management. However, inaccessible reinforced concrete will be inspected if excavated for any reason, as required by Hope Creek Structures Monitoring Program, B.2.1.32. The Structures Monitoring Program is described in Appendix B.

2. *Cracking due to expansion and reaction with aggregates could occur in below-grade inaccessible concrete areas for Groups 1-5 and 7-9 structures. The GALL Report recommends further evaluation of inaccessible areas of these Groups of structures if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.*

   Item Number 3.5.1-27 is not applicable to Hope Creek Groups 1 and 3 structures. Reinforced concrete for Groups 1 and 3 structures is designed in accordance with ACI 318-71 and constructed in accordance with ACI 301-72. The cement is Type II, Portland cement conforming to ASTM C-150, with alkali content limited to 0.6 percent by weight. Aggregates were tested in accordance with ASTM specifications C 289, and C 295. These requirements meet the intent of ACI 201.2R, Guide to Durable Concrete and demonstrate no potential for alkali reactivity for the aggregate.

   As described above, reinforced concrete is designed and constructed to meet ACI and ASTM specifications and meets the intent of ACI 201.2R. Aggregate was tested in accordance with ASTM specifications C 289, and C 295 to demonstrate no potential for alkali reactivity for the aggregate. Thus, cracking due to expansion and reaction with aggregate is not applicable and requires no aging management. However, inaccessible concrete will be inspected for cracking if excavated for any reason, as required by the Hope Creek Structures Monitoring Program, B.2.1.32. The Structures Monitoring Program is described in Appendix B.

3. *Cracks and distortion due to increased stress levels from settlement and reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The existing program relies on structures monitoring program to manage these aging effects. Some plants may rely on a de-watering system to lower the site ground water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.*

   The Structures Monitoring Program, B.2.1.32, will be used to manage cracks and distortion due to increased stress level from settlement for Groups 1 and 3 structures. However this aging mechanism is insignificant for Hope Creek structures because the structures are founded on dense soil or the Vincetown Formation. Evaluation of pre-construction and post-construction soil explorations, predicted no more than 1.5 inches settlement for safety-related structures and settlement leveled off soon after construction. The building foundations for the safety-related structures consist of reinforced concrete mats, which bear on dense soil or the Vincetown Formation. Nonsafety-related building foundations for structures that meet 10 CFR 54.4(a)(3) consist of reinforced concrete slabs supported on concrete piles encased in steel. For those Group 3 structures founded on concrete piles encased in steel, cracks and distortion due to increased stress levels from settlement is not applicable. Since the magnitude of the total settlements is small, the differential settlements are expected to be smaller, thus settlement distortion is insignificant for Hope Creek structures. A de-watering system is not relied upon in Hope Creek CLB to control settlement and porous concrete is not used in the design of sub-foundations. Operating experience review has not identified significant signs of distress due to settlement.

   The Structures Monitoring Program, B.2.1.32, will be used to manage cracks and distortion due to increased stress levels from settlement. Degradation of piles or foundation mats will manifest in settlement distortion or cracking, and accessible concrete examinations will detect cracks and distortion of Groups 1 and 3 structures.

   Studies have shown that steel piles driven into undisturbed natural soil are not appreciably affected by corrosion due to the oxygen deficiency in soil at a few feet below grade. Piles driven into disturbed soil, have been shown to experience only minor to moderate corrosion. In either case the observed loss of material due to corrosion was not considered significant enough to impact the intended function of the piles, which is consistent with NUREG-1557.

The condition of the accessible and above grade concrete are used as an indicator for the condition of the inaccessible and below grade structural components and provides reasonable assurance that degradation of inaccessible structural components will be detected before a loss of an intended function. However inaccessible concrete for Groups 1 and 3 structures will be inspected for cracking and distortion due to settlement if excavated for any reason, as required by the Hope Creek Structures Monitoring Program, B.2.1.32. The Structures Monitoring Program is described in Appendix B.

Item Number 3.5.1-29 is not applicable to Hope Creek, Groups 1 and 3 structures. The structures are not subject to reduction in foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundation because the structures are not founded on porous concrete subfoundation.

4. *Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects in inaccessible areas of these Groups of structures if the environment is aggressive. The acceptance criteria are described in Branch Technical Position RLSB-1.*

At Hope Creek, inaccessible below-grade reinforced concrete for Groups 1 and 3 structures is subject to an aggressive environment. Test results for groundwater and river water samples taken in 2008 and 2009 showed pH limits are above the threshold limit pH > 5.5, and sulfates are lower than the threshold limit sulfates <1500 ppm and this would indicate a non- aggressive environment. Chlorides exceed the threshold limit chlorides < 500 ppm which indicates an aggressive environment. The ground water and river water are considered an aggressive environment due to chloride levels.

Hope Creek will continue periodic ground water testing and will examine exposed portions of the below-grade concrete, when excavated for any reason. Also the results of periodic inspections of the submerged portions of the Service Water Intake Structure will be used as indicators for the condition of below-grade structures. Because groundwater chemistry is bounded by river water chemistry, the use of submerged structures as a leading indicator for the potential degradation of below-grade structures provides reasonable assurance that degradation of inaccessible structures will be detected before a loss of an intended function. In the event inspection of submerged structures identify significant concrete degradations at the Service Water Intake Structure, corrective actions will be initiated to evaluate the condition of inaccessible groups 1 and 3 structures and determine if excavation of concrete for inspection is warranted. Operating experience review has not identified significant signs of distress due to aggressive chemical attack or corrosion of embedded steel of submerged reinforced concrete components.

Therefore, increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in below-grade inaccessible concrete. These aging effects will be monitored for submerged reinforced concrete components and used as a leading indicator for the potential degradation to below-grade structures. If the aging effects are significant for submerged structures, corrective actions will be initiated to evaluate inaccessible concrete and determine if excavation to exposure and inspect the concrete is warranted. In addition Hope Creek will inspect inaccessible reinforced concrete if excavated for any reason, and monitor groundwater chemistry periodically as required by the Structures Monitoring Program, B.2.1.32. The Structures Monitoring Program is described in Appendix B.

5. *Increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide could occur in below-grade inaccessible concrete areas of Groups 1-3, 5 and 7-9 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas of these Groups of structures if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.*

   Leaching of calcium hydroxide is applicable for a flowing water environment, which may occur to a limited extent in accessible or inaccessible portions of Groups 1 and 3 structures. Operating experience at Hope Creek has found that increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide, is not significant and is adequately managed by the Structures Monitoring Program, B.2.1.32.

   At Hope Creek, the Portland cement conforms to ASTM C 150, Type II and 15 to 30 percent pozzolan was used in the concrete batch design. The use of Type II cement and pozzolan results in concrete resistant to the aging effect increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide. Hope Creek reinforced concrete is designed and constructed to meet ACI and ASTM Specifications that meets the intent of ACI 201.2R, cement and additives have been established to produce durable concrete. Therefore, managing the aging effect of increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide are not required for concrete in inaccessible areas in Groups 1 and 3 structures. However, Hope Creek will continue periodic groundwater testing and will examine exposed portions of the below-grade concrete, when excavated for any reason in accordance with the Structures Monitoring Program. The Structures Monitoring Program is described in Appendix B.

3.5.2.2.2.3 Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature

Reduction of strength and modulus of concrete due to elevated temperatures could occur in PWR and BWR Group 1-5 concrete structures. For any concrete elements that exceed specified temperature limits, further evaluations are recommended. Appendix A of ACI 349-85 specifies the concrete temperature limits for normal operation or any other long-term period. The temperatures shall not exceed 150°F except for local areas, which are allowed to have increased temperatures not to exceed 200°F. The GALL Report recommends further evaluation of a plant-specific *program if any portion of the safety-related and other concrete structures exceeds specified temperature limits, i.e., general area temperature greater than 66°C (150°F) and local area temperature greater than 93°C (200°F). The acceptance criteria are described in Branch Technical Position RLSB-1.*

Item Number 3.5.1-33 is not applicable to Hope Creek. Group 1 and 3 concrete structures are not subject to general area temperature greater than 150°F. Group 1 structures (Reactor Building) are subject to normal indoor air with temperatures not greater than 120° F and outdoor design temperature of 94° F. Group 3 structures are exposed to normal indoor air temperatures not greater than 115° F. Group 4 structures are exposed to normal indoor air temperature inside the drywell. The Technical Specification and UFSAR limit the bulk air temperature inside the drywell during normal plant operation to 135° F, with a maximum local area air temperature of 194° F above elevation 162'. The bulk air temperature is maintained within the Technical Specification limits by recirculating air through the Drywell Air Cooling System. Group 5 structures, i.e., refuel floor and spent fuel storage pool, are part of the Reactor Building and are exposed to normal indoor air temperatures not greater than 104° F. The spent fuel storage pool water temperature is maintained at a maximum of 135° F under normal plant operating conditions.

Group 1, 3 and 4 concrete structural components are not subject to local temperature greater 200° F. Process piping operating at temperatures greater than 200° F is insulated through penetrations. The insulation in combination with compartment air circulation reduces concrete local temperature to less than 200° F. Plant operating experience has not identified elevated general and local temperature as a concern for concrete structural components.

3.5.2.2.2.4 Aging Management of Inaccessible Areas for Group 6 Structures

The GALL Report recommends further evaluation for inaccessible areas of certain Group 6 structure/aging effect combinations as identified below, whether or not they are covered by inspections in accordance with the GALL Report, Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC / US Army Corp of Engineers dam inspections and maintenance.

1. *Increase in porosity and permeability, cracking, loss of material (spalling, scaling)/ aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling)/ corrosion of embedded steel could occur in below-grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects in inaccessible areas if the environment is aggressive. The acceptance criteria are described in Branch Technical Position RLSB-1.*

   At Hope Creek, RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, B.2.1.33, will be used to manage increase in porosity and permeability, cracking, loss of material due to aggressive chemical attack; cracking, loss of bond, and loss of material due to corrosion of embedded steel in accessible areas of water-control structures (Group 6 structures). Evaluation of inaccessible areas follows.

Inaccessible below-grade reinforced concrete for Group 6 structures is subject to an aggressive environment. Test results for groundwater and river water samples taken in 2008 and 2009 showed pH limits are above the threshold limit pH > 5.5, and sulfates are lower than the threshold limit sulfates <1500 ppm and this would indicate a non- aggressive environment. Chlorides exceed the threshold limit chlorides < 500 ppm which indicates an aggressive environment. The ground water and river water are considered aggressive environments due to chloride levels.

Hope Creek will continue periodic groundwater testing and will examine exposed portions of the below-grade concrete, when excavated for any reason. Also the results of periodic inspections of the submerged portions of the Service Water Intake Structure will be used as indicators for the condition of below-grade structures. Because groundwater chemistry is bounded by river water chemistry, the use of submerged structures as a leading indicator for potential degradation of below-grade structures provides reasonable assurance that degradation of inaccessible structures will be detected before a loss of an intended function. In the event inspection of submerged structures identify significant concrete degradations at the Service Water Intake Structure, corrective actions will be initiated to evaluate the condition of inaccessible Group 6 structures and determine if excavation of concrete for inspection is warranted. Operating experience review has not identified significant signs of distress due to aggressive chemical attack or corrosion of embedded steel of submerged concrete components.

Therefore, increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack; and cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel could occur in below-grade inaccessible concrete. These aging effects will be monitored for submerged concrete components and used as a leading indicator for the potential degradation to below-grade concrete structures. If the aging effects are significant for submerged concrete structures, corrective actions will be initiated to evaluate inaccessible concrete and determine if excavation to exposure and inspect the concrete is warranted. In addition, Hope Creek will inspect inaccessible concrete if excavated for any reason in accordance with RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, B.2.1.33. Groundwater chemistry will be periodically monitored as required by the Structures Monitoring Program, B.2.1.32. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, and the Structures Monitoring Programs consists of periodic visual inspections, by qualified individuals, to identify and evaluate degradations of structures and components due to concrete deterioration such that there is no loss of structure or component intended function. This will ensure that the design basis remains valid through the period of extended operation. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, and the Structures Monitoring Program are described in Appendix B.

Components in the Service Water System have been aligned to this item number based on material, environment and aging effect. The Buried Non-Steel Piping Inspection program, B.2.2.4, will be substituted to manage increase in porosity and permeability, cracking, loss of material due to aggressive chemical attack for reinforced concrete piping and fittings for this system. The Buried Non-Steel Piping Inspection program manages the buried piping and components that are not included in the Buried Piping Inspection program. The Buried Non-Steel Piping Inspection program manages piping and components that are exposed an external soil environment for cracking, loss of bond, increase in porosity and permeability and loss of material. These aging effects will be monitored and identified through visual inspections of the external surfaces of the piping and components. Inspection of buried components identifies coating degradation, if coated, or base metal corrosion, if uncoated. These inspections assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions. The Buried Non-Steel Piping Inspection program is described in Appendix B.

2. *Loss of material (spalling, scaling) and cracking due to freeze-thaw could occur in below-grade inaccessible concrete areas of Group 6 structures. The GALL Report recommends further evaluation of this aging effect for inaccessible areas for plants located in moderate to severe weathering conditions.*

   At Hope Creek, RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, B.2.1.33, will be used to manage loss of material (spalling, scaling) and cracking due to freeze-thaw in accessible areas of water-control structures (Group 6 structures). Evaluation of inaccessible areas follows.

   Hope Creek is located in severe weathering conditions. As a result loss of material (spalling, scaling) and cracking due to freeze-thaw are applicable to Group 6 structures. However, these concrete structures are designed and constructed in accordance with ACI 318-71 and ACI 301-72. The design provides for low permeability and adequate air entrainment (3% - 6%) such that the concrete is not susceptible to freeze-thaw aging effects. Concrete mixes have approximately 15 to 30 percent pozzolan by weight as cement replacement. Air entraining admixtures conform to ASTM C 260, and water reducing and retarding admixtures conform to ASTM C 494 for types A and D. Mixing water was controlled so as not to contain more than 250 ppm of chlorides or 1000 ppm of sulfates. Concrete mix and proportions of ingredients provide required concrete strength, durability, and unit weight while maintaining adequate workability and proper consistency to permit required consolidation without excessive segregation or bleeding. Compression tests conform to ASTM Specifications C 39, C 138, and C 143. The specified compressive strength for structural concrete of Group 6 structures is 4000 psi at 90 days. These measures provide a concrete with good freeze-thaw resistance.

   As described above, the design and construction of reinforced concrete for Group 6 structures is in accordance with ACI specifications that preclude significant loss of material (spallng, scaling) and cracking due to freeze-thaw.

Operating experience review has not identified significant loss of material and cracking of reinforced concrete in Group 6 structures.

Therefore, loss of material (spalling, scaling), and cracking due to freeze-thaw of inaccessible reinforced concrete are insignificant and require no aging management. However, inaccessible reinforced concrete will be inspected if excavated for any reason, as required by the Hope Creek Structures Monitoring Program, B.2.1.32. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, and the Structures Monitoring Program are described in Appendix B.

3. *Cracking due to expansion and reaction with aggregates and increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide could occur in below-grade inaccessible reinforced concrete areas of Group 6 structures. The GALL Report recommends further evaluation of inaccessible areas if concrete was not constructed in accordance with the recommendations in ACI 201.2R-77.*

Item Number 3.5.1-36 is not applicable to Hope Creek. Concrete specifications require Type II; low alkali cement shall be used. Alkali content is limited to 0.6 percent total alkali and testing of aggregates performed in accordance with ASTM C 289 and C 295 demonstrate no potential for alkali reactivity for the aggregate, see discussion below.

For Item Number 3.5.1-37, RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, B.2.1.33, will be used at Hope Creek to manage loss of strength due to leaching of calcium hydroxide of reinforced concrete components that have a flowing water environment in accessible and inaccessible areas of water-control structures (Group 6 structures). Leaching is a potential aging mechanism applicable to submerged portions of Group 6 structures exposed to flowing water. These areas are accessible for inspections when dewatered. Evaluation of inaccessible areas follows.

Reinforced concrete for Hope Creek Group 6 structures is designed in accordance with ACI 318-71 and constructed in accordance with ACI 301-72. The Cement is Type II, Portland cement conforming to ASTM C-150, with alkali content limited to 0.6 percent by weight. Fine and coarse aggregates conform to ASTM C 33. Concrete mixes have approximately 15 to 30 percent pozzolan by weight as cement replacement. Air-entraining admixtures conform to ASTM C 260, and water reducing and retarding admixtures conform to ASTM C 494 for types A and D. Mixing water was controlled so as not to contain more than 250 ppm of chlorides or 1000 ppm of sulfates. Concrete mix and proportions of ingredients provide required concrete strength, durability, and unit weight while maintaining adequate workability and proper consistency to permit required consolidation without excessive segregation or bleeding. Aggregates were tested in accordance with ASTM Specifications C 40, C 88, C 127, C 128, C 131, C 289, and C 295. Compression tests conform to ASTM specifications C 39, C 138, and C 143. The specified compressive strength for structural concrete of Group 6 structures is 4000 psi at 90 days. These requirements meet the intent of ACI 201.2R, Guide to Durable Concrete.

As described above, reinforced concrete for Group 6 structures is designed and constructed to meet ACI and ASTM specifications and meets the intent of ACI 201.2R. Aggregate was tested in accordance with ASTM specifications C 289, and C 295 to confirm no reaction with aggregates. Thus, further evaluation of inaccessible areas is not necessary for these aging effects.

Therefore, concrete aging effects of cracking due to expansion and reaction with aggregates and increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide are insignificant and require no aging management for inaccessible concrete. Periodic inspection of submerged reinforced concrete components will be used as a leading indicator for inaccessible concrete. Inaccessible concrete will also be inspected if excavated for any reason, as required by the Hope Creek Structures Monitoring Program, B.2.1.32. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, and the Structures Monitoring Program are described in Appendix B.

3.5.2.2.2.5 Cracking due to Stress Corrosion Cracking and Loss of Material due to Pitting and Crevice Corrosion

Cracking due to stress corrosion cracking and loss of material due to pitting and crevice corrosion could occur for Group 7 and 8 stainless steel tank liners exposed to standing water. The GALL Report recommends further evaluation of plant-specific programs to manage these aging effects.

Item Number 3.5.1-38 is not applicable. Hope Creek does not have Group 7 and 8 structures.

3.5.2.2.2.6 Aging of Supports Not Covered by Structures Monitoring Program

The GALL Report recommends further evaluation of certain component support/aging effect combinations if they are not covered by the structures monitoring program. This includes (1) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; (2) loss of material due to general and pitting corrosion, for Groups B2-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program.

At Hope Creek, (1) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports, (2) loss of material for Groups B2-B5 supports, and (3) reduction/loss of isolation function due to degradation of vibration isolation elements for Group B4 supports are covered under the Structures Monitoring Program, B.2.1.32. The Structures Monitoring Program is described in Appendix B.

3.5.2.2.2.7 Cumulative Fatigue Damage due to Cyclic Loading

Fatigue of component support members, anchor bolts, and welds for Groups B1.1, B1.2, and B1.3 component supports is a TLAA as defined in 10 CFR 54.3 only if a

CLB fatigue analysis exists. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis," of this SRP-LR.

Item Number 3.5.1-42 is not applicable to Hope Creek. Hope Creek current licensing basis contains no fatigue analysis for component supports members, anchor bolts, and welds of Groups B1.1, B1.2, and B1.3 component supports. Therefore, a TLAA is not required to be evaluated in accordance with 10 CFR 54.21(c) for these components.

3.5.2.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

QA provisions applicable to license renewal are discussed in Section B.1.3

3.5.2.3 Time-Limited Aging Analysis

The time-limited aging analyses identified below are associated with the Containments, Structures and Components:

- Section 4.5, Loss of Prestress in Concrete Containment Tendons
- Section 4.6, Fatigue of Primary Containment, Attached Piping, and Components.

3.5.3 CONCLUSION

The Primary Containment, Structures, Component Supports, and Piping and Component Insulation components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Primary Containment, Structures, Component Supports, and Piping and Component Insulation components are identified in the summaries in Section 3.5.2.1 above.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the conclusions provided in Appendix B, the effects of aging associated with the Primary Containment, Structures, Component Supports, and Piping and Component Insulation components will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-1	Concrete elements: walls, dome, basemat, ring girder, buttresses, containment (as applicable)	Aging of accessible and inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	ISI (IWL) and for inaccessible concrete, an examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant specific program is to be evaluated if environment is aggressive.	Yes, plant-specific, if the environment is aggressive	Not Applicable. It is not applicable to the Hope Creek Mark I steel containment. The containment is located in the Reactor Building. The indoor environment of the Reactor Building does not subject the containment to an aggressive environment. Also, Hope Creek containment reinforced concrete is designed and constructed to meet ACI and ASTM specifications that meets the intent of ACI 201.2R. Inaccessible concrete areas of the Reactor Building is addressed by Item Number 3.5.1-31 and Item Number 3.5.1-23 address Group 4 concrete. See Subsection 3.5.2.2.1.1.
3.5.1-2	Concrete elements; All	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if not within the scope of the applicant's structures monitoring program or a de-watering system is relied upon	Not Applicable. It is not applicable to the Hope Creek Mark I steel containment. The containment is supported from the Reactor Building foundation and its design does not incorporate a de-watering system. The Structures Monitoring Program, B.2.1.32, will be used to manage cracks and distortion due to increase stress level from settlement for the Reactor Building. See Subsection 3.5.2.2.1.2.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-3	Concrete elements: foundation, sub-foundation	Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program If a de-watering system is relied upon for control of erosion of cement from porous concrete subfoundations, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if not within the scope of the applicant's structures monitoring program or a de-watering system is relied upon	Not Applicable. This aging effect/mechanism does not apply to the Hope Creek Mark I steel containment concrete foundation and sub-foundation. The foundation design does not incorporate porous concrete and a de-watering system is not used. See Subsection 3.5.2.2.1.2.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-4	Concrete elements: dome, wall, basemat, ring girder, buttresses, containment, concrete fill-in annulus (as applicable)	Reduction of strength and modulus of concrete due to elevated temperature	A plant-specific aging management program is to be evaluated	Yes, plant-specific if temperature limits are exceeded	Not Applicable. It is not applicable to the Hope Creek Mark I steel containment. The containment concrete structural components are not subject to elevated temperature. The Technical Specification and UFSAR limit the bulk air temperature inside the Drywell during normal plant operation to 135^{o} F, with a maximum local area air temperature of 194 ^{o} F above elevation 162'. The bulk air temperature is maintained within the Technical Specification limits by recirculating air through the Drywell Air Cooling System. See Subsection 3.5.2.2.1.3.
3.5.1-5	Steel elements: Drywell; torus; drywell head; embedded shell and sand pocket regions; drywell support skirt; torus ring girder; downcomers; liner plate, ECCS suction header, support skirt, region shielded by diaphragm floor,	Loss of material due to general, pitting and crevice corrosion	ISI (IWE), and 10 CFR Part 50, Appendix J.	Yes, if corrosion is significant for inaccessible areas	Consistent with NUREG-1801. The ASME Section XI, Subsection IWE, B.2.1.28, and 10 CFR Part 50, Appendix J, B.2.1.30, will be used to manage loss of material due to general, pitting and crevice corrosion of steel elements of the drywell, torus, drywell head, embedded shell, drywell support skirt, torus ring girders, downcomers, torus vent line, vent header, penetration seals and closure components. Corrosion is not significant for inaccessible areas of the Hope Creek Mark I containment. The design has no "sand bed region", and water intrusion has not been detected at the air gap drains between the Reactor Building concrete and the drywell shell. Miscellaneous steel components (catwalks, stairs,

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	suppression chamber (as applicable)				handrails, ladders, platforms, etc.) inside the Primary Containment suppression chamber have been aligned to this line item based on material, environment and aging effect. The Structures Monitoring Program will be substituted to manage loss of material due to general, pitting and crevice corrosion of these components. See Subsection 3.5.2.2.1.4.
3.5.1-6	Steel elements: steel liner, liner anchors, integral attachments	Loss of material due to general, pitting and crevice corrosion	ISI (IWE), and 10 CFR Part 50, Appendix J.	Yes, if corrosion is significant for inaccessible areas	Not Applicable. This is applicable only to the liner for PWR and BWR concrete containments. It is not applicable to the Hope Creek Mark I steel containment. See Subsection 3.5.2.2.1.4.
3.5.1-7	Prestressed containment tendons	Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Not Applicable. This is applicable only to PWR and BWR prestressed concrete containments. It is not applicable to the Hope Creek Mark I steel containment. See Subsection 3.5.2.2.1.5.
3.5.1-8	Steel and stainless steel elements: vent line, vent header, vent line bellows; downcomers;	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue is a TLAA; further evaluation is documented in Subsection 3.5.2.2.1.6.
3.5.1-9	Steel, stainless steel elements,	Cumulative fatigue damage	TLAA, evaluated in accordance with 10	Yes, TLAA	Fatigue is a TLAA; further evaluation is documented in Subsection 3.5.2.2.1.6.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers	(CLB fatigue analysis exists)	CFR 54.21(c)		
3.5.1-10	Stainless steel penetration sleeves, penetration bellows, dissimilar metal welds	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examinations/evaluations for bellows assemblies and dissimilar metal welds.	Yes, detection of aging effects is to be evaluated	Not Applicable. Stress corrosion cracking (SCC) is not an applicable aging effect/mechanism for the Primary Containment stainless steel penetration sleeves, penetration bellows, and dissimilar metal welds. The components are located in an air-indoor environment. Aging management reviews concluded SCC of stainless steel is not considered credible because stainless steel SCC requires a concentration of chloride or sulfate contaminants, which is not present in significant quantities in this environment at Hope Creek. See Subsection 3.5.2.2.1.7.
3.5.1-11	Stainless steel vent line bellows,	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J, and additional appropriate examination/evaluation for bellows assemblies and	Yes, detection of aging effects is to be evaluated	Not Applicable. Stress corrosion cracking (SCC) is not an applicable aging effect/mechanism for the vent line stainless steel bellows. The bellows are located in an air-indoor environment. Aging management reviews concluded SCC of stainless steel is not considered credible because stainless steel SCC requires a concentration of chloride or sulfate contaminants, which is not present in

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
			dissimilar metal welds.		significant quantities in this environment at Hope Creek. See Subsection 3.5.2.2.1.7.
3.5.1-12	Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J, and supplemented to detect fine cracks	Yes, detection of aging effects is to be evaluated	Not Applicable. Fatigue analysis exists in the Hope Creek CLB for these containment elements. Therefore cracking due to cyclic loading is a TLAA addressed by Item Number 3.5.1-9. Expansion bellows not associated with the containment are located in the Reactor Building and Yard Structures. These bellows have a design specification requirement of 2000 normal cycles. Evaluation of fatigue due to cyclic loading for these components shows the projected number of cycles for 60 years is less than the design cycles. Thus, significant cracking of the bellows due to cyclic loading is not expected to occur through the period of extended operation. Furthermore plant operating experience has not identified cracking of bellows as a concern. See Subsection 3.5.2.2.1.8
3.5.1-13	Steel, stainless steel elements, dissimilar metal welds: torus; vent line; vent header; vent line bellows; downcomers	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J, and supplemented to detect fine cracks	Yes, detection of aging effects is to be evaluated	Not Applicable. Fatigue analysis exists in the Hope Creek CLB for steel, stainless steel elements, dissimilar metal welds, torus vent line, vent header, vent line bellows, downcomers. Therefore cracking due to cyclic loading is a TLAA addressed by Item Number 3.5.1-8. See Subsection 3.5.2.2.1.8.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-14	Concrete elements: dome, wall, basemat ring girder, buttresses, containment (as applicable)	Loss of material (Scaling, cracking, and spalling) due to freeze-thaw	ISI (IWL). Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557).	Yes, for inaccessible areas of plants located in moderate to severe weathering conditions	Not Applicable. This is applicable only to PWR and BWR concrete containments. It is not applicable to the Hope Creek Mark I steel containment. See Subsection 3.5.2.2.1.9.
3.5.1-15	Concrete elements: walls, dome, basemat, ring girder, buttresses, containment, concrete fill-in annulus (as applicable).	Cracking due to expansion and reaction with aggregate; increase in porosity, permeability due to leaching of calcium hydroxide	ISI (IWL) for accessible areas. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R.	Yes, if concrete was not constructed as stated for inaccessible areas	Not Applicable. This is applicable only to PWR and BWR concrete containments. It is not applicable to the Hope Creek Mark I steel containment. Also Hope Creek containment reinforced concrete is designed and constructed to meet ACI and ASTM specifications that meets the intent of ACI 201.2R. See Subsection 3.5.2.2.1.10.
3.5.1-16	Seals, gaskets, and moisture barriers	Loss of sealing and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers (caulking,	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Consistent with NUREG-1801. The ASME Section XI, Subsection IWE, B.2.1.28 will be used to manage loss of sealing of the containment moisture barrier (caulk) during period of extended operation, and 10 CFR Part 50, Appendix J, B.2.1.30, will be used to manage loss of sealing and leakage through containment due to deterioration of seals and gaskets.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
		flashing, and other sealants)			
3.5.1-17	Personnel airlock, equipment hatch and CRD hatch locks, hinges, and closure mechanisms	Loss of leak tightness in closed position due to mechanical wear of locks, hinges and closure mechanisms	10 CFR Part 50, Appendix J and Plant Technical Specifications	No	Consistent with NUREG-1801. The 10 CFR Part 50, Appendix J, B.2.1.30, and Technical Specifications, will be used to manage loss of leak tightness in closed position due to mechanical wear of locks, hinges, closure mechanisms and other components.
3.5.1-18	Steel penetration sleeves and dissimilar metal welds; personnel airlock, equipment hatch and CRD hatch	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J.	No	Consistent with NUREG-1801. The ASME Section XI, Subsection IWE, B.2.1.28, and 10 CFR Part 50, Appendix J, B.2.1.30, will be used to manage loss of material due to general, pitting and crevice corrosion of Primary Containment steel penetration sleeves, dissimilar metal welds, personnel airlock, equipment hatch, and CRD hatch.
3.5.1-19	Steel elements: stainless steel suppression chamber shell (inner surface)	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Not Applicable. Hope Creek is a Mark I steel containment. The suppression chamber (Torus) shell inner surface is carbon steel and has no stainless steel elements.
3.5.1-20	Steel elements: suppression chamber liner (interior	Loss of material due to general, pitting, and crevice	ISI (IWE) and 10 CFR Part 50, Appendix J	No	Not Applicable. This is applicable only to BWR concrete containments with suppression chamber steel liner. It is not applicable to the Hope Creek Mark I steel containment.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	surface)	corrosion			
3.5.1-21	Steel elements: drywell head and downcomer pipes	Fretting or lock up due to mechanical wear	ISI (IWE)	No	Consistent with NUREG-1801. The ASME Section XI, Subsection IWE, B.2.1.28, will be used to manage fretting or lock up due to mechanical wear of the drywell head and downcomers.
3.5.1-22	Prestressed containment: tendons and anchorage components	Loss of material due to corrosion	ISI (IWL)	No	Not Applicable. The Hope Creek Primary Containment is a Mark I steel containment. It is not a prestressed concrete containment with tendons and anchorage components.
3.5.1-23	All Groups except Group 6: interior and above grade exterior concrete	Cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel	Structures Monitoring Program	Yes, if not within the scope of the applicant's structures monitoring program	Consistent with NUREG-1801. The Structures Monitoring Program, B.2.1.32, will be used to manage cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for interior and above grade exterior concrete components. Applicable structural groups for Hope Creek are Groups 1, 3, and 4 structures. Components in the Fire Protection system have been aligned to this item number based on material, environment and aging effect. The Fire Protection Program, B.2.1.17, will be added to manage cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for concrete components for this system. See Subsection 3.5.2.2.2.1
3.5.1-24	All Groups	Increase in	Structures	Yes, if not within	Not Applicable. The component, material,

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	except Group 6: interior and above grade exterior concrete	porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack	Monitoring Program	the scope of the applicant's structures monitoring program	environment, and aging effect/mechanism combination does not apply. Hope Creek does not have an aggressive chemical environment for interior and above-grade exterior concrete components. See Subsection 3.5.2.2.2.1.
3.5.1-25	All Groups except Group 6: steel components: all structural steel	Loss of material due to corrosion	Structures Monitoring Program. If protective coatings are relied upon to manage the effects of aging, the structures monitoring program is to include provisions to address protective coating monitoring and maintenance.	Yes, if not within the scope of the applicant's structures monitoring program	Consistent with NUREG-1801. The Structures Monitoring Program, B.2.1.32, will be used to manage loss of material due to corrosion of structural steel components including bolting in Groups 1, 3, and 4 structures. Protective coatings are not credited for managing the effects of aging of steel components. Coatings inside the Primary Containment are credited to maintain adhesion to protect against failure of the coating which may block the suction strainers. The Protective Coating Monitoring and Maintenance Program, B.2.1.34, aging management program will manage the aging of coatings inside the Primary Containment. See Subsection 3.5.2.2.2.1.
3.5.1-26	All Groups except Group 6: accessible and inaccessible concrete: foundation	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Structures Monitoring Program. Evaluation is needed for plants that are located in moderate to severe	Yes, if not within the scope of the applicant's structures monitoring program (See subsection 3.5.2.2.2.1) or for	Consistent with NUREG-1801. The Structures Monitoring Program, B.2.1.32, will be used to manage loss of material (spalling, scaling) and cracking due to freeze-thaw for accessible concrete foundations.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
			weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557).	inaccessible areas of plants located in moderate to severe weathering conditions (See subsection 3.5.2.2.2.2.1)	See Subsection 3.5.2.2.2.1. Further Evaluation of inaccessible areas is provided in Subsection 3.5.2.2.2.2.1
3.5.1-27	All Groups except Group 6: accessible and inaccessible interior/exterior concrete	Cracking due to expansion due to reaction with aggregates	Structures Monitoring Program. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes, if not within the scope of the applicant's structures monitoring program (See subsection 3.5.2.2.2.1) or concrete was not constructed as stated for inaccessible areas (See subsection 3.5.2.2.2.2)	Not Applicable. The aging effect/mechanism does not apply to Hope Creek Group 1 and 3 structures. Concrete specifications required the use of Type II, low alkali cement. Alkali content is limited to 0.6 percent total alkali and testing of aggregates was performed in accordance with ASTM C 289 and C 295 to demonstrate no potential for alkali reactivity with the aggregate. The Structures Monitoring Program, B.2.1.32, will be used to manage cracking of reinforced concrete in accessible areas of structures regardless of aging mechanism. See Subsection 3.5.2.2.2.1. Further evaluation of inaccessible areas is provided in Subsection 3.5.2.2.2.2.2.
3.5.1-28	Groups 1-3, 5-9: All	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to	Yes, if not within the scope of the applicant's structures monitoring program (See subsection 3.5.2.2.2.1) or a de-watering system	Consistent with NUREG-1801. The Structures Monitoring Program, B.2.1.32, will be used to manage cracks and distortion due to increased stress levels from settlement for structures founded on soil. Hope Creek design does not employ a de-watering system to control settlement. Components in the Fire Protection system have

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
			ensure proper functioning of the de-watering system through the period of extended operation.	is relied upon (See subsection 3.5.2.2.2.2.3)	been aligned to this item number based on material, environment and aging effect. The Fire Protection Program, B.2.1.17, will be added to manage cracks and distortion due to increased stress levels from settlement for concrete components for this system. See Subsections 3.5.2.2.2.1 and 3.5.2.2.2.2.3.
3.5.1-29	Groups 1-3, 5-9: foundation	Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if not within the scope of the applicant's structures monitoring program (See subsection 3.5.2.2.2.1) or a de-watering system is relied upon (See subsection 3.5.2.2.2.2.3)	Not Applicable. Hope Creek design does not employ a de-watering system to control settlement and does not include porous concrete subfoundations. See Subsections 3.5.2.2.2.1 and 3.5.2.2.2.2.3.
3.5.1-30	Group 4: Radial beam seats in BWR drywell; RPV support shoes for PWR with nozzle supports; Steam generator	Lock-up due to wear	ISI (IWF) or Structures monitoring Program	Yes, if not within the scope of ISI or structures monitoring program	Consistent with NUREG-1801. The Structures Monitoring Program, B.2.1.32, will be used to manage lock-up due to wear for supports for the radial beam seats in the drywell. See Subsection 3.5.2.2.2.1.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	supports				
3.5.1-31	Groups 1-3, 5, 7-9: below-grade concrete components, such as exterior walls below grade and foundation	Increase in porosity and permeability, cracking, loss of material (spalling, scaling)/ aggressive chemical attack; Cracking, loss of bond, and loss of material (spalling, scaling)/ corrosion of embedded steel	Structures Monitoring Program; Examination of representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant specific program is to be evaluated if environment is aggressive.	Yes, plant-specific, if environment is aggressive	Consistent with NUREG-1801. The Structures Monitoring Program, B.2.1.32, will be used to manage increase in porosity and permeability, cracking, loss of material (spalling, scaling)/ aggressive chemical attack; cracking, loss of bond, and loss of material (spalling, scaling)/corrosion of embedded steel in accessible areas. A representative sample of below-grade concrete will be inspected, if excavated for any reason, and periodic groundwater monitoring will be done as required by the Structures Monitoring Program, B.2.1.32. See subsection 3.5.2.2.2.2.4 Components in the Service Water System have been aligned to this item number based on material, environment and aging effect. The Buried Non-Steel Piping Inspection Program, B.2.2.4, will be substituted to manage cracking, loss of bond, and loss of material (spalling, scaling)/ corrosion of embedded steel for reinforced concrete piping and fittings for this system.
3.5.1-32	Groups 1-3, 5, 7-9: exterior above and below grade reinforced concrete foundations	Increase in porosity and permeability, and loss of strength due to leaching of calcium	Structures monitoring Program for accessible areas. None for inaccessible areas if concrete was	Yes, if concrete was not constructed as stated for inaccessible areas	Consistent with NUREG-1801. The Structures Monitoring Program, B.2.1.32, will be used to manage Increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide in accessible areas. Hope Creek may have a flowing water environment in accessible or in inaccessible areas of exterior below grade

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
		hydroxide	constructed in accordance with the recommendations in ACI 201.2R-77.		reinforced concrete foundations for Groups 1 and 3 structures. At Hope Creek, the Portland cement conforms to ASTM C 150, Type II and 15 to 30 percent pozzolan was also used. The use of Type II cement and pozzolan result in concrete resistant to increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide. Hope Creek reinforced concrete is designed and constructed to meet ACI and ASTM specifications that meets the intent of ACI 201.2R, cement and additives have been established to produce durable concrete. See Subsection 3.5.2.2.2.2.5.
3.5.1-33	Groups 1-5: concrete	Reduction of strength and modulus of concrete due to elevated temperature	A plant-specific aging management program is to be evaluated	Yes, plant-specific if temperature limits are exceeded	Not Applicable. The aging effect/mechanism does not apply to Hope Creek. Group 1, 3 and 4 concrete structural components are not subject to elevated temperature. See Subsection 3.5.2.2.2.3.
3.5.1-34	Group 6: Concrete; all	Increase in porosity and permeability, cracking, loss of material due to aggressive chemical attack; cracking, loss of bond, loss of material due to	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs and for inaccessible concrete, an examination of	Yes, plant-specific if environment is aggressive	Consistent with NUREG-1801. RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, B.2.1.33, will be used to manage increase in porosity and permeability, cracking, loss of material due to aggressive chemical attack; cracking, loss of bond, and loss of material due to corrosion of embedded steel for concrete in accessible areas of Group 6 structures. A representative sample of below-grade concrete will be inspected, if excavated for any reason, and periodic groundwater monitoring

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
		corrosion of embedded steel	representative samples of below-grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant specific program is to be evaluated if environment is aggressive.		and inspection of submerged concrete components will also be done. Components in the Service Water System have been aligned to this item number based on material, environment and aging effect. The Buried Non-Steel Piping Inspection Program, B.2.2.4, will be substituted to manage increase in porosity and permeability, cracking, loss of material due to aggressive chemical attack for reinforced concrete piping and fittings for this system. See Subsection 3.5.2.2.2.4.1.
3.5.1-35	Group 6: exterior above and below grade concrete foundation	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557).	Yes, for inaccessible areas of plants located in moderate to severe weathering conditions	Consistent with NUREG-1801. RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, B.2.1.33, will be used to manage loss of material (spalling, scaling) and cracking due to freeze-thaw of concrete in accessible areas of Group 6 structures. See Subsection 3.5.2.2.2.4.2.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-36	Group 6: all accessible/ inaccessible reinforced concrete	Cracking due to expansion/ reaction with aggregates	Accessible areas: Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77.	Yes, if concrete was not constructed as stated for inaccessible areas	Not Applicable. The aging effect/mechanism is not applicable to Hope Creek. Concrete specifications required the use of Type II, low alkali cement. Alkali content is limited to 0.6 percent total alkali and testing of aggregates was performed in accordance with ASTM C 289 and C 295 to demonstrate no potential for alkali reactivity with the aggregate. The Structures Monitoring Program, B.2.1.32, and RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, B.2.1.33, will be used to manage cracking of reinforced concrete in accessible areas of Group 6 structures regardless of aging mechanism. See Subsection 3.5.2.2.2.4.3.
3.5.1-37	Group 6: exterior above and below grade reinforced concrete foundation interior slab	Increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide	For accessible areas, inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs. None for inaccessible areas if concrete was constructed in accordance with the recommendations	Yes, if concrete was not constructed as stated for inaccessible areas	Consistent with NUREG-1801. RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, B.2.1.33, will be used to manage the increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide for reinforced concrete in accessible areas of Group 6 structures. Increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide is not significant in the inaccessible below grade areas of these structures as these areas are constructed with durable concrete, that meets the intent of ACI 201.2R. Components in the Service Water System have

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
			in ACI 201.2R-77.		been aligned to this item number based on material, environment and aging effect. The Open-Cycle Cooling Water System Program, B.2.1.13, will be substituted to manage increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide for reinforced concrete piping and fittings for this system. See Subsection 3.5.2.2.2.4.3.
3.5.1-38	Groups 7, 8: Tank liners	Cracking due to stress corrosion cracking; loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated	Yes, plant specific	Not Applicable. Hope Creek does not have Group 7 and 8 structures. See Subsection 3.5.2.2.2.5.
3.5.1-39	Support members; welds; bolted connections; support anchorage to building structure	Loss of material due to general and pitting corrosion	Structures Monitoring Program	Yes, if not within the scope of the applicant's structures monitoring program	Consistent with NUREG-1801. The Structures Monitoring Program, B.2.1.32, will be used to manage loss of material due to general and pitting corrosion for support members, welds, bolted connections, and support anchorage to building structure. See subsection 3.5.2.2.2.6.
3.5.1-40	Building concrete at locations of expansion and grouted anchors; grout	Reduction in concrete anchor capacity due to local concrete degradation/	Structures Monitoring Program	Yes, if not within the scope of the applicant's structures monitoring program	Consistent with NUREG-1801. The Structures Monitoring Program, B.2.1.32, will be used to manage reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms in building concrete at locations of

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	pads for support base plates	service-induced cracking or other concrete aging mechanisms			expansion and grouted anchors, and grout pads for support base plates. See subsection 3.5.2.2.2.6.
3.5.1-41	Vibration isolation elements	Reduction or loss of isolation function/ radiation hardening, temperature, humidity, sustained vibratory loading	Structures Monitoring Program	Yes, if not within the scope of the applicant's structures monitoring program	Consistent with NUREG-1801. The Structures Monitoring Program, B.2.1.32, will be used to manage reduction or loss of isolation function/ radiation hardening, temperature, humidity, sustained vibratory loading for vibration isolation elements. See subsection 3.5.2.2.2.6.
3.5.1-42	Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Not Applicable. Hope Creek current licensing basis contains no fatigue analysis for component supports members, anchor bolts, and welds of Groups B1.1, B1.2, and B1.3 component supports. Therefore, a TLAA is not evaluated in accordance with 10 CFR 54.21(c) for these components. See Subsection 3.5.2.2.2.7.
3.5.1-43	Groups 1-3, 5, 6: all masonry block walls	Cracking due to restraint shrinkage, creep, and aggressive environment	Masonry Wall Program	No	Consistent with NUREG-1801. The Masonry Wall Program, B.2.1.31, as implemented by the Structures Monitoring Program, B.2.1.32, will be used to manage cracking due to restraint shrinkage, creep, and aggressive environment of structural masonry block walls.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					Components in the Fire Protection system have been aligned to this item number based on material, environment and aging effect. The Fire Protection Program, B.2.1.17, will be added to manage cracking due to restraint shrinkage, creep, and aggressive environment of fire barrier masonry block walls for this system.
3.5.1-44	Group 6 elastomer seals, gaskets, and moisture barriers	Loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program, B.2.1.32, will be used to manage loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants) of structures.
3.5.1-45	Group 6: exterior above and below grade concrete foundation; interior slab	Loss of material due to abrasion, cavitation	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance	No	Consistent with NUREG-1801. RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, B.2.1.33, will be used to monitor loss of material due to abrasion and cavitation for reinforced concrete in water control structures (Group 6 structures). Components in the Service Water System have been aligned to this item number based on material, environment and aging effect. The Open-Cycle Cooling Water System Program, B.2.1.13, will be substituted to manage increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide for reinforced concrete piping and fittings for this system.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.5.1-46	Group 5: Fuel pool liners	Cracking due to stress corrosion cracking; loss of material due to pitting and crevice corrosion	Water Chemistry and monitoring of spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels.	No	Consistent with NUREG-1801 with exceptions. Water Chemistry, B.2.1.2, and monitoring of spent fuel pool water level in accordance with technical specifications, and leakage from the leak chase channels in accordance with Hope Creek procedures, will be used to manage loss of material due to pitting and crevice corrosion of the Reactor Building spent fuel pool liner and components, in addition to the spent fuel storage racks. Cracking due to stress corrosion cracking is not an applicable aging effect since the spent fuel pool temperature is less than 140°F. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation.
3.5.1-47	Group 6: all metal structural members	Loss of material due to general (steel only), pitting and crevice corrosion	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance. If protective coatings are relied upon to manage aging, protective coating monitoring and maintenance provisions should be included.	No	Consistent with NUREG-1801. RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, B.2.1.33, will be used to monitor loss of material due to general, pitting and crevice corrosion of steel in water control structures (Group 6 structures). Protective coatings are not credited for managing the effects of aging of steel components for Group 6 structures. Components in Group 1 and Group 3 Structures and Components Supports have been aligned to this item number based on material, environment and aging effect. The Structures Monitoring Program, B.2.1.32, will be substituted to monitor

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					loss of material due to general, pitting and crevice corrosion of steel in a water environment for these components.
3.5.1-48	Group 6: earthen water control structures - dams, embankments, reservoirs, channels, canals, and ponds	Loss of material, loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, Seepage	Inspection of Water-Control Structures or FERC/US Army Corps of Engineers dam inspections and maintenance programs	No	Consistent with NUREG-1801. RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, B.2.1.33, will be used to monitor loss of material, loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, seepage in earthen water control structures (Group 6 structures).
3.5.1-49	Support members; welds; bolted connections; support anchorage to building structure	Loss of material/ general, pitting, and crevice corrosion	Water Chemistry and ISI(IWF)	No	Consistent with NUREG-1801 with exceptions. Water Chemistry, B.2.1.2, and ASME Section XI, Subsection IWF Program, B.2.1.29, will be used to manage loss of material/general, pitting, and crevice corrosion for component supports in Treated Water environment. Exceptions apply to the NUREG-1801 recommendations for Water Chemistry program implementation.
3.5.1-50	Groups B2, and B4: galvanized steel, aluminum, stainless steel support	Loss of material due to pitting and crevice corrosion	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring Program, B.2.1.32, will be used to manage loss of material due to pitting and crevice corrosion in Group B2, and Group B4 Component Supports. Components in the Auxiliary Systems, Engineered Safety Features, Steam and Power Conversion

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	members; welds; bolted connections; support anchorage to building structure				Systems, Structures and Components Supports, and Electrical Components have been aligned to this item number based on material, environment and aging effect. The Open-Cycle Cooling Water System Program, B.2.1.13, Periodic Inspection Program, B.2.2.2, Aboveground Steel Tanks Program B.2.1.19, Aboveground Non-Steel Tanks Program B.2.2.3, and Fire Protection Program, B.2.1.17, will be substituted to monitor loss of material due to pitting and crevice corrosion of piping, tanks and miscellaneous mechanical components.
3.5.1-51	Group B1.1: high strength low-alloy bolts	Cracking due to stress corrosion cracking; loss of material due to general corrosion	Bolting Integrity	No	The ASME Section XI, Subsection IWF Program, B.2.1.29, will be substituted to monitor loss of material due to general corrosion for high strength low-alloy steel bolts used for Groups B1.1 component supports. Cracking due to stress corrosion cracking is not an applicable aging effect for Hope Creek Groups B1.1 component supports. Aging management reviews determined that high strength ASTM A-490 bolts (actual yield strength could be ≥150 ksi) used in NSSS Class 1 component supports (reactor pressure vessel support) are not subject to stress corrosion cracking. The bolts are not subject to high-sustained preload stress, an aggressive environment, and lubricants containing contaminants are not approved for use. Additionally, ASTM A-490 bolts have high resistance to stress corrosion cracking due to their

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
					ductility and industry and plant specific operating experience have not identified stress corrosion cracking of ASTM A-490 bolts as a concern.
3.5.1-52	Groups B2, and B4: sliding support bearings and sliding support surfaces	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Structures Monitoring Program	No	Not Applicable. This component, material, environment, and aging effect/mechanism does not apply. Hope Creek does not have sliding support bearings and sliding support surfaces in Groups B2, and B4 component supports.
3.5.1-53	Groups B1.1, B1.2, and B1.3: support members: welds; bolted connections; support anchorage to building structure	Loss of material due to general and pitting corrosion	ISI (IWF)	No	Consistent with NUREG-1801. The ASME Section XI, Subsection IWF, B.2.1.29, will be used to manage loss of material due to general and pitting corrosion in Groups B1.1, B1.2, and B1.3 component supports.
3.5.1-54	Groups B1.1, B1.2, and B1.3: Constant and variable load spring hangers; guides; stops;	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and	ISI (IWF)	No	Consistent with NUREG-1801. The ASME Section XI, Subsection IWF, B.2.1.29, will be used to manage loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads in Groups B1.1, B1.2, and B1.3 component supports.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
		cyclic thermal loads			
3.5.1-55	PWR Only				
3.5.1-56	Groups B1.1, B1.2, and B1.3: Sliding surfaces	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	No	Consistent with NUREG-1801. The ASME Section XI, Subsection IWF, B.2.1.29, will be used to manage loss of mechanical function in Groups B1.1, B1.2, and B1.3 sliding surfaces for component supports.
3.5.1-57	Groups B1.1, B1.2, and B1.3: Vibration isolation elements	Reduction or loss of isolation function/ radiation hardening, temperature, humidity, sustained vibratory loading	ISI (IWF)	No	Not Applicable. This component, material, environment, and aging effect/mechanism does not apply. Hope Creek design does not have the component vibration isolation elements in Groups B1.1, B1.2, and B1.3 component supports.
3.5.1-58	Galvanized steel and aluminum support members; welds; bolted connections;	None	None	NA - No AEM or AMP	Consistent with NUREG-1801. Hope Creek aging management review concluded that galvanized steel and aluminum components exposed to an air - indoor environment have no aging effects requiring aging management.

Table 3.5.1 Summary of Aging Management Evaluations for Structures and Component Supports

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
	support anchorage to building structure exposed to air - indoor uncontrolled				
3.5.1-59	Stainless steel support members; welds; bolted connections; support anchorage to building structure	None	None	NA - No AEM or AMP	Consistent with NUREG-1801. Hope Creek aging management review concluded that stainless steel components exposed to an air - indoor environment have no aging effects requiring aging management.

Table 3.5.2-1
Auxiliary Boiler Building
Summary of Aging Management Evaluation

Table 3.5.2-1 Auxiliary Boiler Building

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (Structural)	Structural Support	Aluminum Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1
Cable Trays	Structural Support	Aluminum	Air - Indoor	None	None	III.B5-2	3.5.1-58	C
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.5.2-1 Auxiliary Boiler Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Foundation	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Foundation	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A

Table 3.5.2-1 Auxiliary Boiler Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Conduit	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Shelter, Protection	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Conduit	Shelter, Protection	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Conduit	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Conduit	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Doors	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Masonry walls: Above-grade exterior	Shelter, Protection	Concrete block	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Above-grade exterior	Shelter, Protection	Concrete block	Air - Outdoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 2
Masonry walls: Above-grade exterior	Shelter, Protection	Concrete block	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	C
Masonry walls: Above-grade exterior	Structural Support	Concrete block	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Above-grade exterior	Structural Support	Concrete block	Air - Outdoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 2

Table 3.5.2-1 Auxiliary Boiler Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Masonry walls: Above-grade exterior	Structural Support	Concrete block	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	C
Masonry walls: Interior	Shelter, Protection	Concrete block	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Interior	Shelter, Protection	Concrete block	Air - Indoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 2
Masonry walls: Interior	Structural Support	Concrete block	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Interior	Structural Support	Concrete block	Air - Indoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 2
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Shelter, Protection	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Table 3.5.2-1 Auxiliary Boiler Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Piles	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Piles	Structural Support	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 3
Piles	Structural Support	Concrete	Encased in Steel	None	None			G, 4
Precast Panels	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Precast Panels	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Precast Panels	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	C
Precast Panels	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Precast Panels	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C

Table 3.5.2-1 Auxiliary Boiler Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Precast Panels	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	C
Roofing membrane	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Steel Components: All structural steel	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. Based on industry standards and operating experience age related loss of preload/self-loosening of structural bolting could be caused by vibration, flexing of the joint or cyclic shear loads that could occur in any environment. However these causes are considered in the design of structural connections and eliminated by the initial preload bolt torquing. Thus loss of preload/self-loosening of structural bolting is not significant and will not impact structural intended functions. Never the less, loss of preload/self-loosening will be monitored through the Structures Monitoring Program.

2. Masonry walls are inspected as a part of the Structures Monitoring Program, which includes the ten attributes of NUREG-1801 Masonry Wall Program (XI.S5).

3. Structures Monitoring Program is the applicable aging management program for this component.

4. Concrete encased in steel is protected from environments that promote age related degradations.

Table 3.5.2-2
Auxiliary Building Control/Diesel Generator Area
Summary of Aging Management Evaluation

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (Structural)	Structural Support	Aluminum Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Cable Trays	Structural Support	Aluminum	Air - Indoor	None	None	III.B5-2	3.5.1-58	C
Compressible Joints and Seals (Seismic Gaps)	Expansion / Separation	Elastomers	Air - Indoor	Increased Hardness, Shrinkage and Loss of Strength/Weathering	Structures Monitoring Program	VII.G-1	3.3.1-61	E, 2
Compressible Joints and Seals (Seismic Gaps)	Expansion / Separation	Elastomers	Air - Outdoor	Increased Hardness, Shrinkage and Loss of Strength/Weathering	Structures Monitoring Program	VII.G-2	3.3.1-61	E, 2

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete Curbs	Direct Flow	Concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete Curbs	Direct Flow	Concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete Embedments	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Embedments	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Embedments	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete Embedments	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Concrete Embedments	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Embedments	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Above-grade exterior	Shielding	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Shielding	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Shielding	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Flood Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Interior	Flood Barrier	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Interior	Flood Barrier	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Interior	HELB/MELB Shielding	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Interior	HELB/MELB Shielding	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Interior	Missile Barrier	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Interior	Missile Barrier	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Interior	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Interior	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Interior	Shielding	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Interior	Shielding	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Interior	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Interior	Structural Support	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Conduit	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Shelter, Protection	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Conduit	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Doors	Flood Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Doors	Flood Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	HELB/MELB Shielding	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Missile Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Missile Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Equipment foundations	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Equipment foundations	Structural Support	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Hatches/Plugs	HELB/MELB Shielding	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Hatches/Plugs	Missile Barrier	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Hatches/Plugs	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Hatches/Plugs	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration seals	Flood Barrier	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Flood Barrier	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Flood Barrier	Elastomers	Groundwater/Soil	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Flood Barrier	Grout	Air - Indoor	Cracking/Shrinkage	Structures Monitoring Program			F, 3
Penetration seals	Flood Barrier	Grout	Air - Outdoor	Cracking/Shrinkage	Structures Monitoring Program			F, 3
Penetration seals	Flood Barrier	Grout	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program			F, 4
Penetration seals	Flood Barrier	Grout	Groundwater/Soil	Cracking/Shrinkage	Structures Monitoring Program			F, 3

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration seals	Flood Barrier	Grout	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program			F, 4
Penetration seals	HELB/MELB Shielding	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Groundwater/Soil	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Grout	Air - Indoor	Cracking/Shrinkage	Structures Monitoring Program			F, 3
Penetration seals	Shelter, Protection	Grout	Air - Outdoor	Cracking/Shrinkage	Structures Monitoring Program			F, 3
Penetration seals	Shelter, Protection	Grout	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program			F, 4

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration seals	Shelter, Protection	Grout	Groundwater/Soil	Cracking/Shrinkage	Structures Monitoring Program			F, 3
Penetration seals	Shelter, Protection	Grout	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program			F, 4
Penetration sleeves	Flood Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Flood Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Flood Barrier	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Flood Barrier	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2
Penetration sleeves	Flood Barrier	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	Flood Barrier	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Flood Barrier	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Flood Barrier	Galvanized Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2
Penetration sleeves	HELB/MELB Shielding	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	HELB/MELB Shielding	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration sleeves	HELB/MELB Shielding	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	HELB/MELB Shielding	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Support	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2
Penetration sleeves	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Support	Galvanized Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2
Pipe Whip Restraints and Jet Impingement Shields	HELB/MELB Shielding	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Pipe Whip Restraints and Jet Impingement Shields	Pipe Whip Restraint	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Roofing membrane	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Flood Barrier	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Flood Barrier	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Steel Components (Curbs)	Direct Flow	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Steel Components: All structural steel	Missile Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-2 Auxiliary Building Control/Diesel Generator Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Steel Components: All structural steel	Missile Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Steel Components: All structural steel	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Steel Components: All structural steel	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Tube Track	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Tube Track	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. Based on industry standards and operating experience age related loss of preload/self-loosening of structural bolting could be caused by vibration, flexing of the joint or cyclic shear loads that could occur in any environment. However these causes are considered in the design of structural connections and eliminated by the initial preload bolt torquing. Thus loss of preload/self-loosening of structural bolting is not significant and will not impact structural intended functions. Never the less, loss of preload/self-loosening will be monitored through the Structures Monitoring Program.

2. Structures Monitoring Program is the applicable aging management program for this component.

3. Based on industry standards and guidelines, grout is susceptible to cracking due to shrinkage in this environment. However shrinkage cracking occurs early in plant life and is not expected to be significant for the extended period of operation. Never the less the aging effect will be monitored through the Structures Monitoring Program.

4. The aging effects and Aging Management Program identified for this material/environment combination are consistent with industry guidance.

Table 3.5.2-3
Auxiliary Building Service/Radwaste Area
Summary of Aging Management Evaluation

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Blowout Panel	Missile Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Blowout Panel	Missile Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Blowout Panel	Missile Barrier	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Blowout Panel	Missile Barrier	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Blowout Panel	Pressure Relief	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Blowout Panel	Pressure Relief	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Blowout Panel	Pressure Relief	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Blowout Panel	Pressure Relief	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Blowout Panel	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Blowout Panel	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Blowout Panel	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Blowout Panel	Shelter, Protection	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (Structural)	Structural Support	Aluminum Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Cable Trays	Structural Support	Aluminum	Air - Indoor	None	None	III.B5-2	3.5.1-58	C
Compressible Joints and Seals (Seismic Gaps)	Expansion / Separation	Elastomers	Air - Indoor	Increased Hardness, Shrinkage and Loss of Strength/Weathering	Structures Monitoring Program	VII.G-1	3.3.1-61	E, 2
Compressible Joints and Seals (Seismic Gaps)	Expansion / Separation	Elastomers	Air - Outdoor	Increased Hardness, Shrinkage and Loss of Strength/Weathering	Structures Monitoring Program	VII.G-2	3.3.1-61	E, 2
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete Curbs	Direct Flow	Concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete Curbs	Direct Flow	Concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete Curbs	Direct Flow	Concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete Embedments	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Embedments	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Embedments	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete Embedments	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Concrete Embedments	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Embedments	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Above-grade exterior	Shielding	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Above-grade exterior	Shielding	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Shielding	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Above-grade exterior	Water retaining boundary	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Water retaining boundary	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Water retaining boundary	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Below-grade exterior	Water retaining boundary	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Water retaining boundary	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Water retaining boundary	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Water retaining boundary	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Water retaining boundary	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Water retaining boundary	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Foundation	Water retaining boundary	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Water retaining boundary	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Interior	Flood Barrier	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Interior	Flood Barrier	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Interior	HELB/MELB Shielding	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Interior	HELB/MELB Shielding	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Interior	Missile Barrier	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Interior	Missile Barrier	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Interior	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Interior	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Interior	Shielding	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Interior	Shielding	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Interior	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Interior	Structural Support	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Interior	Water retaining boundary	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Interior	Water retaining boundary	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Conduit	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Shelter, Protection	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Conduit	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Doors	Flood Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Flood Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	HELB/MELB Shielding	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Missile Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Missile Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Water retaining boundary	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Water retaining boundary	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Equipment foundations	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Equipment foundations	Structural Support	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Hatches/Plugs	HELB/MELB Shielding	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Hatches/Plugs	Missile Barrier	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Hatches/Plugs	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Hatches/Plugs	Shielding	Lead Blocks	Air - Indoor	None	None			F, 3
Hatches/Plugs	Shielding	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Hatches/Plugs	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Metal components: Steel curb	Direct Flow	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Metal decking	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Shelter, Protection	Aluminum	Air - Indoor	None	None	III.B5-2	3.5.1-58	C
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Shelter, Protection	Aluminum	Air - Outdoor	Loss of Material/Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-7	3.5.1-50	C
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration seals	Flood Barrier	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Flood Barrier	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Flood Barrier	Elastomers	Groundwater/Soil	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Flood Barrier	Grout	Air - Indoor	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration seals	Flood Barrier	Grout	Air - Outdoor	Cracking/Shrinkage	Structures Monitoring Program			F, 4

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration seals	Flood Barrier	Grout	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program			F, 5
Penetration seals	Flood Barrier	Grout	Groundwater/Soil	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration seals	Flood Barrier	Grout	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program			F, 5
Penetration seals	HELB/MELB Shielding	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Groundwater/Soil	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Grout	Air - Indoor	Cracking/Shrinkage	Structures Monitoring Program			F, 4

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration seals	Shelter, Protection	Grout	Air - Outdoor	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration seals	Shelter, Protection	Grout	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program			F, 5
Penetration seals	Shelter, Protection	Grout	Groundwater/Soil	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration seals	Shelter, Protection	Grout	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program			F, 5
Penetration sleeves	Flood Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Flood Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Flood Barrier	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Flood Barrier	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2
Penetration sleeves	Flood Barrier	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	Flood Barrier	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Flood Barrier	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Flood Barrier	Galvanized Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration sleeves	HELB/MELB Shielding	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	HELB/MELB Shielding	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	HELB/MELB Shielding	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	HELB/MELB Shielding	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Support	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2
Penetration sleeves	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Support	Galvanized Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Roofing membrane	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Flood Barrier	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Flood Barrier	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Spray Shields	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Steel Components: All structural steel	Missile Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Steel Components: All structural steel	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-3 Auxiliary Building Service/Radwaste Area (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tube Track	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Tube Track	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. Based on industry standards and operating experience age related loss of preload/self-loosening of structural bolting could be caused by vibration, flexing of the joint or cyclic shear loads that could occur in any environment. However these causes are considered in the design of structural connections and eliminated by the initial preload bolt torquing. Thus loss of preload/self-loosening of structural bolting is not significant and will not impact structural intended functions. Never the less, loss of preload/self-loosening will be monitored through the Structures Monitoring Program.

2. Structures Monitoring Program is the applicable aging management program for this component.

3. Based on plant operating experience, there are no aging effects requiring management for this material and environment combination.

4. Based on industry standards and guidelines, grout is susceptible to cracking due to shrinkage in this environment. However shrinkage cracking occurs early in plant life and is not expected to be significant for the extended period of operation. Never less the aging effect will be monitored through the Structures Monitoring Program.

5. The aging effects and Aging Management Program identified for this material/environment combination are consistent with industry guidance.

Table 3.5.2-4
Component Supports Commodity Group
Summary of Aging Management Evaluation

Table 3.5.2-4 Component Supports Commodity Group

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class 1 Piping and Components (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support	Reinforced concrete; Grout	Air - Indoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	III.B1.1-1	3.5.1-40	A
Supports for ASME Class 1 Piping and Components (Constant and variable load spring hangers; guides; stops)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	ASME Section XI, Subsection IWF	III.B1.1-13	3.5.1-53	C
Supports for ASME Class 1 Piping and Components (Constant and variable load spring hangers; guides; stops)	Structural Support	Carbon Steel	Air - Indoor	Loss of Mechanical Function/Corrosion, Distortion, Dirt, Overload, Fatigue due to Vibratory and Cyclic Thermal Loads	ASME Section XI, Subsection IWF	III.B1.1-2	3.5.1-54	A
Supports for ASME Class 1 Piping and Components (High strength bolting for NSSS component supports)	Structural Support	High Strength Low Alloy Steel Bolting with Yield Strength > 150 ksi	Air - Indoor	Loss of Material/General Corrosion	ASME Section XI, Subsection IWF	III.B1.1-4	3.5.1-51	E, 1, 2

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class 1 Piping and Components (High strength bolting for NSSS component supports)	Structural Support	High Strength Low Alloy Steel Bolting with Yield Strength > 150 ksi	Air - Indoor	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWF	VII.I-5	3.3.1-45	E, 1, 2, 3
Supports for ASME Class 1 Piping and Components (Sliding surfaces)	Structural Support	Lubrite	Air - Indoor	Loss of Mechanical Function/Corrosion, Distortion, Dirt, Overload, Fatigue due to Vibratory and Cyclic Thermal Loads	ASME Section XI, Subsection IWF	III.B1.1-5	3.5.1-56	A
Supports for ASME Class 1 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	ASME Section XI, Subsection IWF	III.B1.1-13	3.5.1-53	A
Supports for ASME Class 1 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.1-13	3.5.1-53	A
Supports for ASME Class 1 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWF	VII.I-5	3.3.1-45	E, 1, 3

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class 1 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B1.1-7	3.5.1-58	A
Supports for ASME Class 1 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWF	VII.I-5	3.3.1-45	E, 1, 3
Supports for ASME Class 1 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Stainless Steel	Air - Indoor	None	None	III.B1.1-9	3.5.1-59	A
Supports for ASME Class 1 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Stainless Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWF			H, 1, 3

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class 2 and 3 Piping and Components (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support	Reinforced concrete; Grout	Air - Indoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	III.B1.2-1	3.5.1-40	A
Supports for ASME Class 2 and 3 Piping and Components (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support	Reinforced concrete; Grout	Air - Outdoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	III.B1.2-1	3.5.1-40	A
Supports for ASME Class 2 and 3 Piping and Components (Constant and variable load spring hangers; guides; stops)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	ASME Section XI, Subsection IWF	III.B1.2-10	3.5.1-53	C
Supports for ASME Class 2 and 3 Piping and Components (Constant and variable load spring hangers; guides; stops)	Structural Support	Carbon Steel	Air - Indoor	Loss of Mechanical Function/Corrosion, Distortion, Dirt, Overload, Fatigue due to Vibratory and Cyclic Thermal Loads	ASME Section XI, Subsection IWF	III.B1.2-2	3.5.1-54	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class 2 and 3 Piping and Components (Constant and variable load spring hangers; guides; stops)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.2-10	3.5.1-53	C
Supports for ASME Class 2 and 3 Piping and Components (Constant and variable load spring hangers; guides; stops)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Mechanical Function/Corrosion, Distortion, Dirt, Overload, Fatigue due to Vibratory and Cyclic Thermal Loads	ASME Section XI, Subsection IWF	III.B1.2-2	3.5.1-54	A
Supports for ASME Class 2 and 3 Piping and Components (Constant and variable load spring hangers; guides; stops)	Structural Support	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.1-11	3.5.1-49	C
Supports for ASME Class 2 and 3 Piping and Components (Constant and variable load spring hangers; guides; stops)	Structural Support	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	III.B1.1-11	3.5.1-49	D
Supports for ASME Class 2 and 3 Piping and Components (Sliding surfaces)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	ASME Section XI, Subsection IWF	III.B1.2-10	3.5.1-53	C

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class 2 and 3 Piping and Components (Sliding surfaces)	Structural Support	Carbon Steel	Air - Indoor	Loss of Mechanical Function/Corrosion, Distortion, Dirt, Overload, Fatigue due to Vibratory and Cyclic Thermal Loads	ASME Section XI, Subsection IWF	III.B1.2-2	3.5.1-54	C
Supports for ASME Class 2 and 3 Piping and Components (Sliding surfaces)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.2-10	3.5.1-53	C
Supports for ASME Class 2 and 3 Piping and Components (Sliding surfaces)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Mechanical Function/Corrosion, Distortion, Dirt, Overload, Fatigue due to Vibratory and Cyclic Thermal Loads	ASME Section XI, Subsection IWF	III.B1.2-2	3.5.1-54	C
Supports for ASME Class 2 and 3 Piping and Components (Sliding surfaces)	Structural Support	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.1-11	3.5.1-49	A
Supports for ASME Class 2 and 3 Piping and Components (Sliding surfaces)	Structural Support	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	III.B1.1-11	3.5.1-49	B
Supports for ASME Class 2 and 3 Piping and Components (Sliding surfaces)	Structural Support	Carbon Steel	Treated Water	Loss of Mechanical Function/Corrosion, Distortion, Dirt, Overload, Fatigue due to Vibratory and Cyclic Thermal Loads	ASME Section XI, Subsection IWF			G
Supports for ASME Class 2 and 3 Piping and Components (Sliding surfaces)	Structural Support	Carbon Steel	Treated Water	Loss of Mechanical Function/Corrosion, Distortion, Dirt, Overload, Fatigue due to Vibratory and Cyclic Thermal Loads	Water Chemistry			G

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class 2 and 3 Piping and Components (Sliding surfaces)	Structural Support	Lubrite	Air - Indoor	Loss of Mechanical Function/Corrosion, Distortion, Dirt, Overload, Fatigue due to Vibratory and Cyclic Thermal Loads	ASME Section XI, Subsection IWF	III.B1.2-3	3.5.1-56	A
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	ASME Section XI, Subsection IWF	III.B1.2-10	3.5.1-53	A
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.2-10	3.5.1-53	A
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.1-11	3.5.1-49	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	III.B1.1-11	3.5.1-49	B
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.2-10	3.5.1-53	A
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWF	VII.I-5	3.3.1-45	E, 1, 3

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.2-10	3.5.1-53	A
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWF			H, 1, 3
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.1-11	3.5.1-49	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	III.B1.1-11	3.5.1-49	B
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Treated Water	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWF			G, 1, 3
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B1.2-5	3.5.1-58	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWF	VII.I-5	3.3.1-45	E, 1, 3
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Nickel Alloy Bolting	Water - Flowing	Loss of Material/Galvanic Corrosion	ASME Section XI, Subsection IWF			J, 4
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Nickel Alloy Bolting	Water - Flowing	Loss of Material/Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF			F, 1

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Stainless Steel	Air - Indoor	None	None	III.B1.2-7	3.5.1-59	A
Supports for ASME Class 2 and 3 Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Stainless Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWF			H, 1, 3
Supports for ASME Class MC Components (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support	Reinforced concrete; Grout	Air - Indoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	III.B1.3-1	3.5.1-40	A
Supports for ASME Class MC Components (Constant and variable load spring hangers; guides; stops)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	ASME Section XI, Subsection IWF	III.B1.3-10	3.5.1-53	C

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class MC Components (Constant and variable load spring hangers; guides; stops)	Structural Support	Carbon Steel	Air - Indoor	Loss of Mechanical Function/Corrosion, Distortion, Dirt, Overload, Fatigue due to Vibratory and Cyclic Thermal Loads	ASME Section XI, Subsection IWF	III.B1.3-2	3.5.1-54	A
Supports for ASME Class MC Components (Sliding surfaces)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	ASME Section XI, Subsection IWF	III.B1.3-10	3.5.1-53	C
Supports for ASME Class MC Components (Sliding surfaces)	Structural Support	Carbon Steel	Air - Indoor	Loss of Mechanical Function/Corrosion, Distortion, Dirt, Overload, Fatigue due to Vibratory and Cyclic Thermal Loads	ASME Section XI, Subsection IWF			F
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	ASME Section XI, Subsection IWF	III.B1.3-10	3.5.1-53	A
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.1-11	3.5.1-49	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	III.B1.1-11	3.5.1-49	B
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.3-10	3.5.1-53	A
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWF	VII.I-5	3.3.1-45	E, 1, 3
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.1-11	3.5.1-49	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	III.B1.1-11	3.5.1-49	B
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Treated Water	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWF			G, 1, 3
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Stainless Steel	Air - Indoor	None	None	III.B1.3-7	3.5.1-59	A
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Stainless Steel	Treated Water	Loss of Material/Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.1-11	3.5.1-49	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Stainless Steel	Treated Water	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	III.B1.1-11	3.5.1-49	B
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Stainless Steel Bolting	Treated Water	Loss of Material/Pitting and Crevice Corrosion	ASME Section XI, Subsection IWF	III.B1.1-11	3.5.1-49	A
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Stainless Steel Bolting	Treated Water	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	III.B1.1-11	3.5.1-49	B
Supports for ASME Class MC Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Stainless Steel Bolting	Treated Water	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWF			G, 1, 3

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support	Reinforced concrete; Grout	Air - Indoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	III.B2-1	3.5.1-40	A
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support	Reinforced concrete; Grout	Air - Outdoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	III.B2-1	3.5.1-40	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	Structures Monitoring Program	III.B2-10	3.5.1-39	A
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-10	3.5.1-39	A
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Water - Flowing	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A6-11	3.5.1-47	E, 5

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-10	3.5.1-39	A
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 3, 5
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-10	3.5.1-39	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 3, 5
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B2-5	3.5.1-58	A
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-7	3.5.1-50	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 3, 5
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-7	3.5.1-50	A
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 3, 5

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Stainless Steel	Air - Indoor	None	None	III.B2-8	3.5.1-59	A
Supports for Cable Trays, Conduit, HVAC Ducts, Tube Track, Instrument Tubing, Non-ASME Piping and Components (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Stainless Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 3, 5

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support	Reinforced concrete; Grout	Air - Indoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	III.B4-1	3.5.1-40	A
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support	Reinforced concrete; Grout	Air - Outdoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	III.B4-1	3.5.1-40	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	Structures Monitoring Program	III.B4-10	3.5.1-39	A
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B4-10	3.5.1-39	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 3, 5
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B4-5	3.5.1-58	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 3, 5
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Vibration isolation elements)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	Structures Monitoring Program	III.B4-10	3.5.1-39	C
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Vibration isolation elements)	Structural Support	Elastomers	Air - Indoor	Reduction or Loss of Isolation Function/Radiation Hardening, Temperature, Humidity, Sustained Vibratory Loading	Structures Monitoring Program	III.B4-12	3.5.1-41	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Vibration isolation elements)	Vibration Isolation	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	Structures Monitoring Program	III.B4-10	3.5.1-39	C
Supports for Emergency Diesel Generator, HVAC System Components, and Other Misc Mechanical Equipment (Vibration isolation elements)	Vibration Isolation	Elastomers	Air - Indoor	Reduction or Loss of Isolation Function/Radiation Hardening, Temperature, Humidity, Sustained Vibratory Loading	Structures Monitoring Program	III.B4-12	3.5.1-41	A
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support	Reinforced concrete; Grout	Air - Indoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	III.B5-1	3.5.1-40	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support	Reinforced concrete; Grout	Air - Outdoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	III.B5-1	3.5.1-40	A
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	Structures Monitoring Program	III.B5-7	3.5.1-39	A
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B5-7	3.5.1-39	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General and Pitting Corrosion	Structures Monitoring Program	III.B5-7	3.5.1-39	A
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 3, 5
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B5-7	3.5.1-39	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 3, 5
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	A
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B5-7	3.5.1-39	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 3, 5
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B5-7	3.5.1-39	A
Supports for Platforms, Pipe Whip Restraints, Jet Impingement Shields, and Other Misc Structures (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 3, 5

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support	Reinforced concrete; Grout	Air - Indoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	III.B3-1	3.5.1-40	A
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Building concrete at locations of expansion and grouted anchors; grout pads for support base plates)	Structural Support	Reinforced concrete; Grout	Air - Outdoor	Reduction in concrete anchor capacity due to local concrete degradation/ service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	III.B3-1	3.5.1-40	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General and Pitting Corrosion	Structures Monitoring Program	III.B3-7	3.5.1-39	A
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B3-7	3.5.1-39	A
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General and Pitting Corrosion	Structures Monitoring Program	III.B3-7	3.5.1-39	A

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 3, 5
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B3-7	3.5.1-39	A
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 3, 5

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B3-3	3.5.1-58	A
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B3-7	3.5.1-39	A
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 3, 5

Table 3.5.2-4 Component Supports Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.B3-7	3.5.1-39	A
Supports for Racks, Panels, Cabinets, and Enclosures for Electrical Equipment and Instrumentation (Support members; welds; bolted connections; support anchorage to building structure)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 3, 5

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. ASME Section XI, Subsection IWF is the applicable aging management program for this component.

2. NSSS Class 1 component supports (reactor pressure vessel support) utilize high strength ASTM A490 bolts (actual yield strength could be greater than or equal to 150 ksi). The bolts are not subject to high-sustained preload stress, aggressive environment, and lubricants containing contaminants not approved for use. Additionally ASTM A490 bolts have high resistance to stress corrosion cracking due to their ductility and industry and plant specific operating experience have not identified stress corrosion cracking of ASTM A490 bolts as a concern. Therefore cracking due to stress corrosion cracking is not an aging effect requiring aging management. Loss of material is the only aging effect requiring aging management. They are monitored for loss of material due to corrosion and loss of preload by visual inspection using the ASME Section XI, Subsection IWF.

3. Based on industry standards and operating experience age related loss of preload/self-loosening of structural bolting could be caused by vibration, flexing of the joint or cyclic shear loads that could occur in any environment. However these causes are considered in the design of structural connections and eliminated by the initial preload bolt torquing. Thus loss of preload/self-loosening of structural bolting is not significant and will not impact structural intended functions. Never the less, loss of preload/self-loosening will be monitored through the applicable aging management program.

4. Based on industry operating experience, galvanic corrosion has occurred for this material and the ASME Section XI, Subsection IWF is the applicable aging management program for this component.

5. Structural Monitoring Program is the applicable aging management program for this component.

Table 3.5.2-5
Fire Water Pump House
Summary of Aging Management Evaluation

Table 3.5.2-5 Fire Water Pump House

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.5.2-5 Fire Water Pump House (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Foundation	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Foundation	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A

Table 3.5.2-5 Fire Water Pump House (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Conduit	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Shelter, Protection	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Conduit	Shelter, Protection	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Conduit	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Conduit	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Doors	Shelter, Protection	Aluminum	Air - Indoor	None	None	III.B5-2	3.5.1-58	C
Doors	Shelter, Protection	Aluminum	Air - Outdoor	Loss of Material/Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-7	3.5.1-50	C
Doors	Shelter, Protection	Fiberglass	Air - Indoor	None	None			F, 2
Doors	Shelter, Protection	Fiberglass	Air - Outdoor	None	None			F, 2
Equipment foundations	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Equipment foundations	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Equipment foundations	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A

Table 3.5.2-5 Fire Water Pump House (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Equipment foundations	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Masonry walls: Above-grade exterior	Shelter, Protection	Concrete block	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Above-grade exterior	Shelter, Protection	Concrete block	Air - Outdoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 3
Masonry walls: Above-grade exterior	Shelter, Protection	Concrete block	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	C
Masonry walls: Above-grade exterior	Structural Support	Concrete block	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Above-grade exterior	Structural Support	Concrete block	Air - Outdoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 3
Masonry walls: Above-grade exterior	Structural Support	Concrete block	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	C
Masonry walls: Interior	Shelter, Protection	Concrete block	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Interior	Shelter, Protection	Concrete block	Air - Indoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 3

Table 3.5.2-5 Fire Water Pump House (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Masonry walls: Interior	Structural Support	Concrete block	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Interior	Structural Support	Concrete block	Air - Indoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 3
Metal decking	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Metal decking	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Shelter, Protection	Aluminum	Air - Indoor	None	None	III.B5-2	3.5.1-58	C
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Shelter, Protection	Aluminum	Air - Outdoor	Loss of Material/Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-7	3.5.1-50	C
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Table 3.5.2-5 Fire Water Pump House (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration seals	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Grout	Air - Indoor	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration seals	Shelter, Protection	Grout	Air - Outdoor	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration seals	Shelter, Protection	Grout	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program			F, 5
Penetration sleeves	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Support	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 6
Penetration sleeves	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-5 Fire Water Pump House (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration sleeves	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Support	Galvanized Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 6
Piles	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Piles	Structural Support	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 6
Piles	Structural Support	Concrete	Encased in Steel	None	None			G, 7
Roofing membrane	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Steel components: All structural steel	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Tube Track	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Table 3.5.2-5 Fire Water Pump House (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tube Track	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Notes **Definition of Note**

A Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

B Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

C Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

D Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

E Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.

F Material not in NUREG-1801 for this component.

G Environment not in NUREG-1801 for this component and material.

H Aging effect not in NUREG-1801 for this component, material and environment combination.

I Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. Based on industry standards and operating experience age related loss of preload/self-loosening of structural bolting could be caused by vibration, flexing of the joint or cyclic shear loads that could occur in any environment. However these causes are considered in the design of structural connections and eliminated by the initial preload bolt torquing. Thus loss of preload/self-loosening of structural bolting is not significant and will not impact structural intended functions. Never the less, loss of preload/self-loosening will be monitored through the Structures Monitoring Program.

2. Based on plant operating experience, there are no aging effects requiring management for this material and environment combination.

3. Masonry walls are inspected as a part of the Structures Monitoring Program, which includes the ten attributes of NUREG-1801 Masonry Walls Program (XI.S5).

4. Based on industry standards and guidelines, grout is susceptible to cracking due to shrinkage in this environment. However shrinkage cracking occurs early in plant life and is not expected to be significant for the extended period of operation. Never less the aging effect will be monitored through the Structures Monitoring Program.

5. The aging effects and Aging Management Program identified for this material/environment combination are consistent with industry guidance.

6. Structures Monitoring Program is the applicable aging management program for this component.

7. Concrete encased in steel is protected from environments that promote age related degradations.

Table 3.5.2-6

Piping and Component Insulation Commodity Group

Summary of Aging Management Evaluation

Table 3.5.2-6 Piping and Component Insulation Commodity Group

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Insulation	Thermal Insulation	"Min-K"	Air - Indoor	None	None			J, 1
Insulation	Thermal Insulation	Calcium Silicate	Air - Indoor	None	None			J, 1
Insulation	Thermal Insulation	Calcium Silicate	Air - Outdoor	None	None			J, 1
Insulation	Thermal Insulation	Cellular glass	Air - Indoor	None	None			J, 1
Insulation	Thermal Insulation	Ceramic Fiber	Air - Indoor	None	None			J, 1
Insulation	Thermal Insulation	Fiberglass	Air - Indoor	None	None			J, 1
Insulation	Thermal Insulation	Fiberglass	Air - Outdoor	None	None			J, 1
Insulation	Thermal Insulation	Fiberglass (Molded)	Air - Indoor	None	None			J, 1
Insulation	Thermal Insulation	NUKON	Air - Indoor	None	None			J, 1
Insulation	Thermal Insulation	Stainless Steel (Mirror Insulation)	Air - Indoor	None	None	III.B5-5	3.5.1-59	C
Insulation jacketing (includes wire mesh, tie wires, straps, clips)	Shelter, Protection	Aluminum	Air - Indoor	None	None	III.B5-2	3.5.1-58	C
Insulation jacketing (includes wire mesh, tie wires, straps, clips)	Shelter, Protection	Aluminum	Air - Outdoor	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 2
Insulation jacketing (includes wire mesh, tie wires, straps, clips)	Shelter, Protection	Fiberglass cloth	Air - Indoor	None	None			J, 1

Table 3.5.2-6 Piping and Component Insulation Commodity Group (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Insulation jacketing (includes wire mesh, tie wires, straps, clips)	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Insulation jacketing (includes wire mesh, tie wires, straps, clips)	Shelter, Protection	Stainless Steel	Air - Indoor	None	None	III.B5-5	3.5.1-59	C
Insulation jacketing (includes wire mesh, tie wires, straps, clips)	Structural Support	Aluminum	Air - Indoor	None	None	III.B5-2	3.5.1-58	C
Insulation jacketing (includes wire mesh, tie wires, straps, clips)	Structural Support	Aluminum	Air - Outdoor	Loss of Material/Pitting and Crevice Corrosion	Periodic Inspection	III.B2-7	3.5.1-50	E, 2
Insulation jacketing (includes wire mesh, tie wires, straps, clips)	Structural Support	Fiberglass cloth	Air - Indoor	None	None			J, 1
Insulation jacketing (includes wire mesh, tie wires, straps, clips)	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Insulation jacketing (includes wire mesh, tie wires, straps, clips)	Structural Support	Stainless Steel	Air - Indoor	None	None	III.B5-5	3.5.1-59	C

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. Based on plant operating experience, there are no aging effects requiring management for this material and environment combination.
2. The Periodic Inspection program is the applicable aging management program for this component.

Table 3.5.2-7
Primary Containment
Summary of Aging Management Evaluation

Table 3.5.2-7 Primary Containment

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (Containment Closure)	Pressure Boundary	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	V.E-4	3.2.1-23	E, 1
Bolting (Containment Closure)	Pressure Boundary	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	10 CFR Part 50, Appendix J	V.E-5	3.2.1-24	E, 1
Bolting (Containment Closure)	Pressure Boundary	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWE	V.E-5	3.2.1-24	E, 1
Bolting (Containment Closure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	V.E-4	3.2.1-23	E, 1
Bolting (Containment Closure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	10 CFR Part 50, Appendix J	V.E-5	3.2.1-24	E, 1
Bolting (Containment Closure)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	ASME Section XI, Subsection IWE	V.E-5	3.2.1-24	E, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 2, 3
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 2, 3
Bolting (Structural)	Structural Support	Stainless Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	IV.C2-8	3.1.1-52	E, 2, 3

Table 3.5.2-7 Primary Containment (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Cable Trays	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Coatings	Maintain Adhesion	Paint	Air - Indoor	Cracking, blistering, flaking, peeling, and delamination	Protective Coating Monitoring and Maintenance Program			J
Coatings	Maintain Adhesion	Paint	Treated Water	Cracking, blistering, flaking, peeling, and delamination	Protective Coating Monitoring and Maintenance Program			J
Concrete anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Concrete anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete embedments	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Concrete embedments	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete: Interior	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A4-3	3.5.1-23	A
Concrete: Interior (Biological shield)	Shielding	Concrete	Encased in Steel	None	None			G, 4
Concrete: Interior (Biological shield)	Shielding	Concrete (High Density)	Encased in Steel	None	None			G, 4
Concrete: Interior (Biological shield)	Shielding	Grout (High Density)	Encased in Steel	None	None			F, 4
Concrete: Interior (Biological shield)	Structural Support	Concrete	Encased in Steel	None	None			G, 4
Concrete: Interior (Biological shield)	Structural Support	Concrete (High Density)	Encased in Steel	None	None			G, 4
Concrete: Interior (Biological shield)	Structural Support	Grout (High Density)	Encased in Steel	None	None			F, 4

Table 3.5.2-7 Primary Containment (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Interior (RPV Pedestal)	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A4-3	3.5.1-23	A
Conduit	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Doors	Shielding	Boron Concrete	Encased in Steel	None	None			F, 4
Doors	Shielding	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Hatches/Plugs	Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B4-6	3.5.1-18	C
Hatches/Plugs	Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B4-6	3.5.1-18	C
Hatches/Plugs	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B4-6	3.5.1-18	C
Hatches/Plugs	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B4-6	3.5.1-18	C
Miscellaneous steel (catwalks, stairs, handrails, ladders, platforms, etc.)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, platforms, etc.)	Structural Support	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	II.B1.1-2	3.5.1-5	E, 3
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A

Table 3.5.2-7 Primary Containment (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Stainless Steel	Air - Indoor	None	None	VII.J-15	3.3.1-94	C
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Stainless Steel	Air - Indoor	None	None	VII.J-15	3.3.1-94	C
Penetration bellows	Expansion / Separation	Stainless Steel; Dissimilar Metal Welds	Air - Indoor	Cumulative Fatigue Damage/Fatigue	TLAA	II.B4-4	3.5.1-9	A, 5
Penetration bellows	Pressure Boundary	Stainless Steel; Dissimilar Metal Welds	Air - Indoor	Cumulative Fatigue Damage/Fatigue	TLAA	II.B4-4	3.5.1-9	A, 5
Penetration seals (End Caps)	Pressure Boundary	Carbon Steel; Dissimilar Metal Welds	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B1.1-2	3.5.1-5	C
Penetration seals (End Caps)	Pressure Boundary	Carbon Steel; Dissimilar Metal Welds	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B1.1-2	3.5.1-5	C
Penetration sleeves	Pressure Boundary	Carbon Steel; Dissimilar Metal Welds	Air - Indoor	Cumulative Fatigue Damage/Fatigue	TLAA	II.B4-4	3.5.1-9	A, 5
Penetration sleeves	Pressure Boundary	Carbon Steel; Dissimilar Metal Welds	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B4-1	3.5.1-18	A

Table 3.5.2-7 Primary Containment (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration sleeves	Pressure Boundary	Carbon Steel; Dissimilar Metal Welds	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B4-1	3.5.1-18	A
Penetration sleeves	Pressure Boundary	Stainless Steel; Dissimilar Metal Welds	Air - Indoor	Cumulative Fatigue Damage/Fatigue	TLAA	II.B4-4	3.5.1-9	A, 5
Penetration sleeves	Shelter, Protection	Carbon Steel; Dissimilar Metal Welds	Air - Indoor	Cumulative Fatigue Damage/Fatigue	TLAA	II.B4-4	3.5.1-9	A, 5
Penetration sleeves	Shelter, Protection	Carbon Steel; Dissimilar Metal Welds	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B4-1	3.5.1-18	A
Penetration sleeves	Shelter, Protection	Carbon Steel; Dissimilar Metal Welds	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B4-1	3.5.1-18	A
Penetration sleeves	Shelter, Protection	Stainless Steel; Dissimilar Metal Welds	Air - Indoor	Cumulative Fatigue Damage/Fatigue	TLAA	II.B4-4	3.5.1-9	A, 5
Penetration sleeves	Structural Support	Carbon Steel; Dissimilar Metal Welds	Air - Indoor	Cumulative Fatigue Damage/Fatigue	TLAA	II.B4-4	3.5.1-9	A, 5
Penetration sleeves	Structural Support	Carbon Steel; Dissimilar Metal Welds	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B4-1	3.5.1-18	A
Penetration sleeves	Structural Support	Carbon Steel; Dissimilar Metal Welds	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B4-1	3.5.1-18	A
Penetration sleeves	Structural Support	Stainless Steel; Dissimilar Metal Welds	Air - Indoor	Cumulative Fatigue Damage/Fatigue	TLAA	II.B4-4	3.5.1-9	A, 5
Personnel airlock, equipment hatch, CRD hatch	Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B4-6	3.5.1-18	A

Table 3.5.2-7 Primary Containment (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Personnel airlock, equipment hatch, CRD hatch	Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B4-6	3.5.1-18	A
Personnel airlock, equipment hatch, CRD hatch	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B4-6	3.5.1-18	A
Personnel airlock, equipment hatch, CRD hatch	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B4-6	3.5.1-18	A
Personnel airlock, equipment hatch, CRD hatch: Locks, hinges, and closure mechanisms	Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Leaktightness/ Mechanical Wear of Locks, Hinges and Closure Mechanisms	10 CFR Part 50, Appendix J	II.B4-5	3.5.1-17	A, 6
Personnel airlock, equipment hatch, CRD hatch: Locks, hinges, and closure mechanisms	Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B1.1-2	3.5.1-5	C
Personnel airlock, equipment hatch, CRD hatch: Locks, hinges, and closure mechanisms	Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B1.1-2	3.5.1-5	C
Personnel airlock, equipment hatch, CRD hatch: Locks, hinges, and closure mechanisms	Structural Support	Carbon Steel	Air - Indoor	Loss of Leaktightness/ Mechanical Wear of Locks, Hinges and Closure Mechanisms	10 CFR Part 50, Appendix J	II.B4-5	3.5.1-17	A, 6
Personnel airlock, equipment hatch, CRD hatch: Locks, hinges, and closure mechanisms	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B1.1-2	3.5.1-5	C

Table 3.5.2-7 Primary Containment (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Personnel airlock, equipment hatch, CRD hatch: Locks, hinges, and closure mechanisms	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B1.1-2	3.5.1-5	C
Pipe Whip Restraints and Jet Impingement Shields	HELB/MELB Shielding	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Pipe Whip Restraints and Jet Impingement Shields	Pipe Whip Restraint	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Pressure Boundary	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	10 CFR Part 50, Appendix J	II.B4-7	3.5.1-16	A, 7
Steel Components: All structural steel	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Steel Components: Biological shield lateral truss	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Steel Components: Biological shield liner plates	Shielding	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Steel Components: Biological shield liner plates	Shielding	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Steel Components: Biological shield liner plates	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Steel Components: Biological shield liner plates	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C

Table 3.5.2-7 Primary Containment (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Steel Components: Radial beam seats in BWR Drywell	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Steel Components: Radial beam seats in BWR Drywell	Structural Support	Lubrite	Air - Indoor	Lock-up/ wear	Structures Monitoring Program	III.A4-6	3.5.1-30	A
Steel Components: Sump Liners	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Steel Components: Sump Liners	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Steel Components: Sump Liners	Structural Support	Carbon Steel	Raw Water	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A6-11	3.5.1-47	E, 3
Steel Components: Sump Liners	Water retaining boundary	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Steel Components: Sump Liners	Water retaining boundary	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Steel Components: Sump Liners	Water retaining boundary	Carbon Steel	Raw Water	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A6-11	3.5.1-47	E, 3
Steel Elements: Drywell head; Downcomers	Pressure Boundary	Carbon Steel	Air - Indoor	Fretting or Lockup/Mechanical Wear	ASME Section XI, Subsection IWE	II.B1.1-1	3.5.1-21	A
Steel Elements: Drywell; Torus; Drywell Head; Embedded shell; Drywell support skirt; Torus ring girder; Downcomers	Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B1.1-2	3.5.1-5	A

Table 3.5.2-7 Primary Containment (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Steel Elements: Drywell; Torus; Drywell Head; Embedded shell; Drywell support skirt; Torus ring girder; Downcomers	Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B1.1-2	3.5.1-5	A
Steel Elements: Drywell; Torus; Drywell Head; Embedded shell; Drywell support skirt; Torus ring girder; Downcomers	Pressure Boundary	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Steel Elements: Drywell; Torus; Drywell Head; Embedded shell; Drywell support skirt; Torus ring girder; Downcomers	Pressure Boundary	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B1.1-2	3.5.1-5	A
Steel Elements: Drywell; Torus; Drywell Head; Embedded shell; Drywell support skirt; Torus ring girder; Downcomers	Pressure Boundary	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B1.1-2	3.5.1-5	A

Table 3.5.2-7 Primary Containment (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Steel Elements: Drywell; Torus; Drywell Head; Embedded shell; Drywell support skirt; Torus ring girder; Downcomers	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B1.1-2	3.5.1-5	A
Steel Elements: Drywell; Torus; Drywell Head; Embedded shell; Drywell support skirt; Torus ring girder; Downcomers	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B1.1-2	3.5.1-5	A
Steel Elements: Drywell; Torus; Drywell Head; Embedded shell; Drywell support skirt; Torus ring girder; Downcomers	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Steel Elements: Drywell; Torus; Drywell Head; Embedded shell; Drywell support skirt; Torus ring girder; Downcomers	Structural Support	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B1.1-2	3.5.1-5	A

Table 3.5.2-7 Primary Containment (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Steel Elements: Drywell; Torus; Drywell Head; Embedded shell; Drywell support skirt; Torus ring girder; Downcomers	Structural Support	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B1.1-2	3.5.1-5	A
Steel Elements: Torus; Vent line; Vent header; Vent line bellows; Downcomers	Expansion / Separation	Stainless Steel	Air - Indoor	Cumulative Fatigue Damage/Fatigue	TLAA	II.B1.1-4	3.5.1-8	A, 5
Steel Elements: Torus; Vent line; Vent header; Vent line bellows; Downcomers	Pressure Boundary	Carbon Steel	Air - Indoor	Cumulative Fatigue Damage/Fatigue	TLAA	II.B1.1-4	3.5.1-8	A, 5
Steel Elements: Torus; Vent line; Vent header; Vent line bellows; Downcomers	Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B1.1-2	3.5.1-5	A
Steel Elements: Torus; Vent line; Vent header; Vent line bellows; Downcomers	Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B1.1-2	3.5.1-5	A
Steel Elements: Torus; Vent line; Vent header; Vent line bellows; Downcomers	Pressure Boundary	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	10 CFR Part 50, Appendix J	II.B1.1-2	3.5.1-5	A

Table 3.5.2-7 Primary Containment (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Steel Elements: Torus; Vent line; Vent header; Vent line bellows; Downcomers	Pressure Boundary	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	ASME Section XI, Subsection IWE	II.B1.1-2	3.5.1-5	A
Steel Elements: Torus; Vent line; Vent header; Vent line bellows; Downcomers	Pressure Boundary	Stainless Steel	Air - Indoor	Cumulative Fatigue Damage/Fatigue	TLAA	II.B1.1-4	3.5.1-8	A, 5
Thermowell	Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	VII.I-8	3.3.1-58	E, 3
Thermowell	Pressure Boundary	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	One-Time Inspection	VII.E4-17	3.3.1-17	A
Thermowell	Pressure Boundary	Carbon Steel	Treated Water	Loss of Material/General, Pitting and Crevice Corrosion	Water Chemistry	VII.E4-17	3.3.1-17	B
Thermowell	Pressure Boundary	Stainless Steel	Air - Indoor	None	None	VII.J-15	3.3.1-94	A
Thermowell	Pressure Boundary	Stainless Steel	Treated Water	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	A
Thermowell	Pressure Boundary	Stainless Steel	Treated Water	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	B
Tube Track	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A4-5	3.5.1-25	A
Tube Track	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. ASME Section XI, Subsection IWE and 10 CFR Part 50, Appendix J are the applicable aging management program for this component.

2. Based on industry standards and operating experience age related loss of preload/self-loosening of structural bolting could be caused by vibration, flexing of the joint or cyclic shear loads that could occur in any environment. However these causes are considered in the design of structural connections and eliminated by the initial preload bolt torquing. Thus loss of preload/self-loosening of structural bolting is not significant and will not impact structural intended functions. Never the less, loss of preload/self-loosening will be monitored through the Structures Monitoring Program.

3. Structures Monitoring Program is the applicable aging management program for this component.

4. Concrete or Concrete (High Density) or Grout (High Density) or Boron Concrete encased in steel is protected from environments that promote age related degradations.

5. The TLAA designation in the Aging Management Program column indicates fatigue of this component is evaluated in Section 4.6.

6. Primary containment leakage is controlled in accordance with Hope Creek Technical Specifications.

7. 10 CFR 50 Appendix J testing is the applicable aging management program for this component; ASME Section XI, Subsection IWE is not applicable based on the 1998 and later ASME Section XI Code.

Table 3.5.2-8
Reactor Building
Summary of Aging Management Evaluation

Table 3.5.2-8 Reactor Building

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Blowout Panel	Pressure Relief	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Blowout Panel	Pressure Relief	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Blowout Panel	Pressure Relief	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Blowout Panel	Pressure Relief	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Blowout Panel	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Blowout Panel	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Blowout Panel	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Blowout Panel	Shelter, Protection	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Aluminum Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Cable Trays	Structural Support	Aluminum	Air - Indoor	None	None	III.B5-2	3.5.1-58	C
Cable Trays	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Compressible Joints and Seals (Inflatable Pool Seals)	Water retaining boundary	Elastomer	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Compressible Joints and Seals (Inflatable Pool Seals)	Water retaining boundary	Elastomer	Air/Gas - Dry (Internal)	Hardening and Loss of Strength/Elastomer Degradation	Structures Monitoring Program	VII.F3-7	3.3.1-11	E, 2
Compressible Joints and Seals (Inflatable Pool Seals)	Water retaining boundary	Elastomer	Treated Water	Hardening and Loss of Strength/Elastomer Degradation	Structures Monitoring Program	VII.A4-1	3.3.1-12	E, 2
Compressible Joints and Seals (Seismic Gaps)	Expansion / Separation	Elastomers	Air - Indoor	Increased Hardness, Shrinkage and Loss of Strength/Weathering	Structures Monitoring Program	VII.G-1	3.3.1-61	E, 2
Compressible Joints and Seals (Seismic Gaps)	Expansion / Separation	Elastomers	Air - Outdoor	Increased Hardness, Shrinkage and Loss of Strength/Weathering	Structures Monitoring Program	VII.G-2	3.3.1-61	E, 2

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete Curbs	Direct Flow	Concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Concrete Curbs	Direct Flow	Concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete Embedments	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Concrete Embedments	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Concrete Embedments	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete Embedments	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Concrete Embedments	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A1-6	3.5.1-26	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A1-6	3.5.1-26	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A1-6	3.5.1-26	A
Concrete: Above-grade exterior	Shielding	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Above-grade exterior	Shielding	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Above-grade exterior	Shielding	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A1-6	3.5.1-26	A
Concrete: Above-grade exterior	Structural Pressure Boundary	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Concrete: Above-grade exterior	Structural Pressure Boundary	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Above-grade exterior	Structural Pressure Boundary	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A1-6	3.5.1-26	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A1-6	3.5.1-26	A
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-4	3.5.1-31	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A1-5	3.5.1-31	A
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A1-7	3.5.1-32	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-4	3.5.1-31	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A1-5	3.5.1-31	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A1-7	3.5.1-32	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-4	3.5.1-31	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A1-5	3.5.1-31	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A1-7	3.5.1-32	A
Concrete: Below-grade exterior	Structural Pressure Boundary	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-4	3.5.1-31	A
Concrete: Below-grade exterior	Structural Pressure Boundary	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Below-grade exterior	Structural Pressure Boundary	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A1-5	3.5.1-31	A
Concrete: Below-grade exterior	Structural Pressure Boundary	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A1-7	3.5.1-32	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-4	3.5.1-31	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A1-5	3.5.1-31	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A1-7	3.5.1-32	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-4	3.5.1-31	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A1-5	3.5.1-31	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A1-7	3.5.1-32	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-4	3.5.1-31	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A1-5	3.5.1-31	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A1-7	3.5.1-32	A
Concrete: Foundation	Structural Pressure Boundary	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-4	3.5.1-31	A
Concrete: Foundation	Structural Pressure Boundary	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Foundation	Structural Pressure Boundary	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A1-5	3.5.1-31	A
Concrete: Foundation	Structural Pressure Boundary	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A1-7	3.5.1-32	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-4	3.5.1-31	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A1-5	3.5.1-31	A
Concrete: Foundation	Structural Support	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A1-7	3.5.1-32	A
Concrete: Interior	Flood Barrier	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Concrete: Interior	Flood Barrier	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Interior	HELB/MELB Shielding	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Concrete: Interior	HELB/MELB Shielding	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Interior	Missile Barrier	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Interior	Missile Barrier	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Interior	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Concrete: Interior	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Interior	Shielding	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Concrete: Interior	Shielding	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Interior	Structural Pressure Boundary	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Concrete: Interior	Structural Pressure Boundary	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Interior	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Interior	Structural Support	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Concrete: Interior	Structural Support	Reinforced concrete	Encased in Steel	None	None			G, 3
Conduit	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Shelter, Protection	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Conduit	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Doors	Flood Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Doors	Flood Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Doors	HELB/MELB Shielding	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Doors	Missile Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Doors	Missile Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Doors	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Doors	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Doors	Structural Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Doors	Structural Pressure Boundary	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Equipment foundations	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Equipment foundations	Structural Support	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A1-3	3.5.1-28	A
Hatches/Plugs	HELB/MELB Shielding	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Hatches/Plugs	Missile Barrier	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Hatches/Plugs	Missile Barrier	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Hatches/Plugs	Missile Barrier	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A1-6	3.5.1-26	A
Hatches/Plugs	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Hatches/Plugs	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Hatches/Plugs	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A1-6	3.5.1-26	A
Hatches/Plugs	Shielding	Concrete block	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	C
Hatches/Plugs	Shielding	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Hatches/Plugs	Shielding	Reinforced concrete	Encased in Steel	None	None			G, 3
Hatches/Plugs	Shielding	Stainless Steel	Air - Indoor	None	None	III.B5-5	3.5.1-59	C
Hatches/Plugs	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Hatches/Plugs	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A1-9	3.5.1-23	A
Hatches/Plugs	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A1-6	3.5.1-26	A
Metal decking	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Metal panels	HELB/MELB Shielding	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Metal panels	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Aluminum	Air - Indoor	None	None	III.B5-2	3.5.1-58	C
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Aluminum	Treated Water	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-5	3.3.1-24	C
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Aluminum	Treated Water	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-5	3.3.1-24	D
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Stainless Steel	Air - Indoor	None	None	III.B5-5	3.5.1-59	C
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Stainless Steel	Air - Indoor	None	None	III.B5-5	3.5.1-59	C
Penetration bellows (HELB/MELB Shielding)	Flood Barrier	Stainless Steel	Air - Indoor	None	None	III.B5-5	3.5.1-59	C
Penetration bellows (HELB/MELB Shielding)	HELB/MELB Shielding	Stainless Steel	Air - Indoor	None	None	III.B5-5	3.5.1-59	C
Penetration bellows (HELB/MELB Shielding)	Shelter, Protection	Stainless Steel	Air - Indoor	None	None	III.B5-5	3.5.1-59	C
Penetration bellows (HELB/MELB Shielding)	Structural Pressure Boundary	Stainless Steel	Air - Indoor	None	None	III.B5-5	3.5.1-59	C

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration seals	Flood Barrier	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Flood Barrier	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Flood Barrier	Elastomers	Groundwater/Soil	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Flood Barrier	Grout	Air - Indoor	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration seals	Flood Barrier	Grout	Air - Outdoor	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration seals	Flood Barrier	Grout	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program			F, 5
Penetration seals	Flood Barrier	Grout	Groundwater/Soil	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration seals	Flood Barrier	Grout	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program			F, 5

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration seals	HELB/MELB Shielding	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Groundwater/Soil	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Grout	Air - Indoor	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration seals	Shelter, Protection	Grout	Air - Outdoor	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration seals	Shelter, Protection	Grout	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program			F, 5
Penetration seals	Shelter, Protection	Grout	Groundwater/Soil	Cracking/Shrinkage	Structures Monitoring Program			F, 4

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration seals	Shelter, Protection	Grout	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program			F, 5
Penetration seals	Structural Pressure Boundary	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Structural Pressure Boundary	Grout	Air - Indoor	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration sleeves	Flood Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Penetration sleeves	Flood Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Penetration sleeves	Flood Barrier	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Flood Barrier	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2
Penetration sleeves	Flood Barrier	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	Flood Barrier	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Penetration sleeves	Flood Barrier	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Flood Barrier	Galvanized Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration sleeves	HELB/MELB Shielding	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Penetration sleeves	HELB/MELB Shielding	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	A
Penetration sleeves	HELB/MELB Shielding	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	HELB/MELB Shielding	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Penetration sleeves	Structural Pressure Boundary	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Pressure Boundary	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	Structural Pressure Boundary	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Penetration sleeves	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Penetration sleeves	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Support	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2
Penetration sleeves	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Penetration sleeves	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration sleeves	Structural Support	Galvanized Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2
Pipe Whip Restraints and Jet Impingement Shields	HELB/MELB Shielding	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Pipe Whip Restraints and Jet Impingement Shields	Pipe Whip Restraint	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Roofing membrane	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Flood Barrier	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Flood Barrier	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	HELB/MELB Shielding	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Spent fuel pool gates	Water retaining boundary	Stainless Steel	Air - Indoor	None	None	III.B5-5	3.5.1-59	C
Spent fuel pool gates	Water retaining boundary	Stainless Steel	Treated Water	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	III.A5-13	3.5.1-46	B, 6
Spray Shields	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Spray Shields	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Steel Components: All structural steel	Missile Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Steel Components: All structural steel	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Steel Components: All structural steel	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Steel Components: Fuel pool liners	Water retaining boundary	Stainless Steel	Air - Indoor	None	None	III.B5-5	3.5.1-59	C
Steel Components: Fuel pool liners	Water retaining boundary	Stainless Steel	Concrete	None	None	VII.J-17	3.3.1-96	C
Steel Components: Fuel pool liners	Water retaining boundary	Stainless Steel	Treated Water	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	III.A5-13	3.5.1-46	B, 7
Steel Components: Reactor Building dome liner	Structural Pressure Boundary	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Steel Components: Reactor Building dome liner	Structural Pressure Boundary	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Steel Components: Reactor Building dome liner	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Steel Components: Reactor Building dome liner	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Steel Components: Reactor Well, Dryer and Separator Pool and Cask Loading Pit liners	Water retaining boundary	Stainless Steel	Air - Indoor	None	None	III.B5-5	3.5.1-59	C
Steel Components: Reactor Well, Dryer and Separator Pool and Cask Loading Pit liners	Water retaining boundary	Stainless Steel	Concrete	None	None	VII.J-17	3.3.1-96	C
Steel Components: Reactor Well, Dryer and Separator Pool and Cask Loading Pit liners	Water retaining boundary	Stainless Steel	Treated Water	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	III.A5-13	3.5.1-46	B, 8
Steel Components: Refueling bellows (RPV to Drywell and Drywell to Reactor Well)	Water retaining boundary	Stainless Steel	Air - Indoor	Cumulative Fatigue Damage/Fatigue	TLAA	II.B1.1-4	3.5.1-8	C, 9
Steel Components: Refueling bellows (RPV to Drywell and Drywell to Reactor Well)	Water retaining boundary	Stainless Steel	Treated Water	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	III.A5-13	3.5.1-46	D, 8

Table 3.5.2-8 Reactor Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Steel Components: Skimmer Surge Tank liner	Water retaining boundary	Stainless Steel	Air - Indoor	None	None	III.B5-5	3.5.1-59	C
Steel Components: Skimmer Surge Tank liner	Water retaining boundary	Stainless Steel	Concrete	None	None	VII.J-17	3.3.1-96	C
Steel Components: Skimmer Surge Tank liner	Water retaining boundary	Stainless Steel	Treated Water	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	C
Steel Components: Skimmer Surge Tank liner	Water retaining boundary	Stainless Steel	Treated Water	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	D
Steel Components: Skimmer Surge Tank screen	Filter	Stainless Steel	Treated Water	Loss of Material/Pitting and Crevice Corrosion	One-Time Inspection	VII.A4-11	3.3.1-24	C
Steel Components: Skimmer Surge Tank screen	Filter	Stainless Steel	Treated Water	Loss of Material/Pitting and Crevice Corrosion	Water Chemistry	VII.A4-11	3.3.1-24	D
Steel Components: Sump Liners	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Steel Components: Sump Liners	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Steel Components: Sump Liners	Water retaining boundary	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Steel Components: Sump Liners	Water retaining boundary	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Steel Components: Sump Liners	Water retaining boundary	Carbon Steel	Raw Water	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A6-11	3.5.1-47	E, 2
Tube Track	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A1-12	3.5.1-25	A
Tube Track	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. Based on industry standards and operating experience age related loss of preload/self-loosening of structural bolting could be caused by vibration, flexing of the joint or cyclic shear loads that could occur in any environment. However these causes are considered in the design of structural connections and eliminated by the initial preload bolt torquing. Thus loss of preload/self-loosening of structural bolting is not significant and will not impact structural intended functions. Never the less, loss of preload/self-loosening will be monitored through the Structures Monitoring Program.

2. Structures Monitoring Program is the applicable aging management program for this component.

3. Concrete encased in steel is protected from environments that promote age related degradations.

4. Based on industry standards and guidelines, grout is susceptible to cracking due to shrinkage in this environment. However shrinkage cracking occurs early in plant life and is not expected to be significant for the extended period of operation. Never the less the aging effect will be monitored through the Structures Monitoring Program.

5. The aging effects and Aging Management Program identified for this material/environment combination are consistent with industry guidance.

6. The spent fuel pool water level is monitored in accordance with technical specifications.

7. The spent fuel pool water level is monitored in accordance with technical specifications. Leakage from the leak chase channels is monitored in accordance with plant procedures.

8. Reactor well refueling water level is monitored in accordance with technical specifications.

9. The TLAA designation in the Aging Management Program column indicates fatigue of this component is evaluated in Section 4.7

Table 3.5.2-9
Service Water Intake Structures
Summary of Aging Management Evaluation

Table 3.5.2-9 Service Water Intake Structures

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (Structural)	Structural Support	Aluminum Bolting	Air - Indoor	Loss of Preload/Self-Loosening	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	VII.I-5	3.3.1-45	E, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Water - Flowing	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Water - Flowing	Loss of Preload/Self-Loosening	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 1

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	VII.I-5	3.3.1-45	E, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Water - Flowing	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Water - Flowing	Loss of Preload/Self-Loosening	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 1
Cable Trays	Structural Support	Aluminum	Air - Indoor	None	None	III.B5-2	3.5.1-58	C
Concrete anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Concrete anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Concrete anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Water - Flowing	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete embedments (including Traveling Water Screens support)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Concrete embedments (including Traveling Water Screens support)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Concrete embedments (including Traveling Water Screens support)	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete embedments (including Traveling Water Screens support)	Structural Support	Carbon Steel	Water - Flowing	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Concrete embedments (including Traveling Water Screens support)	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Concrete embedments (including Traveling Water Screens support)	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Concrete embedments (including Traveling Water Screens support)	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete embedments (including Traveling Water Screens support)	Structural Support	Galvanized Steel	Water - Flowing	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-5	3.5.1-35	A
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Water - Flowing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Water - Flowing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Above-grade exterior	Flood Barrier	Reinforced concrete	Water - Flowing	Loss of Material/ Abrasion; Cavitation	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-7	3.5.1-45	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-5	3.5.1-35	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Water - Flowing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Water - Flowing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Above-grade exterior	Missile Barrier	Reinforced concrete	Water - Flowing	Loss of Material/ Abrasion; Cavitation	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-7	3.5.1-45	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-5	3.5.1-35	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Water - Flowing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Water - Flowing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Water - Flowing	Loss of Material/ Abrasion; Cavitation	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-7	3.5.1-45	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-5	3.5.1-35	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Water - Flowing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Water - Flowing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Water - Flowing	Loss of Material/ Abrasion; Cavitation	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-7	3.5.1-45	A
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-3	3.5.1-34	A
Concrete: Below-grade exterior	Flood Barrier	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-3	3.5.1-34	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-3	3.5.1-34	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-3	3.5.1-34	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Foundation	Flood Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-3	3.5.1-34	A
Concrete: Foundation	Flood Barrier	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-3	3.5.1-34	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-3	3.5.1-34	A
Concrete: Foundation	Structural Support	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A
Concrete: Interior	Direct Flow	Reinforced concrete	Water - Flowing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Interior	Direct Flow	Reinforced concrete	Water - Flowing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Interior	Direct Flow	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Interior	Direct Flow	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A
Concrete: Interior	Direct Flow	Reinforced concrete	Water - Flowing	Loss of Material/ Abrasion; Cavitation	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-7	3.5.1-45	A
Concrete: Interior	Flood Barrier	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Concrete: Interior	Flood Barrier	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Interior	Flood Barrier	Reinforced concrete	Water - Flowing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Interior	Flood Barrier	Reinforced concrete	Water - Flowing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Interior	Flood Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Interior	Flood Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Interior	Flood Barrier	Reinforced concrete	Water - Flowing	Loss of Material/ Abrasion; Cavitation	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-7	3.5.1-45	A
Concrete: Interior	Missile Barrier	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Concrete: Interior	Missile Barrier	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Interior	Missile Barrier	Reinforced concrete	Water - Flowing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Interior	Missile Barrier	Reinforced concrete	Water - Flowing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Interior	Missile Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Interior	Missile Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A
Concrete: Interior	Missile Barrier	Reinforced concrete	Water - Flowing	Loss of Material/ Abrasion; Cavitation	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-7	3.5.1-45	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Interior	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Concrete: Interior	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Interior	Shelter, Protection	Reinforced concrete	Water - Flowing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Interior	Shelter, Protection	Reinforced concrete	Water - Flowing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Interior	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Interior	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A
Concrete: Interior	Shelter, Protection	Reinforced concrete	Water - Flowing	Loss of Material/ Abrasion; Cavitation	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-7	3.5.1-45	A
Concrete: Interior	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Interior	Structural Support	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Interior	Structural Support	Reinforced concrete	Water - Flowing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Interior	Structural Support	Reinforced concrete	Water - Flowing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Concrete: Interior	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			H, 2
Concrete: Interior	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-6	3.5.1-37	A
Concrete: Interior	Structural Support	Reinforced concrete	Water - Flowing	Loss of Material/ Abrasion; Cavitation	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-7	3.5.1-45	A
Conduit	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Shelter, Protection	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Conduit	Shelter, Protection	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Conduit	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Conduit	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Conduit	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Doors	Flood Barrier	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Doors	Flood Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Doors	Missile Barrier	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Doors	Missile Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Doors	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Doors	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Equipment foundations	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Equipment foundations	Structural Support	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A6-4	3.5.1-28	A
Hatches/Plugs	Flood Barrier	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Hatches/Plugs	Flood Barrier	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Hatches/Plugs	Flood Barrier	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-5	3.5.1-35	A
Hatches/Plugs	Missile Barrier	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Hatches/Plugs	Missile Barrier	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Hatches/Plugs	Missile Barrier	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-5	3.5.1-35	A
Hatches/Plugs	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Hatches/Plugs	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Hatches/Plugs	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-5	3.5.1-35	A
Hatches/Plugs	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Hatches/Plugs	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-1	3.5.1-34	A
Hatches/Plugs	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-5	3.5.1-35	A
Ice Barrier	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Ice Barrier	Shelter, Protection	Carbon Steel	Water - Flowing	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Ice Barrier	Shelter, Protection	Treated Wood	Air - Outdoor	Change in Material Properties, Loss of Material/Moisture Damage, Insect Damage	Structures Monitoring Program			J

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Ice Barrier	Shelter, Protection	Treated Wood	Water - Flowing	Change in Material Properties, Loss of Material/Moisture Damage, Insect Damage	Structures Monitoring Program			J
Metal decking	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Metal decking	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Carbon Steel	Water - Flowing	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration seals	Flood Barrier	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Flood Barrier	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Flood Barrier	Elastomers	Groundwater/Soil	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Flood Barrier	Grout	Air - Indoor	Cracking/Shrinkage	Structures Monitoring Program			F, 3
Penetration seals	Flood Barrier	Grout	Air - Outdoor	Cracking/Shrinkage	Structures Monitoring Program			F, 3
Penetration seals	Flood Barrier	Grout	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program			F, 2
Penetration seals	Flood Barrier	Grout	Groundwater/Soil	Cracking/Shrinkage	Structures Monitoring Program			F, 3
Penetration seals	Flood Barrier	Grout	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program			F, 2

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration seals	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Groundwater/Soil	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Grout	Air - Indoor	Cracking/Shrinkage	Structures Monitoring Program			F, 3
Penetration seals	Shelter, Protection	Grout	Air - Outdoor	Cracking/Shrinkage	Structures Monitoring Program			F, 3
Penetration seals	Shelter, Protection	Grout	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program			F, 2
Penetration seals	Shelter, Protection	Grout	Groundwater/Soil	Cracking/Shrinkage	Structures Monitoring Program			F, 3
Penetration seals	Shelter, Protection	Grout	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program			F, 2
Penetration sleeves	Flood Barrier	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration sleeves	Flood Barrier	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Penetration sleeves	Flood Barrier	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Flood Barrier	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	VII.C1-18	3.3.1-19	E, 4
Penetration sleeves	Flood Barrier	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	Flood Barrier	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Penetration sleeves	Flood Barrier	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Flood Barrier	Galvanized Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	VII.C1-18	3.3.1-19	E, 4
Penetration sleeves	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Penetration sleeves	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Penetration sleeves	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration sleeves	Structural Support	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	VII.C1-18	3.3.1-19	E, 4
Penetration sleeves	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Penetration sleeves	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Support	Galvanized Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	VII.C1-18	3.3.1-19	E, 4
Piles	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Piles	Structural Support	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	VII.C1-18	3.3.1-19	E, 4
Piles	Structural Support	Concrete	Encased in Steel	None	None			G, 5
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Flood Barrier	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Flood Barrier	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Steel components: All structural steel (including trash racks)	Filter	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Steel components: All structural steel (including trash racks)	Filter	Carbon Steel	Water - Flowing	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Steel components: All structural steel (including trash racks)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Steel components: All structural steel (including trash racks)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Steel components: All structural steel (including trash racks)	Structural Support	Carbon Steel	Water - Flowing	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Tube Track	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A

Table 3.5.2-9 Service Water Intake Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tube Track	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. Based on industry standards and operating experience age related loss of preload/self-loosening of structural bolting could be caused by vibration, flexing of the joint or cyclic shear loads that could occur in any environment. However these causes are considered in the design of structural connections and eliminated by the initial preload bolt torquing. Thus loss of preload/self-loosening of structural bolting is not significant and will not impact structural intended functions. Never the less, loss of preload/self-loosening will be monitored through the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants aging management program.

2. The aging effects and Aging Management Program identified for this material/environment combination are consistent with industry guidance.

3. Based on industry standards and guidelines, grout is susceptible to cracking due to shrinkage in this environment. However shrinkage cracking occurs early in plant life and is not expected to be significant for the extended period of operation. Never less the aging effect will be monitored through the Structures Monitoring Program.

4. RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants is the applicable aging management program for this component.

5. Concrete encased in steel is protected from environments that promote age related degradations.

Table 3.5.2-10
Shoreline Protection and Dike
Summary of Aging Management Evaluation

Table 3.5.2-10 Shoreline Protection and Dike

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Earthen water-control structures: Embankments (dikes)	Shelter, Protection	Soil, rip-rap, sand, gravel	Air - Outdoor	Loss of Material, Loss of Form/Erosion, Settlement, Sedimentation, Frost Action, Waves, Currents, Surface Runoff, Seepage	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants			G, 1, 2
Earthen water-control structures: Embankments (dikes)	Shelter, Protection	Soil, rip-rap, sand, gravel	Water - Flowing	Loss of Material, Loss of Form/Erosion, Settlement, Sedimentation, Frost Action, Waves, Currents, Surface Runoff, Seepage	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-9	3.5.1-48	A
Piles (Sheet Piles)	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A
Piles (Sheet Piles)	Shelter, Protection	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Piles (Sheet Piles)	Shelter, Protection	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	VII.C1-18	3.3.1-19	E, 2
Piles (Sheet Piles)	Shelter, Protection	Carbon Steel	Water - Flowing	Loss of Material/General, Pitting and Crevice Corrosion	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	III.A6-11	3.5.1-47	A

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. Based on industry standards and guidelines, earthen water-control structures are susceptible to loss of material and loss of form in Air - Outdoor environment.

2. RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants is the applicable aging management program for this component.

Table 3.5.2-11
Switchyard
Summary of Aging Management Evaluation

Table 3.5.2-11 Switchyard

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Concrete anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Concrete	None	None	VII.J-21	3.3.1-96	C

Table 3.5.2-11 Switchyard (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete embedments	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete embedments	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete embedments	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A

Table 3.5.2-11 Switchyard (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.5.2-11 Switchyard (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Conduit	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Table 3.5.2-11 Switchyard (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Conduit	Shelter, Protection	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Conduit	Shelter, Protection	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Conduit	Shelter, Protection	PVC	Concrete	None	None			J, 2
Conduit	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Conduit	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Doors	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Equipment foundations	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Equipment foundations	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Equipment foundations	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Equipment foundations	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A

Table 3.5.2-11 Switchyard (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Equipment foundations	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Equipment foundations	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Manholes, Handholes & Duct Banks	Shelter, Protection	Aluminum	Air - Outdoor	Loss of Material/Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-7	3.5.1-50	C
Manholes, Handholes & Duct Banks	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Manholes, Handholes & Duct Banks	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Manholes, Handholes & Duct Banks	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Manholes, Handholes & Duct Banks	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Manholes, Handholes & Duct Banks	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Manholes, Handholes & Duct Banks	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A

Table 3.5.2-11 Switchyard (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Manholes, Handholes & Duct Banks	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Manholes, Handholes & Duct Banks	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Manholes, Handholes & Duct Banks	Shelter, Protection	Reinforced concrete	Water - Standing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Manholes, Handholes & Duct Banks	Shelter, Protection	Reinforced concrete	Water - Standing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Manholes, Handholes & Duct Banks	Shelter, Protection	Reinforced concrete	Water - Standing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Manholes, Handholes & Duct Banks	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Manholes, Handholes & Duct Banks	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Manholes, Handholes & Duct Banks	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A

Table 3.5.2-11 Switchyard (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Manholes, Handholes & Duct Banks	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Manholes, Handholes & Duct Banks	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Manholes, Handholes & Duct Banks	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Manholes, Handholes & Duct Banks	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Manholes, Handholes & Duct Banks	Structural Support	Reinforced concrete	Water - Standing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Manholes, Handholes & Duct Banks	Structural Support	Reinforced concrete	Water - Standing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Manholes, Handholes & Duct Banks	Structural Support	Reinforced concrete	Water - Standing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Masonry walls: Above-grade exterior	Shelter, Protection	Concrete block	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C

Table 3.5.2-11 Switchyard (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Masonry walls: Above-grade exterior	Shelter, Protection	Concrete block	Air - Indoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 3
Masonry walls: Above-grade exterior	Shelter, Protection	Concrete block	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Above-grade exterior	Shelter, Protection	Concrete block	Air - Outdoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 3
Masonry walls: Above-grade exterior	Shelter, Protection	Concrete block	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	C
Masonry walls: Above-grade exterior	Structural Support	Concrete block	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Above-grade exterior	Structural Support	Concrete block	Air - Indoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 3
Masonry walls: Above-grade exterior	Structural Support	Concrete block	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Above-grade exterior	Structural Support	Concrete block	Air - Outdoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 3
Masonry walls: Above-grade exterior	Structural Support	Concrete block	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	C
Metal components: Covers	Shelter, Protection	Aluminum	Air - Indoor	None	None	III.B5-2	3.5.1-58	C

Table 3.5.2-11 Switchyard (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Metal components: Covers	Shelter, Protection	Aluminum	Air - Outdoor	Loss of Material/Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-7	3.5.1-50	C
Metal components: Covers	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Shelter, Protection	Aluminum	Air - Outdoor	Loss of Material/Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-7	3.5.1-50	C
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-11 Switchyard (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Piles	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Piles	Structural Support	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 4
Piles	Structural Support	Concrete	Encased in Steel	None	None			G, 5
Roofing membrane	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Transmission towers	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-11 Switchyard (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Tunnel (Cable Vault)	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Tunnel (Cable Vault)	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Tunnel (Cable Vault)	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Tunnel (Cable Vault)	Structural Support	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. Based on industry standards and operating experience age related loss of preload/self-loosening of structural bolting could be caused by vibration, flexing of the joint or cyclic shear loads that could occur in any environment. However these causes are considered in the design of structural connections and eliminated by the initial preload bolt torquing. Thus loss of preload/self-loosening of structural bolting is not significant and will not impact structural intended functions. Never the less, loss of preload/self-loosening will be monitored through the Structures Monitoring Program.

2. Polyvinyl Chloride (PVC) is encased in concrete and has no aging effects for the identified environment.

3. Masonry walls are inspected as a part of the Structures Monitoring Program, which includes the ten attributes of NUREG-1801 Masonry Wall Program (XI.S5)

4. Structures Monitoring Program is the applicable aging management program for this component.

5. Concrete encased in steel is protected from environments that promote age related degradations.

Table 3.5.2-12
Turbine Building
Summary of Aging Management Evaluation

Table 3.5.2-12 Turbine Building

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (Structural)	Structural Support	Aluminum Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Indoor	Loss of Preload/Self-Loosening	Structures Monitoring Program	VII.I-5	3.3.1-45	E, 1
Cable Trays	Structural Support	Aluminum	Air - Indoor	None	None	III.B5-2	3.5.1-58	C
Compressible Joints and Seals (Seismic Gaps)	Expansion / Separation	Elastomers	Air - Indoor	Increased Hardness, Shrinkage and Loss of Strength/Weathering	Structures Monitoring Program	VII.G-1	3.3.1-61	E, 2
Compressible Joints and Seals (Seismic Gaps)	Expansion / Separation	Elastomers	Air - Outdoor	Increased Hardness, Shrinkage and Loss of Strength/Weathering	Structures Monitoring Program	VII.G-2	3.3.1-61	E, 2
Concrete anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Indoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-12 Turbine Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete embedments	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete embedments	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete embedments	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete embedments	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Concrete embedments	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete embedments	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A

Table 3.5.2-12 Turbine Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A

Table 3.5.2-12 Turbine Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A

Table 3.5.2-12 Turbine Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Structural Support	Reinforced concrete	Water - flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Interior	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Interior	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Interior	Shielding	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Interior	Shielding	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Interior	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.5.2-12 Turbine Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Interior	Structural Support	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Conduit	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Shelter, Protection	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Conduit	Shelter, Protection	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Conduit	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Conduit	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Conduit	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Doors	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Doors	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Equipment foundations	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Equipment foundations	Structural Support	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Hatches/Plugs	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.5.2-12 Turbine Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Hatches/Plugs	Shielding	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Hatches/Plugs	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Masonry walls: Interior	Shelter, Protection	Concrete block	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Interior	Shelter, Protection	Concrete block	Air - Indoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 3
Masonry walls: Interior	Shelter, Protection	Concrete block	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	C
Masonry walls: Interior	Shielding	Concrete block	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Interior	Shielding	Concrete block	Air - Indoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 3
Masonry walls: Interior	Shielding	Concrete block	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	C

Table 3.5.2-12 Turbine Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Masonry walls: Interior	Structural Support	Concrete block	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	C
Masonry walls: Interior	Structural Support	Concrete block	Air - Indoor	Cracking/Restraint, Shrinkage, Creep, and Aggressive Environment	Structures Monitoring Program	III.A3-11	3.5.1-43	A, 3
Masonry walls: Interior	Structural Support	Concrete block	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	C
Metal decking	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Metal decking	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Metal siding	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Metal siding	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Table 3.5.2-12 Turbine Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration seals	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Groundwater/Soil	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Grout	Air - Indoor	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration seals	Shelter, Protection	Grout	Air - Outdoor	Cracking/Shrinkage	Structures Monitoring Program			F, 4
Penetration seals	Shelter, Protection	Grout	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program			F, 5
Penetration seals	Shelter, Protection	Grout	Groundwater/Soil	Cracking/Shrinkage	Structures Monitoring Program			F, 4

Table 3.5.2-12 Turbine Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration seals	Shelter, Protection	Grout	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program			F, 5
Penetration sleeves	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Support	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2
Penetration sleeves	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C
Penetration sleeves	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Structural Support	Galvanized Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 2
Precast Panels	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.5.2-12 Turbine Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Precast Panels	Shelter, Protection	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Precast Panels	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Precast Panels	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Precast Panels	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Precast Panels	Structural Support	Reinforced concrete	Air - Indoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Precast Panels	Structural Support	Reinforced concrete	Air - Indoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Precast Panels	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Precast Panels	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A

Table 3.5.2-12 Turbine Building (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Precast Panels	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Roofing membrane	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Indoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Steel components: All structural steel	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Tube Track	Structural Support	Carbon Steel	Air - Indoor	Loss of Material/General Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Tube Track	Structural Support	Galvanized Steel	Air - Indoor	None	None	III.B5-3	3.5.1-58	C

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. Based on industry standards and operating experience age related loss of preload/self-loosening of structural bolting could be caused by vibration, flexing of the joint or cyclic shear loads that could occur in any environment. However these causes are considered in the design of structural connections and eliminated by the initial preload bolt torquing. Thus loss of preload/self-loosening of structural bolting is not significant and will not impact structural intended functions. Never the less, loss of preload/self-loosening will be monitored through the Structures Monitoring Program.

2. Structures Monitoring Program is the applicable aging management program for this component.

3. Masonry walls are inspected as a part of the Structures Monitoring Program, which includes the ten attributes of NUREG-1801 Masonry Walls Program (XI.S5).

4. Based on industry standards and guidelines, grout is susceptible to cracking due to shrinkage in this environment. However shrinkage cracking occurs early in plant life and is not expected to be significant for the extended period of operation. Never the less the aging effect will be monitored through the Structures Monitoring Program.

5. The aging effects and Aging Management Program identified for this material/environment combination are consistent with industry guidance.

Table 3.5.2-13
Yard Structures
Summary of Aging Management Evaluation

Table 3.5.2-13 Yard Structures

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Bolting (Structural)	Structural Support	Galvanized Steel Bolting	Air - Outdoor	Loss of Preload/Self-Loosening	Structures Monitoring Program			H, 1
Cable Trays	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Anchors	Structural Support	Carbon and Low Alloy Steel Bolting	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete Embedments	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Concrete Embedments	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete Embedments	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete Embedments	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Above-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Above-grade exterior	Water retaining boundary	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Above-grade exterior	Water retaining boundary	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Above-grade exterior	Water retaining boundary	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Missile Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Below-grade exterior	Water retaining boundary	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Below-grade exterior	Water retaining boundary	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Below-grade exterior	Water retaining boundary	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Below-grade exterior	Water retaining boundary	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Below-grade exterior	Water retaining boundary	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Below-grade exterior	Water retaining boundary	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Below-grade exterior	Water retaining boundary	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Foundation	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Foundation	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Concrete: Foundation	Water retaining boundary	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Concrete: Foundation	Water retaining boundary	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Foundation	Water retaining boundary	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Concrete: Foundation	Water retaining boundary	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Concrete: Foundation	Water retaining boundary	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Concrete: Foundation	Water retaining boundary	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Concrete: Foundation	Water retaining boundary	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Conduit	Shelter, Protection	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Conduit	Shelter, Protection	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Conduit	Shelter, Protection	PVC	Concrete	None	None			J, 2
Conduit	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Conduit	Structural Support	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Conduit	Structural Support	PVC	Concrete	None	None			J, 2
Equipment foundations	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Equipment foundations	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Equipment foundations	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Equipment foundations	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Equipment foundations	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Equipment foundations	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Hatches/Plugs (Manhole and Handhole covers)	Missile Barrier	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Hatches/Plugs (Manhole and Handhole covers)	Missile Barrier	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Hatches/Plugs (Manhole and Handhole covers)	Shelter, Protection	Cast Iron	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Hatches/Plugs (Manhole and Handhole covers)	Shelter, Protection	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Hatches/Plugs (Manhole and Handhole covers)	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Hatches/Plugs (Manhole and Handhole covers)	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Manholes, Handholes & Duct banks	Missile Barrier	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Manholes, Handholes & Duct banks	Missile Barrier	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Manholes, Handholes & Duct banks	Missile Barrier	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Manholes, Handholes & Duct banks	Missile Barrier	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Manholes, Handholes & Duct banks	Missile Barrier	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Manholes, Handholes & Duct banks	Missile Barrier	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Manholes, Handholes & Duct banks	Missile Barrier	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Manholes, Handholes & Duct banks	Missile Barrier	Reinforced concrete	Water - Standing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Manholes, Handholes & Duct banks	Missile Barrier	Reinforced concrete	Water - Standing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Manholes, Handholes & Duct banks	Missile Barrier	Reinforced concrete	Water - Standing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Manholes, Handholes & Duct banks	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Manholes, Handholes & Duct banks	Shelter, Protection	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Manholes, Handholes & Duct banks	Shelter, Protection	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Manholes, Handholes & Duct banks	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Manholes, Handholes & Duct banks	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Manholes, Handholes & Duct banks	Shelter, Protection	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Manholes, Handholes & Duct banks	Shelter, Protection	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Manholes, Handholes & Duct banks	Shelter, Protection	Reinforced concrete	Water - Standing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Manholes, Handholes & Duct banks	Shelter, Protection	Reinforced concrete	Water - Standing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Manholes, Handholes & Duct banks	Shelter, Protection	Reinforced concrete	Water - Standing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Manholes, Handholes & Duct banks	Structural Support	Reinforced concrete	Air - Outdoor	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-9	3.5.1-23	A
Manholes, Handholes & Duct banks	Structural Support	Reinforced concrete	Air - Outdoor	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Manholes, Handholes & Duct banks	Structural Support	Reinforced concrete	Air - Outdoor	Loss of Material (Spalling, Scaling) and Cracking/Freeze-thaw	Structures Monitoring Program	III.A3-6	3.5.1-26	A
Manholes, Handholes & Duct banks	Structural Support	Reinforced concrete	Groundwater/Soil	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Manholes, Handholes & Duct banks	Structural Support	Reinforced concrete	Groundwater/Soil	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Manholes, Handholes & Duct banks	Structural Support	Reinforced concrete	Groundwater/Soil	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A
Manholes, Handholes & Duct banks	Structural Support	Reinforced concrete	Water - Flowing	Increase in Porosity and Permeability, Loss of Strength/ Leaching of Calcium Hydroxide	Structures Monitoring Program	III.A3-7	3.5.1-32	A
Manholes, Handholes & Duct banks	Structural Support	Reinforced concrete	Water - Standing	Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling)/Corrosion of Embedded Steel	Structures Monitoring Program	III.A3-4	3.5.1-31	A
Manholes, Handholes & Duct banks	Structural Support	Reinforced concrete	Water - Standing	Cracks and Distortion/Increased Stress Levels from Settlement	Structures Monitoring Program	III.A3-3	3.5.1-28	A
Manholes, Handholes & Duct banks	Structural Support	Reinforced concrete	Water - Standing	Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling)/ Aggressive Chemical Attack	Structures Monitoring Program	III.A3-5	3.5.1-31	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Miscellaneous steel (catwalks, stairs, handrails, ladders, vents and louvers, platforms, etc.)	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Panels, Racks, Cabinets, and Other Enclosures	Shelter, Protection	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration bellows (Condensate Storage Tank Dike)	Shelter, Protection	Stainless Steel	Air - Outdoor	Loss of Material/Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-7	3.5.1-50	C
Penetration bellows (Condensate Storage Tank Dike)	Water retaining boundary	Stainless Steel	Air - Outdoor	Loss of Material/Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-7	3.5.1-50	C
Penetration seals	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration seals	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Shelter, Protection	Elastomers	Groundwater/Soil	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Water retaining boundary	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Penetration seals	Water retaining boundary	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration seals	Water retaining boundary	Elastomers	Groundwater/Soil	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Penetration sleeves	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Shelter, Protection	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Shelter, Protection	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 3
Penetration sleeves	Shelter, Protection	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Penetration sleeves	Shelter, Protection	Galvanized Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Penetration sleeves	Shelter, Protection	Galvanized Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 3
Piles	Structural Support	Carbon Steel	Concrete	None	None	VII.J-21	3.3.1-96	C
Piles	Structural Support	Carbon Steel	Groundwater/Soil	Loss of Material/General, Pitting, Crevice, and Microbiologically Influenced Corrosion	Structures Monitoring Program	VII.C1-18	3.3.1-19	E, 3

Table 3.5.2-13 Yard Structures (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Piles	Structural Support	Concrete	Encased in steel	None	None			G, 4
Seals, gaskets, and moisture barriers (caulking, flashing and other sealants)	Shelter, Protection	Elastomers	Air - Outdoor	Loss of Sealing/Deterioration of Seals, Gaskets, and Moisture Barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	III.A6-12	3.5.1-44	A
Steel Components: Bus Duct	Shelter, Protection	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Steel Components: Bus Duct	Structural Support	Carbon Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A
Transmission towers	Structural Support	Galvanized Steel	Air - Outdoor	Loss of Material/General, Pitting and Crevice Corrosion	Structures Monitoring Program	III.A3-12	3.5.1-25	A

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. Based on industry standards and operating experience age related loss of preload/self-loosening of structural bolting could be caused by vibration, flexing of the joint or cyclic shear loads that could occur in any environment. However these causes are considered in the design of structural connections and eliminated by the initial preload bolt torquing. Thus loss of preload/self-loosening of structural bolting is not significant and will not impact structural intended functions. Never the less, loss of preload/self-loosening will be monitored through the Structures Monitoring Program.
2. Polyvinyl Chloride (PVC) is encased in concrete and has no aging effects for the identified environment.
3. Structures Monitoring Program is the applicable aging management program for this component.
4. Concrete encased in steel is protected from environments that promote age related degradations.

3.6 AGING MANAGEMENT OF ELECTRICAL AND INSTRUMENTATION AND CONTROLS

3.6.1 INTRODUCTION

This section provides the results of the aging management review for the electrical commodity groups identified in Section 2.5, Scoping and Screening Results: Electrical Systems/Commodity Groups. The electrical commodity groups requiring aging management review are listed below. The following sections identify materials, environments, aging effects requiring management and associated aging management programs for each electrical commodity group:

- Cable Connections - Metallic Parts (2.5.2.5.1)
- Fuse Holders (Not Part of a Larger Assembly): Fuse Holders - Metallic Clamp (2.5.2.5.3)
- High Voltage Insulators (2.5.2.5.4)
- Insulated Cables and Connections (2.5.2.5.5)
- Metal Enclosed Bus (2.5.2.5.6)
- Switchyard Bus and Connections, Transmission Conductors and Connections (2.5.2.5.7)

Electrical Penetrations (2.5.2.5.2) are not subject to their own aging management review in this section in that they are addressed 1) as a TLAA in the environmental qualification program, 2) as part of the insulated cables and connections commodity group and 3) in the Primary Containment aging management review (Table 3.5.2-7).

3.6.2 RESULTS

3.6.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

3.6.2.1.1 Cable Connections - Metallic Parts

Materials

The materials of construction for the Cable Connections (Metallic Parts) are:

- Various Metals Used for Electrical Connections

Environments

The Cable Connections (Metallic Parts) are exposed to the following environments:

- Air – Indoor
- Air – Outdoor

Aging Effects Requiring Management

The following aging effect associated with the Cable Connections (Metallic Parts) requires management:

- Loosening of Bolted Connections/Thermal Cycling, Ohmic Heating, Electrical Transients, Vibration, Chemical Contamination, Corrosion, and Oxidation

Aging Management Programs

The following aging management program manages the aging effects for the Cable Connections (Metallic Parts):

- Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (B.2.1.39)

Table 3.6.2-1, Electrical Commodities - Summary of Aging Management Evaluation, summarizes the results of the aging management review of the Cable Connections (Metallic Parts).

3.6.2.1.2 Fuse Holders (Not Part of a Larger Assembly): Fuse Holders - Metallic Clamp

Materials

The materials of construction for the metallic clamp portions of Fuse Holders are:

- Copper Alloy

Environments

The fuse holders are exposed to the following environment:

- Air – Indoor

Aging Effects Requiring Management

The metallic clamp portions of Fuse Holders have no aging effects requiring management. See Subsection 3.6.2.3.1 for additional information.

Aging Management Programs

Because there are no aging effects requiring management, no AMPs are required for the metallic clamp portion of Fuse Holders.

Table 3.6.2-1, Electrical Commodities - Summary of Aging Management Evaluation, summarizes the results of the aging management review of the metallic clamp portions of Fuse Holders.

3.6.2.1.3 High Voltage Insulators

Materials

The materials of construction for the High Voltage Insulators are:

- Cement
- Metal
- Porcelain

Environments

The High Voltage Insulators are exposed to the following environment:

- Air - Outdoor

Aging Effects Requiring Management

The following aging effect associated with the high voltage insulators requires management:

- Degradation of Insulator Quality/Presence of Salt Deposits and Surface Contamination

See Subsection 3.6.2.2.2 for further evaluation.

Aging Management Programs

The following plant-specific aging management program will be implemented to manage the degradation of insulator quality due to the presence of salt deposits and surface contamination on high voltage insulators in the Hope Creek Switchyard and the Salem-Hope Creek 500 kV cross-connection (the 5037 line).

- High-Voltage Insulators Program (B.2.2.1)

Table 3.6.2-1, Electrical Commodities - Summary of Aging Management Evaluation, summarizes the results of the aging management review of the High Voltage Insulators.

3.6.2.1.4 Insulated Cables and Connections

The insulated cables and connections commodity group was broken down for aging management review of insulation into subcategories based on categorization in NUREG 1801:

- Insulated Cables and Connections
- Insulated Cables and Connections Used In Instrumentation Circuits
- Insulated Inaccessible Medium Voltage Cables

The types of connection insulation included in this review were splices, electrical penetration pigtails, terminal blocks, and fuse holders.

Materials

The materials of construction for the Insulated Cables and Connections are:

- Various Organic Polymers

Environments

Insulated Cables and Connections are exposed to the following environment:

- Adverse Localized Environment

Aging Effects Requiring Management

The following aging effects associated with Insulated Cables and Connections require management:

- Embrittlement, Cracking, Melting, Discoloration, Swelling, or Loss of Dielectric Strength Leading to Reduced Insulation Resistance and Electrical Failure/Degradation, Radiolysis and Photolysis of Organics; Radiation-Induced Oxidation; Moisture Intrusion
- Localized Damage and Breakdown of Insulation Leading to Electrical Failure/Moisture Intrusion, Water Trees

Aging Management Programs

The following aging management programs manage the aging effects for the Insulated Cables and Connections:

- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (B.2.1.35)
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits (B.2.1.36)
- Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (B.2.1.37)

Table 3.6.2-1, Electrical Commodities - Summary of Aging Management Evaluation, summarizes the results of the aging management review of Insulated Cables and Connections.

3.6.2.1.5 Metal Enclosed Bus

Materials

The materials of construction for the Metal Enclosed Bus are:

- Aluminum
- Copper
- Elastomer
- Porcelain, Various Organic Polymers

Environments

The Metal Enclosed Bus are exposed to the following environments:

- Air - Indoor
- Air - Outdoor

Aging Effects Requiring Management

The following aging effects associated with the Metal Enclosed Bus require management:

- Loosening of Bolted Connections/Thermal Cycling and Ohmic Heating
- Embrittlement, Cracking, Melting, Discoloration, Swelling, or Loss of Dielectric Strength Leading to Reduced Insulation Resistance and Electrical Failure/Degradation, Radiolysis and Photolysis of Organics; Radiation-Induced Oxidation; Moisture Intrusion
- Loss of Material/Pitting and Crevice Corrosion
- Hardening and Loss of Strength/Elastomer Degradation

Aging Management Programs

The following aging management programs manage the aging effects for the Metal Enclosed Bus:

- Metal Enclosed Bus (B.2.1.38)
- Structures Monitoring Program (B.2.1.32)

Table 3.6.2-1, Electrical Commodities - Summary of Aging Management Evaluation, summarizes the results of the aging management review of the Metal Enclosed Bus.

3.6.2.1.6 Switchyard Bus and Connections, Transmission Conductors and Connections

Materials

The materials of construction for the Switchyard Bus and Connections, Transmission Conductors and Connections are:

- Aluminum
- Steel
- Stainless Steel
- Copper

Environments

The Switchyard Bus and Connections, Transmission Conductors and Connections are exposed to the following environment:

- Air - Outdoor

Aging Effects Requiring Management

The Switchyard Bus and Connections, Transmission Conductors and Connections have no aging effects requiring management. See Subsection 3.6.2.2.3 for further evaluation.

Aging Management Programs

Because there are no aging effects requiring management, no AMPs are required for the Switchyard Bus and Connections, Transmission Conductors and Connections.

Table 3.6.2-1, Electrical Commodities - Summary of Aging Management Evaluation, summarizes the results of the aging management review of the Switchyard Bus and Connections, Transmission Conductors and Connections.

3.6.2.2 AMR Results for Which Further Evaluation is Recommended by the GALL Report

NUREG-1801 provides the basis for identifying those programs that warrant further evaluation by the reviewer in the LRA. For the Electrical and Instrumentation and Controls Systems' commodities, those programs are addressed in the following subsections.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

Environmental qualification is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1).

The evaluation of this TLAA is addressed in Section 4.4, "Environmental Qualification (EQ) of Electrical Equipment," of this application.

3.6.2.2.2 Degradation of Insulator Quality Due to Presence of Any Salt Deposits and Surface Contamination, and Loss of Material Due to Mechanical Wear

Degradation of insulator quality due to presence of any salt deposits and surface contamination could occur in high voltage insulators. The GALL Report recommends further evaluation of a plant-specific aging management program for plants located such that the potential exists for salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution). Loss of material due to mechanical wear caused by wind blowing on transmission conductors could occur in high voltage insulators. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

The high voltage insulators evaluated for Hope Creek are those used to support in-scope, uninsulated, high voltage electrical commodities such as transmission conductors and switchyard bus. The supported commodities are those credited for supplying power to in-scope components for recovery of offsite power following a station blackout.

Salt Deposits and Surface Contamination

Various airborne materials such as dust, salt and industrial effluents can contaminate insulator surfaces. The buildup of surface contamination is gradual and in most areas such contamination is washed away by rain; the glazed insulator surface aids this contamination removal. A large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover. Surface contamination can be a problem in areas where there are greater concentrations of airborne particles such as near facilities that discharge soot or near the seacoast where salt spray is prevalent.

Hope Creek is located in a rural area, not near heavy industry that would provide a source for contaminants, and is not in close proximity to the Atlantic Ocean. The station is located at the end of the Delaware River (at the head of Delaware Bay), 50 miles from the Atlantic Ocean. Therefore, Hope Creek is not considered to be a seacoast plant, where salt spray is prevalent. The majority of the insulators in scope for license renewal at Hope Creek is of a vertical configuration, and is designed with an increased creepage distance that is able to withstand "heavy to very heavy" pollution severity levels. Vertical insulators with increased creepage distance are less susceptible to flashover due to surface contamination. Horizontal overhead transmission line insulators are angled to form various “string” configurations, making them more susceptible to surface contamination.

Site-specific operating experience has shown that flashover of insulators due to contamination from salt spray is an applicable aging mechanism that requires management. One plant-specific event occurred at Hope Creek in September 2003, when Hurricane Isabel passed a considerable distance to the south and west of the site. Strong winds with gusts in excess of 60 mph caused switchyard insulators to become coated with salt. Therefore, a plant-specific High Voltage Insulators Program will be implemented to detect the buildup of surface contamination on overhead transmission line insulators in the Hope Creek Switchyard and the Salem-Hope Creek 500 kV cross-connection (the 5037 line).

Mechanical Wear

Mechanical wear is an aging effect for strain and suspension insulators in that they are subject to movement. Movement of the insulators can be caused by wind blowing the supported transmission conductor, causing it to swing from side to side. If this swinging is frequent enough, it could cause wear in the metal contact points of the insulator string and between an insulator and the supporting hardware. Although this mechanism is possible, experience has shown that the transmission conductors do not normally swing and that when they do, due to substantial wind, they do not continue to swing for very long once the wind has subsided.

Wind loading that can cause a transmission line and insulators to sway is considered in the design and installation. Although rare, surface rust of the metallic cap may form where galvanizing is burnt off due to flashover from lightning strikes. Surface rust is not a significant concern and would not cause a loss of intended function if left unmanaged for the period of extended operation. Wear and surface rust has not been identified during routine switchyard inspections.

Based on Hope Creek's design and confirmed by its operating experience, mechanical wear caused by wind blowing on transmission conductors is not significant enough to cause a loss of intended function. Therefore, aging management activities for loss of material due to wear are not required for the period of extended operation.

Conclusion

A plant-specific High Voltage Insulators Program will be implemented to manage the degradation of insulator quality due to the presence of salt deposits and surface contamination on high voltage insulators in the Hope Creek Switchyard and the Salem-Hope Creek 500 kV cross-connection (the 5037 line). Aging management activities for mechanical wear due to wind are not required for the period of extended operation. The High Voltage Insulators program is described in Appendix B.

3.6.2.2.3 Loss of Material Due to Wind Induced Abrasion and Fatigue; Loss of Conductor Strength Due to Corrosion, and Increased Resistance of Connection Due to Oxidation or Loss of Pre-load

Loss of material due to wind induced abrasion and fatigue, loss of conductor strength due to corrosion, and increased resistance of connection due to oxidation or loss of pre-load could occur in transmission conductors and connections, and in switchyard bus and connections. The GALL Report recommends further evaluation of a plant-specific aging management program to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1.

1. Transmission Conductors and Connections

The transmission conductors and connections evaluated for Hope Creek are those credited for supplying power to in-scope components for recovery of offsite power following a station blackout. The in-scope transmission conductors at Hope Creek are 2493 MCM 54/37 aluminum conductor, aluminum-alloyed reinforced (ACAR) overhead electrical conductors.

Wind Induced Abrasion and Fatigue

Transmission conductor vibration or sway could be caused by wind loading. Experience has shown that the transmission conductors do not normally swing significantly. When transmission conductors swing due to a substantial wind, they do not continue to swing for very long once the wind has subsided. Wind loading that can cause a transmission line to vibrate or sway is considered in design and installation. Therefore, the loss of material aging effect that could result from wind induced transmission conductor vibration or sway is not applicable and would not cause a loss of intended function for transmission conductors for the period of extended operation.

Corrosion

Aging management activities regarding loss of conductor strength due to corrosion for Hope Creek transmission conductors are not required for the period of extended operation because the Hope Creek transmission conductors are not susceptible to corrosion. Moreover, if the Hope Creek ACAR transmission conductors do corrode at the same rate as comparable ACSR transmission conductors over 80 years, there would still be margin between the postulated 80-year ultimate conductor strength and the required design strength.

Specifically, the in-scope transmission conductors at Hope Creek are 2493 MCM 54/37 aluminum conductor, aluminum-alloyed reinforced (ACAR) overhead electrical conductors. Each phase has two conductors. These transmission conductors are approximately 1.8 inches in diameter and are configured with 37 aluminum-alloyed conductor wire strands wrapped by 54 aluminum conductor wire strands.

The PSE&G Transmission & Distribution design practices follows the National Electrical Safety Code (NESC) methodologies. The NESC Section 250.B sets the maximum tension a conductor must be designed to withstand under heavy load requirements, which includes consideration of ice, wind and temperature. NESC Section 260.H.1.a requires that heavy load tension on installed conductors be less than 60% of the ultimate conductor strength.

ACAR conductors are similar in construction to steel-reinforced design except that the core is an aluminum alloy that gives the conductor higher mechanical strength than that of all-aluminum conductor, while maintaining corrosion resistant properties in the core. ACAR conductors, unlike ACSR, are not susceptible to environmental influences, such as SO2 concentration in the air. When aluminum corrodes, it forms a protective oxide layer that protects the underlying material from further corrosion. When the steel core of an ACSR conductor loses its galvanized coating, it will continually corrode causing a decrease in ultimate strength. Therefore, the Hope Creek transmission conductors are not susceptible to the same corrosion phenomenon as ACSR transmission conductors.

Although the Hope Creek transmission conductors are not susceptible to same corrosion phenomenon as ACSR transmission conductors, in order to apply the findings from the Ontario Hydroelectric study of ACSR transmission conductors to the Hope Creek ACAR transmission conductors, it is postulated that the Hope Creek ACAR transmission conductors corrode at the same rate as comparable ACSR transmission conductors over 80 years.

The Ontario Hydroelectric study utilized data gathered by an eddy current sensor that travels along the conductor between transmission towers. The eddy current sensor measures potential conductor degradation. In addition, laboratory tests were performed for fatigue, tensile strength, torsional ductility, and electrical performance. Fatigue tests simulating 50 years of service life were also performed to assess existing cables as well as new cables. The study performed by Ontario Hydroelectric showed a 30% loss of composite conductor strength of an 80-year-old ACSR (Aluminum Conductor Steel Reinforced) conductor due to corrosion.

The Ontario Hydroelectric test did not include 2493 MCM 54/37 ACAR conductor. The Ontario Hydroelectric study did report:

> *"The aluminum layers were found to have retained their original properties to a large degree. On the other hand the steel strands showed reductions in both tensile strength and the number of turns to failure."*

The Ontario Hydroelectric study is considered to bound the Hope Creek configuration and corrosion rate because the aluminum alloy core is more corrosion resistant than galvanized steel.

The example presented in the EPRI License Renewal Electrical Handbook, TR-1013475, (page 13-10) compares a 4/0 ACSR conductor to the results of the Ontario Hydroelectric Study. The same comparison method is made here for the Hope Creek transmission conductor.

Tests performed by Ontario Hydroelectric showed a 30% loss of composite conductor strength of an 80-year-old ACSR conductor due to corrosion. The ultimate strength and NESC design strength tension requirements of 2493 MCM 54/37 ACAR are 57600 lbs. and 34560 lbs, respectively. The margin between the NESC design strength and the ultimate strength is 23040 lbs. The Ontario Hydroelectric study showed a 30% loss of composite conductor strength in an 80-year-old conductor. In the case of the 2493 MCM ACAR transmission conductors, postulating a 30% loss of ultimate strength would mean that there would still be 5760 lbs. of margin between what is required by the NESC and the postulated 80-year ultimate conductor strength.

2493 MCM 54/37 ACAR Transmission Conductor	
Ultimate Strength (new)	57600 lbs.
Postulated ultimate strength at 80 years	> 40320 lbs.
NESC Design Strength (required)	34560 lbs.
Heavy Load Tension (HLT) for longest span on Line 5037 (885 ft)	22800 lbs.

This illustrates with reasonable assurance that Hope Creek transmission conductors will have ample strength margin through the period of extended operation. Therefore, aging management activities regarding loss of conductor strength due to corrosion for Hope Creek transmission conductors are not required for the period of extended operation.

Oxidation or Loss of Preload

Transmission conductor connections are treated with corrosion inhibitors to avoid connection oxidation and are torqued to avoid loss of pre-load, at the time of installation. The transmission conductor bolted connections are designed and installed using lock and stainless steel Belleville washers (not electroplated) that provide vibration absorption and prevent loss of preload.

2. Switchyard Bus and Connections

The switchyard bus and connections evaluated for Hope Creek are those credited for supplying power to in-scope components for recovery of offsite power following a station blackout. The switchyard buses within the scope of this review are constructed of rigid 4-inch, schedule 80 aluminum pipe.

Wind Induced Abrasion and Fatigue

Switchyard buses are connected to flexible conductors that do not normally vibrate and are supported by insulators and ultimately by static, structural components such as concrete footings and structural steel. Since there are no connections to moving or vibrating equipment, wind induced abrasion and fatigue is not an applicable aging mechanism.

Corrosion

Hope Creek switchyard bus is not subject to an ocean environment or industrial air pollution. Hope Creek is located in a rural area, not near heavy industry that would provide a source for contaminants, and is not in close proximity to the Atlantic Ocean. The station is located at the end of the Delaware River (at the head of Delaware Bay), 50 miles from the Atlantic Ocean. Therefore, Hope Creek is not considered to be a seacoast plant, where salt spray is prevalent. Aluminum bus material does not experience any appreciable aging effects in this environment. Therefore, corrosion is not an applicable aging mechanism.

Oxidation or Loss of Preload

Switchyard bus connections employ good bolting practices consistent with the recommendations of EPRI 1003471, “Electrical Connector Application Guidelines.” The connections are treated with corrosion inhibitors to avoid connection oxidation and torqued to avoid loss of pre-load, at the time of installation. The switchyard bus bolted connections are designed and installed using lock washers and stainless steel Belleville washers (not electroplated) that provide vibration absorption and prevent loss of preload. Therefore, oxidation and loss of preload are not applicable aging mechanisms.

Finally, transmission and distribution personnel perform normal maintenance activities on all portions of the switchyard, including transmission cable, switchyard bus and connections. These maintenance activities have not revealed significant aging effects or mechanisms associated with the equipment to date.

Conclusion

Aging management activities for Hope Creek transmission conductors and connections, and switchyard bus and connections, are not required for the period of extended operation.

3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

QA provisions applicable to License Renewal are discussed in Section B.1.3.

3.6.2.3 AMR Results Not Consistent with or Not Addressed in the GALL Report

3.6.2.3.1 Fuse Holders Not Part of a Larger Assembly: Fuse Holders – Metallic Clamp

At Hope Creek, there are eight electrical panels that contain only fuse holders and terminal blocks that are in scope for license renewal and are not part of a larger assembly. Four enclosed electrical panels that contain only fuse holders and terminal blocks are located in the Auxiliary Building Control/Diesel Generator Area. Four electrical panels that contain only fuse holders and terminal blocks are also located in switchyard control building. Other Hope Creek fuse holders that are not part of a larger assembly are for circuits that do not perform a license renewal intended function.

The potential aging effects as discussed in NUREG-1801 are not applicable to the fuse holders in these eight in-scope electrical panels. The evaluation of aging effects is discussed below.

Moisture, Chemical Contamination, Oxidation, and Corrosion

The eight fuse panels are located in an environment that does not subject them to environmental aging mechanisms. Four fuse panels located inside the Auxiliary Building Control/Diesel Generator Area are in an electrical panel room. Access into the room is restricted. The environment inside the room is air-conditioned. The other four fuse panels are located inside the switchyard control house. Access into the switchyard control house is restricted. The environment inside the switchyard control house is air-conditioned. Oxidation and corrosion are not a concern since the fuse holders are not located in or near humid areas nor are they exposed to industrial or oceanic environments.

The fuse panels located inside the Auxiliary Building Control/Diesel Generator Area are not subject to outside weather conditions and are therefore not subject to moisture from precipitation. Their indoor location in the Auxiliary Building Control/Diesel Generator Area means they do not experience high relative humidity during normal conditions. A second barrier that protects the fuse holders from exposure to moisture is their location inside an enclosed electrical panel.

The fuse holders located inside the switchyard control house are not subject to outside weather conditions and are therefore not subject to moisture from precipitation. Their indoor location in the switchyard control house means they do not experience high relative humidity during normal conditions. A second barrier that protects the fuse holders from exposure to moisture is their location on an electrical panel under a plastic shield.

All of the fuse holders are protected from chemical contamination, and are within a mild environment inside a building. There are no sources of chemicals in the vicinity of the electrical panels.

A walkdown of these electrical panels containing the in-scope fuse holders confirmed that the operating conditions for these fuse holders are clean and dry, with no evidence of moisture intrusion, chemical contamination, oxidation or corrosion.

Fatigue, Mechanical Stresses, and Manipulation

Fuse holders for circuits that carry significant current in power applications could potentially be exposed to thermal fatigue in the form of high resistance caused by thermal cycling and ohmic heating. Instrumentation and control circuits characteristically operate at low currents where no appreciable thermal cycling or ohmic heating occurs.

The fuse holders located in the Auxiliary Building Control/Diesel Generator Area are for 120 VAC Class 1E control power. The loads are instrumentation and control circuits that operate at low currents where no appreciable thermal cycling or ohmic heating occurs. The fuse holders located in the switchyard control house are for switchyard breaker DC control power. The normal supply of DC control power is from the battery charger. The battery is normally on a float charge, thus the fuses are lightly loaded with a small constant current. Therefore, electrical and thermal cycling is not considered an applicable aging mechanism for these fuse holders.

Mechanical stress due to forces associated with electrical faults and transients are mitigated by the fast action of the circuit protective devices at high currents. Also, mechanical stress due to electrical faults is not considered a credible aging mechanism since such faults are infrequent and random in nature. The corrective action process is used to document adverse conditions and provides corrective actions associated with electrical faults and transients that cause the actuation of circuit protective devices.

Wear and fatigue is caused by repeated insertion and removal of fuses. The fuses in these fuse holders are not subject to frequent manipulation (i.e. removal and reinsertion) because they are neither clearance nor isolation points which support periodic testing or preventative maintenance. Additionally, if fuses are manipulated for non-routine inspection or maintenance, proceduralized good work practices would identify any abnormal condition such as loose or corroded fuse clips.

These fuse holders are located in electrical panels that are not mounted on moving or rotating equipment such as compressors, fans or pumps. Because the electrical panels are mounted with no attached sources of vibration, vibration is not an applicable aging mechanism. Therefore, the metallic clamps of these fuse holders will not exhibit the aging effects/mechanisms of fatigue, mechanical stresses and/or frequent manipulation.

Conclusion

Based on installed location, design configuration, and operating service conditions, fuse holders inside of the eight panels within the scope of this aging management review are not susceptible to the aging effects and mechanisms associated with metallic clamps. Therefore, aging management activities for fuse holders are not required for the period of extended operation.

3.6.3 CONCLUSION

The electrical commodity groups that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the electrical commodity groups are identified in the summaries in Section 3.6.2.1 above.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the conclusions provided in Appendix B, the effects of aging associated with the electrical commodity groups will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

Table 3.6.1 Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1-1	Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements	Degradation due to various aging mechanisms	Environmental Qualification Of Electric Components	Yes, TLAA	Environmental Qualification is a TLAA. Further evaluation is documented in Section 4.4 and Subsection 3.6.2.2.1.
3.6.1-2	Electrical cables, connections and fuse holders (insulation) not subject to 10 CFR 50.49 EQ requirements	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Electrical Cables and Connections Not Subject To 10 CFR 50.49 EQ Requirements	No	Consistent with NUREG-1801. The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program, B.2.1.35, will be used to manage reduced insulation resistance and electrical failure due to various mechanisms, in adverse localized environments, for insulated cables and connections, including connection insulation for splices, electrical penetration pigtails, terminal blocks and fuse holders.
3.6.1-3	Conductor insulation for electrical cables and connections used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (IR)	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Electrical Cables And Connections Used In Instrumentation Circuits Not Subject To 10 CFR 50.49 EQ Requirements	No	Consistent with NUREG-1801. The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used In Instrumentation Circuits program, B.2.1.36, will be used to manage reduced insulation resistance and electrical failure, due to various mechanisms, in adverse localized environments, for insulated cables and connections used in neutron monitoring and radiation monitoring circuits.

Table 3.6.1 Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1-4	Conductor insulation for inaccessible medium voltage (2 kV to 35 kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements	Localized damage and breakdown of insulation leading to electrical failure due to moisture intrusion, water trees	Inaccessible Medium Voltage Cables Not Subject To 10 CFR 50.49 EQ Requirements	No	Consistent with NUREG-1801. The Inaccessible Medium Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements program, B.2.1.37, will be used to manage localized damage and breakdown of insulation leading to electrical failure, due to moisture intrusion and water trees, in adverse localized environments, for medium voltage cables.
3.6.1-5	PWR Only				
3.6.1-6	Fuse Holders (Not Part of a Larger Assembly): Fuse holders – metallic clamp	Fatigue due to ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation	Fuse Holders	No	NUREG-1801 aging effects for fuse holders (metallic clamp) are not applicable to Hope Creek. There are no fuse holders located outside of active devices that are susceptible to the aging effects of fatigue, mechanical stress (frequent manipulation), vibration, chemical contamination, corrosion, and oxidation. See subsection 3.6.2.3.1 for additional evaluation.
3.6.1-7	Metal enclosed bus - Bus/connections	Loosening of bolted connections due to thermal cycling and ohmic heating	Metal Enclosed Bus	No	Consistent with NUREG-1801. The Metal Enclosed Bus program, B.2.1.38, will be used to manage loosening of bolted connections for the metal enclosed bus – bus/connections.

Table 3.6.1 Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1-8	Metal enclosed bus – Insulation/ insulators	Reduced insulation resistance and electrical failure due to various physical, thermal, radiolytic, photolytic, and chemical mechanisms	Metal Enclosed Bus	No	Consistent with NUREG-1801. The Metal Enclosed Bus program, B.2.1.38, will be used to manage reduced insulation for metal enclosed bus – insulation/insulators.
3.6.1-9	Metal enclosed bus – Enclosure assemblies	Loss of material due to general corrosion	Structures Monitoring Program	No	Not applicable. Hope Creek predicts the aging effect of loss of material caused by the mechanisms of pitting and crevice corrosion for aluminum metal enclosed bus – enclosure assemblies. The Hope Creek metal enclosed bus material, environment and aging effect/mechanism are addressed in Item Numbers 3.5.1-50 and 3.5.1-58.
3.6.1-10	Metal enclosed bus – Enclosure assemblies	Hardening and loss of strength due to elastomers degradation	Structures Monitoring Program	No	Consistent with NUREG-1801. The Structures Monitoring program, B.2.1.32, will be used to manage hardening and loss of strength due to elastomer degradation of elastomer metal enclosed bus – enclosure assemblies.

Table 3.6.1 Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1-11	High voltage insulators	Degradation of insulation quality due to presence of any salt deposits and surface contamination, Loss of material caused by mechanical wear due to wind blowing on transmission conductors	Plant Specific	Yes, plant specific	The High Voltage Insulators program (B.2.2.1) will be used to manage the degradation of insulation quality due to presence of any salt deposits and surface contamination for porcelain high voltage insulators. Based on Hope Creek design and operating experience, loss of material is not applicable for Hope Creek high voltage insulators. In-scope high voltage insulators are not subject to wind-induced abrasion. See subsection 3.6.2.2.2 for further evaluation.
3.6.1-12	Transmission conductors and connections, switchyard bus and connections	Loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion, increased resistance of connection due to oxidation or loss of preload	Plant Specific	Yes, plant specific	Loss of material, loss of conductor strength, and increased resistance of connection are not applicable for Hope Creek switchyard bus and connections, and transmission conductors and connections. Based on Hope Creek design and operating experience, in-scope switchyard bus and connections are not subject to wind-induced abrasion and fatigue, corrosion, oxidation or loss of pre-load. In-scope transmission conductors and connections are not subject to wind-induced abrasion and fatigue, corrosion, oxidation or loss of pre-load See subsection 3.6.2.2.3 for further evaluation.

Table 3.6.1 Summary of Aging Management Programs for the Electrical Components Evaluated in Chapter VI of NUREG-1801

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.6.1-13	Cable Connections – Metallic parts	Loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Electrical Cable Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	No	Consistent with NUREG-1801 with exceptions. The Electrical Cable Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements program, B.2.1.39, will be used to manage loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation of the metallic parts of cable connections. Exceptions apply to the NUREG-1801 recommendations for this program, and are in accordance with Draft ISG 2007-02 recommending a one-time inspection, on a representative sampling basis.
3.6.1-14	Fuse Holders (Not Part of a Larger Assembly) Insulation Material	None	None	NA-No AEM or AMP	Consistent with NUREG-1801.

Table 3.6.2-1
Electrical Commodities
Summary of Aging Management Evaluation

Table 3.6.2-1 Electrical Commodities

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Cable Connections - Metallic Parts	Electrical Continuity	Various Metals Used for Electrical Connections	Air - Indoor (External)	Loosening of Bolted Connections/Thermal Cycling, Ohmic Heating, Electrical Transients, Vibration, Chemical Contamination, Corrosion, and Oxidation	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	VI.A-1	3.6.1-13	B, 1
Cable Connections - Metallic Parts	Electrical Continuity	Various Metals Used for Electrical Connections	Air - Outdoor (External)	Loosening of Bolted Connections/Thermal Cycling, Ohmic Heating, Electrical Transients, Vibration, Chemical Contamination, Corrosion, and Oxidation	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	VI.A-1	3.6.1-13	B, 1
Electrical Equipment Subject to 10 CFR 50.49 EQ Requirements	Electrical Continuity	Various Polymeric and Metallic Materials	Adverse localized environment	Various Degradation/Various Aging Mechanisms	Environmental Qualification (EQ) of Electrical Components	VI.B-1	3.6.1-1	A
Fuse Holders	Electrical Continuity	Copper Alloy	Air - Indoor (External)	None	None	VI.A-8	3.6.1-6	I, 2
Fuse Holders	Electrical Continuity	Various Organic Polymers	Adverse localized environment	Embrittlement, Cracking, Melting, Discoloration, Swelling, or Loss of Dielectric Strength Leading to Reduced Insulation Resistance and Electrical Failure/Degradation, Radiolysis and Photolysis of Organics; Radiation-Induced Oxidation; Moisture Intrusion	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	VI.A-6	3.6.1-2	A

Table 3.6.2-1 Electrical Commodities (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Fuse Holders	Electrical Continuity	Various Organic Polymers	Air - Indoor (External)	None	None	VI.A-7	3.6.1-14	A
High Voltage Insulators	Insulation - Electrical	Cement	Air - Outdoor (External)	None	None	VI.A-10	3.6.1-11	I, 3
High Voltage Insulators	Insulation - Electrical	Metal	Air - Outdoor (External)	None	None	VI.A-10	3.6.1-11	I, 3
High Voltage Insulators	Insulation - Electrical	Porcelain	Air - Outdoor (External)	Degradation of Insulation Quality/Presence of Salt Deposits and Surface Contamination	High Voltage Insulators	VI.A-9	3.6.1-11	E, 4
Insulated Cables and Connections	Electrical Continuity	Various Organic Polymers	Adverse localized environment	Embrittlement, Cracking, Melting, Discoloration, Swelling, or Loss of Dielectric Strength Leading to Reduced Insulation Resistance and Electrical Failure/Degradation, Radiolysis and Photolysis of Organics; Radiation-Induced Oxidation; Moisture Intrusion	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	VI.A-2	3.6.1-2	A
Insulated Cables and Connections Used in Instrumentation Circuits	Electrical Continuity	Various Organic Polymers	Adverse localized environment	Embrittlement, Cracking, Melting, Discoloration, Swelling, or Loss of Dielectric Strength Leading to Reduced Insulation Resistance and Electrical Failure/Degradation, Radiolysis and Photolysis of Organics; Radiation-Induced Oxidation; Moisture Intrusion	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	VI.A-3	3.6.1-3	A

Table 3.6.2-1 Electrical Commodities (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Insulated Inaccessible Medium-Voltage Cables	Electrical Continuity	Various Organic Polymers	Adverse localized environment	Localized Damage and Breakdown of Insulation Leading to Electrical Failure/Moisture Intrusion, Water Trees	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	VI.A-4	3.6.1-4	A
Metal-enclosed Bus	Electrical Continuity	Aluminum, Copper	Air - Indoor (External)	Loosening of Bolted Connections/Thermal Cycling and Ohmic Heating	Metal-Enclosed Bus	VI.A-11	3.6.1-7	A
Metal-enclosed Bus	Electrical Continuity	Aluminum, Copper	Air - Outdoor (External)	Loosening of Bolted Connections/Thermal Cycling and Ohmic Heating	Metal-Enclosed Bus	VI.A-11	3.6.1-7	A
Metal-enclosed Bus	Insulation - Electrical	Porcelain, Various Organic Polymers	Air - Indoor (External)	Embrittlement, Cracking, Melting, Discoloration, Swelling, or Loss of Dielectric Strength Leading to Reduced Insulation Resistance and Electrical Failure/Degradation, Radiolysis and Photolysis of Organics; Radiation-Induced Oxidation; Moisture Intrusion	Metal-Enclosed Bus	VI.A-14	3.6.1-8	A
Metal-enclosed Bus	Insulation - Electrical	Porcelain, Various Organic Polymers	Air - Outdoor (External)	Embrittlement, Cracking, Melting, Discoloration, Swelling, or Loss of Dielectric Strength Leading to Reduced Insulation Resistance and Electrical Failure/Degradation, Radiolysis and Photolysis of Organics; Radiation-Induced Oxidation; Moisture Intrusion	Metal-Enclosed Bus	VI.A-14	3.6.1-8	A

Table 3.6.2-1 Electrical Commodities (Continued)

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Vol. 2 Item	Table 1 Item	Notes
Metal-enclosed Bus	Shelter, Protection	Aluminum	Air - Indoor (External)	None	None	III.B2-4	3.5.1-58	C
Metal-enclosed Bus	Shelter, Protection	Aluminum	Air - Outdoor (External)	Loss of Material/Pitting and Crevice Corrosion	Structures Monitoring Program	III.B2-7	3.5.1-50	C
Metal-enclosed Bus	Shelter, Protection	Elastomer	Air - Indoor (External)	Hardening and Loss of Strength/Elastomer Degradation	Structures Monitoring Program	VI.A-12	3.6.1-10	A
Metal-enclosed Bus	Shelter, Protection	Elastomer	Air - Outdoor (External)	Hardening and Loss of Strength/Elastomer Degradation	Structures Monitoring Program	VI.A-12	3.6.1-10	A
Switchyard Bus and Connections	Electrical Continuity	Aluminum, Stainless Steel, Copper	Air - Outdoor (External)	None	None	VI.A-15	3.6.1-12	I, 5
Transmission Conductors and Connections	Electrical Continuity	Aluminum, Steel	Air - Outdoor (External)	None	None	VI.A-16	3.6.1-12	I, 6

Notes	Definition of Note
A	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
B	Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
C	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.
D	Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.
E	Consistent with NUREG-1801 item for material, environment and aging effect, but a different aging management program is credited or NUREG-1801 identifies a plant-specific aging management program.
F	Material not in NUREG-1801 for this component.
G	Environment not in NUREG-1801 for this component and material.
H	Aging effect not in NUREG-1801 for this component, material and environment combination.
I	Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.
J	Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant Specific Notes:

1. NRC LR interim Staff guidance (ISG) 2007-02 (September 2007 draft) will revise NUREG-1801, XI.E6, Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements recommending a one-time inspection, on a representative sampling basis.

2. NUREG-1801 specifies an aging management program for fuse holders. Based on Hope Creek design and operating experience, aging effects and mechanisms are not applicable for Hope Creek fuse holders. The metallic clamp portion of in scope fuse holders that are not part of a larger assembly are not subject to frequent manipulation or environment conditions that could result in aging effects.

3. NUREG-1801 specifies a plant-specific program for high voltage insulators. Based on Hope Creek design and operating experience, loss of material is not applicable for Hope Creek high voltage insulators. In-scope high voltage insulators are not subject to wind-induced mechanical wear.

4. NUREG-1801 specifies a plant-specific program. The High Voltage Insulator Program is used to manage the aging affects applicable to this component type, material, and environment combination.

5. NUREG-1801 specifies a plant-specific program for switchyard bus and connections. Based on Hope Creek design and operating experience, loss of material, loss of conductor strength, and increased resistance of connection are not applicable for Hope Creek switchyard bus and connections. In-scope switchyard bus and connections are not subject to wind-induced abrasion and fatigue, corrosion, oxidation or loss of pre-load.

6. NUREG-1801 specifies a plant-specific program for transmission conductors and connections. Based on Hope Creek design and operating experience, loss of material, loss of conductor strength, and increased resistance of connection are not applicable for Hope Creek transmission conductors and connections. In-scope transmission conductors and connections are not subject to wind-induced abrasion and fatigue, corrosion, oxidation or loss of pre-load.

4.0 TIME-LIMITED AGING ANALYSES

4.1 INTRODUCTION

This section presents descriptions of the Time-Limited Aging Analyses (TLAAs) for Hope Creek Generating Station (HCGS) in accordance with 10 CFR 54.3(a) and 10 CFR 54.21(c). The document is divided into sections, each containing one or more TLAAs associated with a common category: Table 4.1-1 lists the TLAAs in categories and provides a reference to the section where they are evaluated.

Information about the TLAAs in a category is presented within each section, as follows:

Summary Description: A brief description of the TLAA topic is provided.

Analysis: A description of the current license analysis is provided.

Disposition: The disposition is provided and classified in accordance with one or more of the following methods from 10 CFR 54.21(c)(1):

- **Validation - 10 CFR 54.21(c)(1)(i)** – The analysis remains valid for the period of extended operation, or
- **Revision - 10 CFR 54.21(c)(1)(ii)** – The analysis has been projected to the end of the period of extended operation, or
- **Aging Management - 10 CFR 54.21(c)(1)(iii)** – The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

4.1.1 IDENTIFICATION OF TLAAS

The scope and methods for identifying TLAAs at HCGS are consistent with the NUREG-1800 Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (SRP) and with the License Renewal Rule, 10 CFR 54, which states those licensee calculations and analyses are "Time-Limited Aging Analyses" (TLAAs) only if they meet all six of the defining criteria per 10 CFR 54.3(a). These are:

1. Involve systems, structures, and components within the scope of license renewal, as delineated in 10 CFR 54.4(a);
2. Consider the effects of aging;
3. Involve time-limited assumptions defined by the current operating term, for example, 40 years;
4. Were determined to be relevant by the licensee in making a safety determination;

5. Involve conclusions or provide the basis for conclusions related to the capability of the system, structure, and component to perform its intended function(s), as delineated in 10 CFR 54.4(b); and
6. Are contained or incorporated by reference in the CLB (current licensing basis).

A list of potential generic TLAAs was assembled from the SRP, industry guidance and experience, including:

- NUREG-1800, Standard Review Plan for License Renewal
- NUREG-1801, The Generic Aging Lessons Learned (GALL) report
- NEI 95-10, Industry Guideline for Implementing the Requirements of 10 CFR 54 the License Renewal Rule
- The 10 CFR 54 Final Rule "Statement of Considerations," and
- Prior license renewal applications.

The HCGS current licensing basis (CLB) was searched to confirm the existence of generic and plant-specific TLAAs. The CLB search included the following documents:

- Updated Final Safety Analysis Report (UFSAR)
- Operating License and License Conditions
- Technical Specifications
- Safety Evaluation Reports (SERs)
- HCGS and NRC Licensing Correspondence

The resulting list of potential TLAAs was reviewed (screened) against the six 10 CFR 54.3(a) criteria with the aid of supporting documents, such as:

- Design Basis Documents
- Specifications
- Calculations

The Rule requires that identified TLAAs must be evaluated to demonstrate that:

(i) The analyses remain valid for the period of extended operation;

(ii) The analyses have been projected to the end of the period of extended operation; or

(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

One of these three methods was used to disposition each TLAA identified for HCGS, and the method used is identified in each TLAA evaluation section.

4.1.2 IDENTIFICATION OF EXEMPTIONS

10 CFR 54.21(c)(2) requires that the application for a renewed license include a list of plant-specific exemptions granted pursuant to 10 CFR 50.12 and in effect that are based upon TLAAs as defined in 10 CFR 54.3. The applicant shall provide an evaluation that justifies the continuation of these exemptions for the period of extended operation. A search of docketed correspondence, the operating license, and the Updated Final Safety Analysis Report (UFSAR) identified the exemptions in effect, which were evaluated to determine if they were based upon a TLAA as defined in 10 CFR 54.3.

The search identified no exemptions that are based upon a TLAA that require evaluation for continued use during the period of extended operation.

4.1.3 SUMMARY OF RESULTS

Six general categories of TLAAs applicable to HCGS were identified in Sections 4.2 through 4.7 of this section, with their dispositions. A summary is presented in Table 4.1-1. The table includes a reference to the applicable section of this report that discusses the TLAA.

NUREG-1800, Tables 4.1-2 and 4.1-3, list examples of analyses that could be TLAAs, depending on the applicant's current licensing basis (CLB). Table 4.1.3-1 of this section compares the TLAAs found for HCGS to the potential TLAAs identified in Tables 4.1-2 and 4.1-3 of NUREG-1800.

Table 4.1-1
Time-Limited Aging Analyses Applicable to HCGS

TLAA Category	Description	Disposition Category	Section
1.	**Neutron Embrittlement of the Reactor Pressure Vessel and Internals**		4.2
	Reactor Pressure Vessel Materials Upper-Shelf Energy Reduction Due to Neutron Embrittlement	§54.21(c)(1)(ii)	4.2.1
	Adjusted Reference Temperature for Reactor Pressure Vessel Materials Due to Neutron Embrittlement	§54.21(c)(1)(ii)	4.2.2
	Reactor Pressure Vessel Analyses: Pressure – Temperature Limits	§54.21(c)(1)(iii)	4.2.3
	Reactor Pressure Vessel Circumferential Weld Examination Relief	§54.21(c)(1)(ii)	4.2.4
	Reactor Pressure Vessel Axial Weld Failure Probability	§54.21(c)(1)(ii)	4.2.5
	Reactor Pressure Vessel Core Reflood Thermal Shock Analysis	§54.21(c)(1)(ii)	4.2.6
	Reactor Internals Components	§54.21(c)(1)(iii)	4.2.7
2.	**Metal Fatigue of the Reactor Pressure Vessel, Internals, and Reactor Coolant Pressure Boundary Piping and Components**		4.3
	Reactor Pressure Vessel Fatigue Analyses	§54.21(c)(1)(iii)	4.3.1
	Reactor Pressure Vessel Internals Fatigue Analyses	§54.21(c)(1)(ii)	4.3.2
	Reactor Coolant Pressure Boundary Piping and Component Fatigue Analyses	§54.21(c)(1)(iii)	4.3.3
	Non-Class 1 Component Fatigue Analyses	§54.21(c)(1)(i)	4.3.4
	Effects of Reactor Coolant Environment on Fatigue Life of Components and Piping (GSI-190)	§54.21(c)(1)(iii)	4.3.5
3.	**Environmental Qualification of Electrical Equipment**		
	Environmental Qualification of Electrical Equipment	§54.21(c)(1)(iii)	4.4
4.	**Loss of Prestress in Concrete Containment Tendon**	Not Applicable	4.5
5.	**Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analyses**		4.6
	Fatigue Analysis of Primary Containment, Attached Piping, and Components	§54.21(c)(1)(iii)	4.6.1
	Primary Containment Process Penetrations and Bellows Fatigue Analysis	§54.21(c)(1)(iii)	4.6.2
	Vent Line Bellows	§54.21(c)(1)(i)	4.6.3
6.	**Other Plant-Specific Time-Limited Aging Analyses**		4.7
	Crane Load Cycle Limit	§54.21(c)(1)(i)	4.7.1
	Refueling Bellows Fatigue	§54.21(c)(1)(i)	4.7.2
	Neutron Fluence-Induced Stress Relaxation - Jet Pump Auxiliary Spring Wedges and Slip Joint Clamps	§54.21(c)(1)(i) and (iii)	4.7.3

Table 4.1.3-1

Review of Analyses Listed in NUREG-1800, Tables 4.1-2 and 4.1-3		
NUREG-1800 Examples	**Applicability to HCGS**	**LRA Section**
NUREG-1800, Table 4.1-2 – Examples of Potential TLAAs		
Reactor vessel neutron embrittlement	Yes	4.2
Concrete containment tendon prestress	No	4.5
Metal fatigue	Yes	4.3
Environmental qualification of electrical equipment	Yes	4.4
Metal corrosion allowance	No	N/A
Inservice flaw growth analyses that demonstrate structure stability for 40 years	No	N/A
Inservice local metal containment corrosion analyses	No	N/A
High-energy line-break postulation based on fatigue cumulative usage factor	Yes	4.3.3
NUREG-1800, Table 4.1-3 – Additional Examples of Plant-Specific TLAAs		
Intergranular separation in the heat-affected zone of reactor vessel low-alloy steel under austenitic SS cladding	No	N/A
Low-temperature overpressure (LTOP) analyses	No (PWR)	N/A
Fatigue analysis for the main steam supply lines to the turbine driven auxiliary feedwater pumps	No (PWR)	N/A
Fatigue analysis for the reactor coolant pump flywheel	No (PWR)	N/A
Fatigue analysis of polar crane	Yes	4.7.1
Flow-induced vibration endurance limit for the reactor vessel internals	Yes	4.3.2
Transient cycle count assumptions for the reactor vessel internals	Yes	4.3.2
Leak-before-break	No (PWR)	N/A
Fatigue analysis for the containment liner plate	Yes	4.6.1
Containment penetration pressurization cycles	Yes	4.6.2
Reactor vessel circumferential weld inspection relief (BWR)	Yes	4.2.4

4.2 NEUTRON EMBRITTLEMENT OF THE REACTOR PRESSURE VESSEL AND INTERNALS

The ferritic materials of the reactor pressure vessel are subject to embrittlement due to high energy (E > 1 MeV) neutron exposure. Embrittlement means the material has lower toughness (i.e., will absorb less strain energy during a crack or rupture), thus allowing a crack to propagate more easily under thermal and/or pressure loading.

Toughness (indirectly measured in foot-pounds of absorbed energy in a Charpy impact test) is temperature dependent in ferritic materials. An initial nil-ductility reference temperature (RT_{NDT}), the temperature associated with the transition from ductile to brittle behavior, is determined for vessel materials through a combination of Charpy and drop weight testing. Toughness increases with temperature up to a maximum value called the “upper-shelf energy,” or USE. Neutron embrittlement results in a decrease to the USE of reactor pressure vessel steels. The increase or shift in the initial nil-ductility reference temperature (ΔRT_{NDT}) means higher temperatures are required for the material to continue to act in a ductile manner.

To reduce the potential for brittle fracture during reactor pressure vessel operation, changes in material toughness as a function of neutron radiation exposure (fluence) are accounted for by operating pressure-temperature (P-T) limit curves that are included in the HCGS Technical Specifications. The P-T curves account for the decrease in material toughness associated with a given fluence, which is used to predict the loss in toughness of the reactor pressure vessel materials. Based on the projected drop in toughness for a given fluence, the P-T curves are generated to provide a minimum temperature limit associated with the reactor pressure vessel pressure. The P-T curves are determined using the RT_{NDT} and ΔRT_{NDT} values for the licensed operating period along with appropriate margins.

The reactor pressure vessel material ΔRT_{NDT} and USE values, calculated on the basis of neutron fluence, are part of the licensing basis and support safety determinations. The increases in RT_{NDT} (ΔRT_{NDT}) affect the bases for relief from circumferential weld inspection and their associated supporting calculation of limiting axial weld conditional failure probability. Therefore, these calculations are TLAAs. Section 4.2 includes the following TLAA discussions related to the issue of neutron embrittlement:

- Reactor Pressure Vessel Materials Upper-Shelf Energy Reduction Due to Neutron Embrittlement (4.2.1)
- Adjusted Reference Temperature for Reactor Pressure Vessel Materials Due to Neutron Embrittlement (4.2.2)
- Reactor Pressure Vessel Analyses: Pressure – Temperature Limits (4.2.3)
- Reactor Pressure Vessel Circumferential Weld Examination Relief (4.2.4)
- Reactor Pressure Vessel Axial Weld Failure Probability (4.2.5)

- Reactor Pressure Vessel Core Reflood Thermal Shock Analysis (4.2.6)
- Reactor Internals Components (4.2.7)

The chemistry data used for the supporting HCGS materials evaluations (e.g., USE, ART, circumferential weld examination relief, and axial weld failure probability) reported in the TLAA discussions in Section 4.2 are taken from the values documented in Reference 4.8.1. Reference 4.8.1 reports the results of a recent systematic review and analysis of the metallurgical data available for the HCGS reactor pressure vessel weld, plate, and forging materials. Included in Reference 4.8.1 are incorporation of the most recent data to be used for materials evaluations from the BWR Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP). A review of the NRC Reactor Vessel Integrity Database (RVID2), Reference 4.8.32, indicates that not all of the values documented in Reference 4.8.1 are reflected in RVID2. The TLAA analyses reported in Section 4.2 are based on the data provided in Reference 4.8.1, which is the most recent estimate of the chemistry data for the HCGS reactor pressure vessel.

Neutron Fluence Analysis

To determine the total accumulated fluence for 60 years, fluence was calculated using the actual power histories for cycles 1-14, and conservatively assumed the Extended Power Uprate (EPU) power level for the remainder of the 60 year period with a capacity factor of 100 percent. As a result, fluence was calculated at 56 EFPY. This is bounding for license renewal purposes, since a capacity factor of 100 percent is not achievable due to planned and forced shutdowns, and power reductions. Therefore, 56 EFPY bounds the actual exposure that will be accrued over the 60-year life of the plant.

Fluence was calculated for the HCGS reactor pressure vessel for the extended 60-year (56 EFPY) licensed operating period (Reference 4.8.2), using the methodology of the RAMA Fluence Methodology software package as described in BWRVIP-126 (Reference 4.8.3). The RAMA methodology was developed for EPRI and complies with the requirements of Regulatory Guide 1.190 (Reference 4.8.4) as recommended in NUREG-1800, Section 4. The NRC has reviewed and approved RAMA for BWR reactor pressure vessel fluence predictions (Reference 4.8.5). The HCGS fluence analysis complies with the conditions of the RAMA SER (Reference 4.8.31). As part of the fluence analysis for the reactor pressure vessel, results of fluence measurements from HCGS surveillance specimens were evaluated to develop a plant specific uncertainty analysis as required by the SER for the application of RAMA to HCGS (Reference 4.8.2). The uncertainty analysis demonstrates compliance to the requirements of Regulatory Guide 1.190. The RAMA fluence values for HCGS were used in the TLAA evaluations that follow.

4.2.1 REACTOR PRESSURE VESSEL MATERIALS UPPER-SHELF ENERGY REDUCTION DUE TO NEUTRON EMBRITTLEMENT

Summary Description

The regulations governing reactor pressure vessel integrity are in 10 CFR 50 (Reference 4.8.6). Section 50.60 requires that all light-water reactors meet the fracture toughness, pressure-temperature limits, and material surveillance program requirements for the reactor coolant pressure boundary as set forth in 10 CFR 50 Appendices G and H. The HCGS current licensing basis analyses evaluating reduction of fracture toughness of the reactor pressure vessel for 40 years are TLAAs. The reactor pressure vessel neutron embrittlement TLAA has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) as summarized below.

Appendix G of 10 CFR 50 requires that reactor pressure vessel beltline materials "…have Charpy upper-shelf energy…of no less than 75 ft-lb (102 J) initially and must maintain Charpy upper-shelf energy throughout the life of the vessel of no less than 50 ft-lb (68 J)…" These bounding limits are addressed using the methodology defined by BWRVIP-74-A (Reference 4.8.7), which has been reviewed and approved by the NRC (Reference 4.8.8). NRC Regulatory Guide 1.99, Revision 2 (RG 1.99) (Reference 4.8.9) defines the method for predicting upper-shelf energy (USE) drop in terms of a percentage from the unirradiated value.

USE is the standard industry parameter used to indicate the maximum toughness of a material at high temperature. 10 CFR 50 Appendix G requires the predicted end-of-life Charpy impact test USE for reactor pressure vessel materials to be at least 50 ft-lb (absorbed energy), unless an approved analysis supports a lower value. The predicted USE drop is determined in accordance with RG 1.99, Revision 2. For BWRs that cannot meet the 50 ft-lb criterion, the BWRVIP has provided a bounding equivalent margins USE analysis for plants in BWRVIP-74-A, which is valid for up to 54 EFPY of operation.

Predicted USE drop for each reactor pressure vessel material in the beltline region exposed to fluence greater than 1.0×10^{17} n/cm^2 for 56 EFPY was determined in accordance with RG 1.99 Revision 2. In all cases, the 50 ft-lb criterion was met, so an equivalent margin analysis (EMA) using BWRVIP-74-A was not required.

The 40-year end-of-life USE calculations satisfy the criteria of 10 CFR 54.3(a) and have been identified as TLAAs requiring evaluation for 60 years.

Analysis

The 60-year USE assessment for the HCGS reactor pressure vessel materials is shown in Table 4.2.1-1. The list of materials included in Table 4.2.1-1 includes any reactor pressure vessel weld, forging, and plate materials exposed to a fluence greater than $1x10^{17}$ n/cm^2. As shown in Table 4.2.1-1, the projected 60-year (56 EFPY) USE values for all plate and weld materials are greater than 50 ft-lbs, and do not require an EMA. Therefore, all HCGS materials are acceptable from a USE standpoint for 56 EFPY.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

The Upper Shelf Energy TLAAs for HCGS have been satisfactorily projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

Table 4.2.1-1
HCGS USE Assessment for 56 EFPY

	RPV Material Description		Heat/Lot Number	Cu (wt %)	Unirradiated Transverse C_vUSE (ft-lbs)*	1/4t Fluence (n/cm^2)	% Drop in C_vUSE	C_vUSE @ 1/4t (ft-lbs)**	Requires EMA
Plates	**Intermediate Shell (IS)**								
	Course 3	-	5K3025/1	0.15	75	4.161E+17	11.4	66.44	NO
	Course 3	-	5K2608/1	0.09	75	4.161E+17	8.9	68.29	NO
	Course 3	-	5K2698/1	0.10	75	4.161E+17	8.9	68.29	NO
	Lower Intermediate Shell								
	Course 4	-	5K2963/1	0.07	102	1.068E+18	11.2	90.60	NO
	Course 4	-	5K2530/1	0.08	86	1.068E+18	11.2	76.39	NO
	Course 4	-	5K3238/1	0.09	76	1.068E+18	11.2	67.51	NO
	Lower Shell								
	Course 5	-	5K3230/1	0.07	121	7.350E+17	10.2	108.62	NO
	Course 5	-	6C35/1	0.09	107	7.350E+17	10.2	96.06	NO
	Course 5	-	6C45/1	0.08	97	7.350E+17	10.2	87.08	NO
	RPV Material Description	**Flux Type**	**Heat/Lot Number**	**%Cu**	**Unirradiated Transverse C_vUSE (ft-lbs)***	**1/4t Fluence (n/cm^2)**	**% Drop in C_vUSE**	**C_vUSE @ 1/4t (ft-lbs)****	**Requires EMA**
Welds	**Vertical**								
	W13	SMAW	510-01205	0.09	92.5	4.098E+17	11.0	82.36	NO
	W13	SAW	D53040/1125-02205	0.084	135	4.098E+17	10.7	120.56	NO
	W14	SMAW	510-01205	0.09	92.5	9.292E+17	13.3	80.23	NO
	W14	SAW	D53040/1125-02205	0.084	135	9.292E+17	13.0	117.51	NO
	W15	SMAW	510-01205	0.09	92.5	6.733E+17	12.3	81.12	NO
	W15	SAW	D53040/1125-02205	0.084	135	6.733E+17	12.0	118.78	NO
	Girth								
	W6	SMAW	519-01205	0.01	109	4.161E+17	8.9	99.26	NO
	W6	SMAW	504-01205	0.01	125	4.161E+17	8.9	113.82	NO
	W6	SMAW	510-01205	0.09	92.5	4.161E+17	11.0	82.32	NO
	W6	SAW	D53040/1810-02205	0.084	95	4.161E+17	10.7	84.80	NO
	W6	SAW	D55733/1810-02205	0.10	68	4.161E+17	11.4	60.24	NO
	W7	SMAW	510-01205	0.09	92.5	7.350E+17	12.6	80.88	NO
	W7	SAW	D53040/1125-02205	0.084	95	7.350E+17	12.3	83.35	NO
	LPCI Nozzle								
	W179	SMAW	001-01205	0.020	109	3.668E+17	8.7	99.54	NO
	W179	SMAW	519-01205	0.010	109	3.668E+17	8.7	99.54	NO
	W179	SMAW	504-01205	0.010	125	3.668E+17	8.7	114.15	NO
	RPV Material Description	**Plate Location**	**Heat/Lot Number**	**%Cu**	**Unirradiated Transverse C_vUSE (ft-lbs)***	**1/4t Fluence (n/cm^2)**	**% Drop in C_vUSE**	**C_vUSE @ 1/4t (ft-lbs)****	**Requires EMA**
Nozzles	LPCI (N17; A-D)	IS Course 3	19468/1	0.120	79	3.668E+17	9.7	71.35	NO
	LPCI (N17; A-D)	IS Course 3	10024/1	0.140	70	3.668E+17	10.6	62.56	NO

Notes: Terms used: RPV = reactor pressure vessel, Cu = copper content, CvUSE = Charpy V-notch upper shelf energy, 1/4t = one-quarter RPV wall thickness location,

EMA = Equivalent Margins Analysis

SMAW = Shield Metal Arc Welding

SAW = Submerged Arc Welding

* Transverse plate values conservatively estimated as described in the HCGS UFSAR.
** Where information is limited or unavailable,weld values are conservatively estimated from data taken at 10°F.
*** C_VUSE @ 1/4t calculated by the following formula:
Unirradiated CvUSE X ((100 – %Drop CvUSE) / 100)

4.2.2 ADJUSTED REFERENCE TEMPERATURE FOR REACTOR PRESSURE VESSEL MATERIALS DUE TO NEUTRON EMBRITTLEMENT

Summary Description

The adjusted reference temperature (ART) of the limiting beltline material is used to adjust the beltline P-T curves to account for irradiation effects. RG 1.99, Revision 2 provides the methods for determining the ART. The methodology for determining the limiting material and adjusting the P-T curves using ART are discussed in this section.

The initial nil-ductility reference temperature, RT_{NDT}, is the temperature at which a non-irradiated metal (ferritic steel) changes in fracture characteristics going from ductile to brittle behavior. RT_{NDT} is evaluated according to the procedures in the American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code, Section III, Paragraph NB-2331. Neutron embrittlement increases the initial RT_{NDT}. 10 CFR 50 Appendix G defines the fracture toughness requirements for the life of the vessel. The shift in the initial RT_{NDT} (ΔRT_{NDT}) is evaluated as the difference in the 30 ft-lb index temperatures from the average Charpy curves measured before and after irradiation. This increase (ΔRT_{NDT}) means that higher temperatures are required for the material to continue to act in a ductile manner. The ART is defined as Initial RT_{NDT} + ΔRT_{NDT} + Margin. The Margin term is defined in RG 1.99, Revision 2.

The current P-T curves are developed from limiting ART values for the vessel materials and are valid for 32 EFPY. Since the ART values are determined by adding the unirradiated RT_{NDT} and the ΔRT_{NDT} values for the 40-year licensed operating period, these ART calculations meet the criteria of 10 CFR 54.3(a) and have been identified as TLAAs requiring evaluation for 60 years.

Analysis

56 EFPY fluence values were calculated for the HCGS reactor pressure vessel for the extended 60-year licensed operating period, using the RAMA Fluence Methodology software package (Reference 4.8.2). Peak fluence was calculated at the vessel inner surface (inner diameter at clad/base metal interface) for purposes of evaluating ART. The value of neutron fluence was also calculated for the 1/4T location into the vessel wall base material measured radially from the inside diameter (ID) at the clad/base metal interface, using Equation 3 from Paragraph 1.1 of RG 1.99. This 1/4T depth is recommended in the ASME Code, Section XI, Appendix G, 2001 Edition, with Addenda up to and including 2003 (Reference 4.8.10), Sub-article G-2120, as the maximum postulated defect depth.

The 56 EFPY ΔRT_{NDT} values for all beltline materials (i.e., those materials with a fluence exposure greater than $1x10^{17}$ n/cm^2) were calculated based on the embrittlement correlation found in RG 1.99. The peak fluence, ΔRT_{NDT}, and ART values for the 60-year (56 EFPY) licensed operating period are presented in Table 4.2.2-1. HCGS will re-project, as necessary, the 56 EFPY ΔRT_{NDT} and ART values in conjunction with the surveillance capsule results from the BWRVIP ISP (BWRVIP Reports –86 and -116). See the Reactor Pressure Vessel Surveillance program

(B.2.1.21) for additional details. The material information shown in Table 4.2.2-1 incorporates the most recent data from the BWRVIP ISP, so the values shown may differ from those previously published in the NRC's Reactor Vessel Integrity Database (RVID2).

As shown in Table 4.2.2-1 ΔRT_{NDT} and ART values are provided for the beltline materials. Also shown are 56 EFPY fluence values at the inner surface and ¼ T depth, as well as plate, forging, and weld specific chemistry information. The material with the limiting ART value occurs in the reactor pressure vessel intermediate shell plate material.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

Table 4.2.2-1
56 EFPY Adjusted Reference Temperatures for HCGS Reactor Pressure Vessel Materials

	RPV Material Description	Heat/Lot Number		Initial RT_{NDT} (°F)	Chemistry (wt %) Cu	Chemistry (wt %) Ni	Chemistry Factor (°F)	Adjustments For 1/4t ΔRT_{NDT} (°F)	Margin Terms σ_{Δ} (°F)	Margin Terms σ_i (°F)	ART_{NDT} (°F)
Plates	**Intermediate Shell (3)**	**5K3025/1**	**-**	**19**	**0.15**	**0.71**	**112.75**	**29.8**	**14.9**	**0.0**	**78.7**
Plates	Intermediate Shell (3)	5K2608/1	-	19	0.09	0.58	58.00	15.4	7.7	0.0	49.7
Plates	Intermediate Shell (3)	5K2698/1	-	19	0.10	0.58	65.00	17.2	8.6	0.0	53.4
Plates	Lower Intermediate Shell (4)	5K2963/1	-	-10	0.07	0.58	44.00	18.9	9.5	0.0	27.9
Plates	Lower Intermediate Shell (4)	5K2530/1	-	19	0.08	0.56	51.00	21.9	11.0	0.0	62.9
Plates	Lower Intermediate Shell (4)	5K3238/1	-	7	0.09	0.64	58.00	24.9	12.5	0.0	56.9
Plates	Lower Shell (5)	5K3230/1	-	-10	0.07	0.56	44.00	15.8	7.9	0.0	21.5
Plates	Lower Shell (5)	6C35/1	-	-11	0.09	0.54	58.00	20.8	10.4	0.0	30.5
Plates	Lower Shell (5)	6C45/1	-	1	0.08	0.57	51.00	18.3	9.1	0.0	37.5
	RPV Material Description	**Heat/Lot Number**	**Flux Type**	**Initial RT_{NDT} (°F)**	**Cu**	**Ni**	**Chemistry Factor (°F)**	**ΔRT_{NDT} (°F)**	**σ_{Δ} (°F)**	**σ_i (°F)**	**ART_{NDT} (°F)**
Welds	Vertical W13	510-01205	SMAW	-40	0.09	0.54	108.70	28.5	14.3	0.0	17.1
Welds	Vertical W13	D53040/1125-02205	SAW	-30	0.084	0.626	110.12	28.9	14.4	0.0	27.8
Welds	Vertical W14	510-01205	SMAW	-40	0.09	0.54	108.70	43.7	21.9	0.0	47.5
Welds	**Vertical W14**	**D53040/1125-02205**	**SAW**	**-30**	**0.084**	**0.626**	**110.12**	**44.3**	**22.2**	**0.0**	**58.6**
Welds	Vertical W15	510-01205	SMAW	-40	0.09	0.54	108.70	37.2	18.6	0.0	34.4
Welds	Vertical W15	D53040/1125-02205	SAW	-30	0.084	0.626	110.12	37.7	18.9	0.0	45.4
Welds	Girth W6 (Shell 3-4)	519-01205	SMAW	-49	0.01	0.53	20.00	5.3	2.6	0.0	-38.4
Welds	Girth W6 (Shell 3-4)	504-01205	SMAW	-31	0.01	0.51	20.00	5.3	2.6	0.0	-20.4
Welds	Girth W6 (Shell 3-4)	510-01205	SMAW	-40	0.09	0.54	108.70	28.8	14.4	0.0	17.5
Welds	Girth W6 (Shell 3-4)	D53040/1810-02205	SAW	-49	0.084	0.626	110.12	29.1	14.6	0.0	9.3
Welds	Girth W6 (Shell 3-4)	D55733/1810-02205	SAW	-40	0.10	0.68	126.40	33.5	16.7	0.0	26.9
Welds	Girth W7 (Shell 4-5)	510-01205	SMAW	-40	0.09	0.54	108.70	38.9	19.5	0.0	37.9
Welds	Girth W7 (Shell 4-5)	D53040/1125-02205	SAW	-30	0.084	0.626	110.12	39.4	19.7	0.0	48.9
Welds	LPCI Nozzle W179	001-01205	SMAW	-40	0.02	0.51	27.00	6.7	3.3	0.0	-26.7
Welds	LPCI Nozzle W179	519-01205	SMAW	-49	0.01	0.53	20.00	4.9	2.5	0.0	-39.1
Welds	LPCI Nozzle W179	504-01205	SMAW	-31	0.01	0.51	20.00	4.9	2.5	0.0	-21.1
	RPV Material Description	**Heat/Lot Number**	**Plate Location**	**Initial RT_{NDT} (°F)**	**Cu**	**Ni**	**Chemistry Factor (°F)**	**ΔRT_{NDT} (°F)**	**σ_{Δ} (°F)**	**σ_i (°F)**	**ART_{NDT} (°F)**
Nozzles	LPCI (N17; A-D)	19468/1	Intermediate Shell (3)	-20	0.12	0.80	86.00	21.2	10.6	0.0	22.4
Nozzles	LPCI (N17; A-D)	10024/1	Intermediate Shell (3)	-20	0.14	0.82	105.10	25.9	13.0	0.0	31.8
Nozzles	**Instrument (N16; A, D)**	**5K3025/1***	**Intermediate Shell (3)**	**19**	**0.15**	**0.71**	**112.75**	**22.2**	**11.1**	**0.0**	**63.3**
Nozzles	Instrument (N16; B, C)	5K2698/1*	Intermediate Shell (3)	19	0.10	0.58	65.00	12.8	6.4	0.0	44.6

Fluence Data

	Location	Wall Thickness (in) Full	Wall Thickness (in) 1/4t	Fluence at ID (n/cm^2)	Attenuation, 1/4t $e^{-0.24x}$	Fluence at 1/4t (n/cm^2)	Fluence Factor, FF $f^{(0.28 - 0.10 \log f)}$
Plates	Intermediate Shell (3)	6.102	1.526	6.00E+17	0.693	4.161E+17	0.265
Plates	Intermediate Shell (3)	6.102	1.526	6.00E+17	0.693	4.161E+17	0.265
Plates	Intermediate Shell (3)	6.102	1.526	6.00E+17	0.693	4.161E+17	0.265
Plates	Lower Intermediate Shell (4)	6.102	1.526	1.54E+18	0.693	1.068E+18	0.430
Plates	Lower Intermediate Shell (4)	6.102	1.526	1.54E+18	0.693	1.068E+18	0.430
Plates	Lower Intermediate Shell (4)	6.102	1.526	1.54E+18	0.693	1.068E+18	0.430
Plates	Lower Shell (5)	6.102	1.526	1.06E+18	0.693	7.35E+17	0.358
Plates	Lower Shell (5)	6.102	1.526	1.06E+18	0.693	7.35E+17	0.358
Plates	Lower Shell (5)	6.102	1.526	1.06E+18	0.693	7.35E+17	0.358
Welds	Vertical W13	6.102	1.526	5.91E+17	0.693	4.098E+17	0.262
Welds	Vertical W13	6.102	1.526	5.91E+17	0.693	4.098E+17	0.262
Welds	Vertical W14	6.102	1.526	1.34E+18	0.693	9.292E+17	0.402
Welds	Vertical W14	6.102	1.526	1.34E+18	0.693	9.292E+17	0.402
Welds	Vertical W15	6.102	1.526	9.71E+17	0.693	6.733E+17	0.342
Welds	Vertical W15	6.102	1.526	9.71E+17	0.693	6.733E+17	0.342
Welds	Girth W6 (Shell 3-4)	6.102	1.526	6.00E+17	0.693	4.161E+17	0.265
Welds	Girth W6 (Shell 3-4)	6.102	1.526	6.00E+17	0.693	4.161E+17	0.265
Welds	Girth W6 (Shell 3-4)	6.102	1.526	6.00E+17	0.693	4.161E+17	0.265
Welds	Girth W6 (Shell 3-4)	6.102	1.526	6.00E+17	0.693	4.161E+17	0.265
Welds	Girth W6 (Shell 3-4)	6.102	1.526	6.00E+17	0.693	4.161E+17	0.265
Welds	Girth W7 (Shell 4-5)	6.102	1.526	1.06E+18	0.693	7.35E+17	0.358
Welds	Girth W7 (Shell 4-5)	6.102	1.526	1.06E+18	0.693	7.35E+17	0.358
Welds	LPCI Nozzle W179	6.102	1.526	5.29E+17	0.693	3.668E+17	0.247
Welds	LPCI Nozzle W179	6.102	1.526	5.29E+17	0.693	3.668E+17	0.247
Welds	LPCI Nozzle W179	6.102	1.526	5.29E+17	0.693	3.668E+17	0.247
Nozzles	LPCI (N17; A-D)	6.102	1.526	5.29E+17	0.693	3.668E+17	0.247
Nozzles	LPCI (N17; A-D)	6.102	1.526	5.29E+17	0.693	3.668E+17	0.247
Nozzles	Instrument (N16; A, D)	6.102	1.526	3.59E+17	0.693	2.489E+17	0.197
Nozzles	Instrument (N16; B, C)	6.102	1.526	3.59E+17	0.693	2.489E+17	0.197

Notes: Terms used: RPV = reactor pressure vessel, RT_{NDT} = reference temperature of nil ductility transition, Cu = copper content, Ni = nickel content, ΔRT_{NDT} = shift in RT_{NDT} due to irradiation, 1/4t = one-quarter RPV wall thickness location, ART_{NDT} = adjusted reference temperature, σ_{Δ} standard deviation for ΔRT_{NDT}= , σ_i = standard deviation for RT_{NDT}, ID = inside diamater, x = distance into RPV wall.

* Heat/Lot No. corresponds to plate where nozzles are located.

4.2.3 REACTOR PRESSURE VESSEL ANALYSES: PRESSURE – TEMPERATURE LIMITS

Summary Description

10 CFR Part 50 Appendix G requires reactor pressure vessel analyses to determine operating P-T limits for boltup, hydrotest, pressure tests and normal operating and anticipated operational occurrences. The ART of the limiting beltline material is used to adjust the beltline P-T limits to account for irradiation effects. Operating limits for pressure and temperature are required for three categories of operation: 1) hydrostatic pressure tests and leak tests, referred to as Curve A; 2) non-nuclear heat-up / cooldown and low-level physics tests, referred to as Curve B; and 3) core critical operation, referred to as Curve C. P-T limits are developed for three bounding vessel regions: the upper vessel region (non-beltline, including the head flange region), the core beltline region, and the vessel bottom head region.

The calculations associated with generation of the P-T curves satisfy the criteria of 10 CFR 54.3(a). As such, these calculations are a TLAA.

Analysis

The current HCGS Technical Specifications contain P-T curves for hydrostatic pressure and leak tests, non-nuclear heat-up/cooldown and low-level physics tests, and critical operation. Technical Specifications also limit the maximum rate of change of the reactor coolant temperature. These P-T curves provide limits up to 32 EFPY. The P-T curves were developed to present steam dome pressure versus minimum vessel metal temperature, incorporating appropriate non-beltline limits and irradiation embrittlement effects in the beltline. Because of the relationship between the P-T limits and the fracture toughness transition of the HCGS reactor pressure vessel, new P-T limits are required to be calculated and will be submitted as updates to the NRC, in compliance with 10 CFR Part 50,Appendix G.

HCGS will re-project the P-T curves using approved fluence calculations when there are changes in power or significant changes in core design in conjunction with surveillance capsule results from the BWRVIP Integrated Surveillance Program (ISP) (BWRVIP -86-A, Reference 4.8.33 and BWRVIP-116, Reference 4.8.34). See the Reactor Pressure Vessel Surveillance program (B.2.1.21) for additional discussion.

Disposition: Aging Management, 10 CFR 54.21(c)(1)(iii)

Reactor Pressure Vessel Analyses for P-T limits, considering the effects of aging on the intended function will be adequately managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.2.4 REACTOR PRESSURE VESSEL CIRCUMFERENTIAL WELD EXAMINATION RELIEF

Summary Description

ASME Code, Section XI governs inspection of the reactor pressure vessel circumferential welds, as implemented by the HCGS In-service Inspection program. These welds are required to be inspected at regular intervals described in Table IWB-2500-1, Examination Category B-A of ASME Code, Section XI. HCGS has received inspection relief for the circumferential welds for the time remaining in the current 40-year licensed operating period (Reference 4.8.11). This inspection relief is based upon NRC Generic Letter 98-05 (Reference 4.8.12).

Relief from reactor pressure vessel circumferential weld examination requirements under NRC Generic Letter 98-05 is based on probabilistic assessments that predict an acceptably low probability of failure per reactor operating year. The analysis is based on reactor pressure vessel metallurgical conditions as well as flaw indication sizes and frequencies of occurrence that are expected through the end of the current licensed operating period. The basis for this relief request was an analysis that satisfied the limiting conditional failure probability for the circumferential welds at the expiration of the current license, based on BWRVIP-05 (Reference 4.8.13) and the extent of neutron embrittlement expected through 40 years of operation. The methodology provided in BWRVIP-05 has been reviewed and approved by the NRC (References 4.8.14, 4.8.15, and 4.8.16). The anticipated metallurgical effects due to increased fluence expected during the period of extended operation require evaluation for 56 EFPY (corresponding to 60 years) and approval by the NRC to extend this relief request.

The circumferential weld examination relief analysis meets the requirements of 10 CFR 54.3(a) and is a TLAA.

Analysis

To address this TLAA for 60 years, an evaluation was performed based upon the methodology presented in BWRVIP-05. There are two circumferential welds, W6 (attaching Shells 3 and 4) and W7 (attaching Shells 4 and 5), in the HCGS beltline region. Nine axial welds (W13-1, W13-2, W-13-3, W14-1, W14-2, W14-3, W15-1, W15-2, and W15-3) have at least a portion of their length in the beltline region. The beltline region is defined as that portion of the reactor vessel which experiences sufficient radiation damage to be of concern.

The circumferential weld examination relief request was reevaluated in accordance with BWRVIP-74-A (Reference 4.8.7), which provides a basis for supporting the elimination of reactor pressure vessel (RPV) circumferential welds from the ISI program. The requirements for continuing this relief into the period of extended operation are provided in the NRC's SER for BWRVIP-74 (Reference 4.8.8).

The NRC evaluation of BWRVIP-05 utilized the FAVOR computer code to perform a probabilistic fracture mechanics (PFM) analysis to estimate the reactor pressure vessel shell weld failure probabilities. Three key assumptions of the PFM analysis are that: 1) the neutron fluence was the estimated end-of-life mean fluence, 2) the chemistry values are mean values based on vessel types, and 3) the potential for beyond-design-basis events is considered.

Table 4.2.4-1 provides a comparison of the HCGS reactor pressure vessel limiting circumferential weld properties for 56 EFPY to those used in the NRC analysis for 64 EFPY for the first two key assumptions. Data provided in Table 4.2.4-1 was supplied from Table 2.6-5 of the Final Safety Evaluation of BWRVIP-05 (Reference 4.8.15) and Table 4.2.2-1 of this document.

The HCGS 56 EFPY fluence is significantly lower than the limits of the NRC analysis, and the chemistry factor is approximately the same for HCGS compared to the NRC analysis value. As a result, the shift in reference temperature (ΔRT_{NDT} w/o margin) is significantly lower for HCGS for 56 EFPY compared to the NRC analysis. Although the unirradiated reference temperature ($RT_{NDT(U)}$) for HCGS is higher, the combination of $RT_{NDT(U)}$ and ΔRT_{NDT} w/o margin yields a HCGS ART value that is considerably lower than the NRC mean analysis value. The Mean RT_{NDT} value at 56 EFPY is bounded by the 64 EFPY Mean RT_{NDT} provided by the NRC.

The probability of a failure event (PoF) results were calculated for 60 years (56 EFPY) for the reactor pressure vessel beltline circumferential welds, including the consideration of the limiting event occurrence probability of $1x10^{-3}$ per year. The PoF for the beltline circumferential welds due to a limiting event is $4.10x10^{-8}$ at 60 years (56 EFPY) and $6.83x10^{-10}$ per year. The $4.10x10^{-8}$ value is less than the value of $1.78x10^{-5}$ for the CB&I reference plant in Table 2.6-5 of the Final Safety Evaluation of BWRVIP-05 (Reference 4.8.15). The $1.78x10^{-5}$ value reported in Table 2.6-5 of the Final Safety Evaluation of BWRVIP-05 is for 64 EFPY. In order to have a one-to-one comparison with the PoF determined for HCGS, the reference CB&I plant PoF was interpolated at 56 EFPY. Using the value of $2.0x10^{-7}$ in the Final Safety Evaluation of BWRVIP-05 for 32 EFPY and interpolating to obtain the 56 EFPY value results in a PoF value of $1.56x10^{-5}$. The $4.10x10^{-8}$ value for HCGS is less than this interpolated CB&I value of $1.56x10^{-5}$. The difference between the two inspection coverage cases (0% and 90%) for the circumferential welds is $1.66x10^{-10}$ probability of failure event per year. This difference is less than the $1x10^{-6}$ per year requirement as specified in Regulatory Guide 1.174 (Reference 4.8.17).

These results justify the elimination of the reactor pressure vessel circumferential volumetric weld examination in the vessel beltline region to the end of the extended period of operation (60 years or 56 EFPY) for HCGS.

The procedures and training used to limit reactor pressure vessel cold over-pressure events will be the same as those approved by the NRC when HCGS requested the BWRVIP-05 technical alternative be used for the current term (Reference 4.8.19). A request for extension of this relief for HCGS for the extended operating period will be submitted to the NRC, in accordance with 10 CFR 50.55(a), prior to the period of extended operation.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

Table 4.2.4-1
Effects of Irradiation on Reactor Pressure Vessel Circumferential Weld Properties for HCGS

Group	CB&I Vessel 64 EFPY [1]	HCGS Vessel 56 EFPY [3]
Copper Content, Cu (wt. %)	0.10	0.084
Nickel Content, Ni (wt. %)	0.99	0.626
Chemistry Factor, CF (°F)	109.5	110.12
Fluence at clad/base metal interface (10^{19} n/cm^2)	1.02	0.106
Unirradiated Reference Temperature, $RT_{NDT(U)}$ (°F)	-65	-30
Shift in Reference Temperature, ΔRT_{NDT} (without margin) (°F)	135.6	39.4
Mean RT_{NDT} (°F) [2]	70.6	9.4

Notes:

1. Information reported in Table 2.6-5 of the SER for BWRVIP-05 (Reference 4.8.15).
2. Mean RT_{NDT} was determined using the peak neutron fluence for the limiting weld.
3. The HCGS values are obtained from Table 4.2.2-1 for limiting circumferential weld W7 (SAW).

4.2.5 REACTOR PRESSURE VESSEL AXIAL WELD FAILURE PROBABILITY

Summary Description

The BWRVIP recommendations for inspection of reactor pressure vessel shell welds in BWRVIP-05 (Reference 4.8.13) contain generic analyses supporting a conclusion in the NRC SER (Reference 4.8.15) that the generic-plant axial weld failure rate is no more than 5 x 10^{-6} per reactor year. BWRVIP-05 showed that this axial weld failure rate of 5 x 10^{-6} per reactor year is orders of magnitude greater than the 40-year end-of-life circumferential weld failure probability, and used this analysis to justify relief from inspection of the circumferential welds as described in Section 4.2.4. The failure frequency is dependent upon given assumptions of flaw density, distribution, and location. The failure frequency also assumes that "essentially 100%" of the reactor pressure vessel axial welds will be inspected. Despite various obstructions within the reactor pressure vessel, HCGS has been able to meet the "essentially 100%" inspection requirement.

The anticipated changes in metallurgical conditions expected over the extended licensed operating period require an additional analysis for 56 EFPY. As such, this analysis meets the requirements of 10 CFR 54.3(a) and has been identified as a TLAA requiring evaluation for the period of extended operation.

Analysis

As stated above, the probability of a failure event, PoF, calculated by the NRC in the BWRVIP-05 SER and its supplements depends in part on an assumption that essentially 100% (≥90%) of axial welds can be inspected. At HCGS greater than 90% of the axial welds can be examined.

The axial weld failure probability analysis has been reanalyzed for 56 EFPY to address the material property changes associated with increased fluence. Table 4.2.5-1 compares the HCGS limiting axial weld properties at 56 EFPY to the values taken from Table 2.6-5 found in the NRC Final Safety Evaluation for BWRVIP-05 (Reference 4.8.15) and the associated supplement to the Final Safety Evaluation (Reference 4.8.16). The Final Safety Evaluation Supplement required the limiting axial weld to be compared with data found in Table 3 of the document. For HCGS, the comparison was made to the CB&I information; although Hitachi manufactured the HCGS reactor pressure vessel, the Final Safety Evaluation for BWRVIP-05 (Reference 4.8.15) determined that the Hitachi-fabricated vessel is comparable to the CB&I vessels.

The HCGS limiting axial weld chemistry, chemistry factor, and 56 EFPY mean RT_{NDT} values are within the limits of the values assumed in the analysis performed by the NRC staff in the March 7, 2000 BWRVIP-05 Final Safety Evaluation Supplement (Reference 4.8.16) and the 64 EFPY limits and values obtained from Table 2.6-5 of the SER. The 56 EFPY mean RT_{NDT} is also less than those specified in Table 1 of the NRC SER for BWRVIP-74 (Reference 4.8.8). Since the comparison of neutron fluence, initial RT_{NDT}, chemistry factor amounts of copper and nickel, delta RT_{NDT}, and the projected mean RT_{NDT} of the limiting axial weld at the end of the period of extended operation has been projected to be less than that found in the reference case in the BWRVIP and

NRC analyses, the axial weld failure probability continues to be bounded by the previously approved value of less than 5E-6 per reactor year.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

Table 4.2.5-1
Effects of Irradiation on Reactor Pressure Vessel Axial Weld Properties for HCGS

Group	CB&I Vessel 64 EFPY [1]	HCGS Vessel 56 EFPY [3]
Copper Content, Cu (wt. %)	0.10	0.084
Nickel Content, Ni (wt. %)	1.08	0.626
Chemistry Factor, CF (°F)	135.0	110.12
Fluence at clad/base metal interface (10^{19} n/cm^2)	1.38	0.134
Unirradiated Reference Temperature, $RT_{NDT(U)}$ (°F)	-30	-30
Shift in Reference Temperature, ΔRT_{NDT} (without margin) (°F)	147.1	44.3
Mean RT_{NDT} (°F) [2]	117.1	14.3

Notes:

1. Information reported in Table 2.6-5 of the SER for BWRVIP-05 (Reference 4.8.15).
2. Mean RT_{NDT} was determined using the peak neutron fluence for the limiting weld.
3. The HCGS values are obtained from Table 4.2.2-1 for limiting axial weld W14 (SAW).

4.2.6 REACTOR PRESSURE VESSEL CORE REFLOOD THERMAL SHOCK ANALYSIS

Summary Description

General Electric Report No. NEDO-10029 (Reference 4.8.20) addressed the concern for brittle fracture of the reactor pressure vessel due to reflood following a postulated Loss of Coolant Accident (LOCA). The thermal shock analysis documented in the report assumed a design basis LOCA followed by a Low Pressure Coolant Injection (LPCI) accounting for the full effects of neutron embrittlement at the end of 40 years. The analysis showed that the total maximum vessel irradiation (E> 1 MeV) at the mid-core inside of the reactor pressure vessel would be $2.4x10^{17}$ n/cm^2, which was considered to be below the threshold level of any nil-ductility temperature shift for the reactor pressure vessel material. As a result, it was concluded that the irradiation effects on all locations of the reactor pressure vessel could be ignored. This analysis bounded only 40 years of operation. NEDO-10029 is referenced in Section 5.3.3 of the HCGS Updated Final Safety Analysis Report (UFSAR) (Reference 4.8.21). Therefore, reflood thermal shock of the reactor pressure vessel has been identified as a TLAA for HCGS requiring evaluation for the period of extended operation.

Analysis

Since the time of the NEDO-10029 analysis, another analysis has been performed for BWR-6 vessels (Reference 4.8.22). The more recent analysis is appropriate for the HCGS reactor pressure vessel because it evaluates the bounding LOCA event, a main steam line break, for a BWR vessel design that is similar to the HCGS reactor pressure vessel. The HCGS reactor pressure vessel inside diameter of 251" is the same size as one of the vessel sizes evaluated in the BWR-6 analysis, and the HCGS reactor pressure vessel wall thickness of 6.102" is slightly larger than the 6" thickness evaluated in the BWR-6 analysis. Therefore, the temperature change (cooldown) due to the reflood event at the 1/4T depth would potentially be different for the HCGS reactor pressure vessel than that of the BWR-6 vessel. Because of these differences, the more recent BWR-6 analysis was reevaluated for the HCGS BWR-4 reactor pressure vessel.

The BWR-6 analysis results in a peak stress intensity factor, K, at 1/4T of approximately 100 ksi√inch. For HCGS, the re-evaluation showed that the allowable material fracture toughness resides on the upper shelf of 200 ksi√inch based on the maximum calculated reactor pressure vessel beltline material ART is 78.7°F for Plate 5K3025/1 from Table 4.2.2-1 at 56 EFPY. The peak applied stress intensity factor of 100 ksi√inch from the BWR-6 analysis was determined to be bounding for HCGS. Since the value of 100 ksi√inch is less than the available fracture toughness of 200 ksi√inch after 56 EFPY (corresponding to 60 years), brittle fracture of the HCGS reactor pressure vessel due to vessel reflood following a design basis LOCA is not possible during the period of extended operation.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation and found to be acceptable in accordance with 10 CFR 54.21(c)(1)(ii).

4.2.7 REACTOR INTERNALS COMPONENTS

Summary Description

A number of the reactor internals components are subject to high fluence because of their proximity to the core. This high fluence can lead to stress relaxation for bolting.

An analysis was performed to assess the effect of neutron fluence on the core plate rim hold down bolts in support of the extended power uprate. Therefore it has been identified as a TLAA.

Additionally, the fluence experienced by components is a function of the life of the plant, the NRC SER for BWRVIP-25 has identified that neutron aging of these components is a TLAA issue. BWRVIP-25 identifies stress relaxation of the core plate rim hold down bolts as a TLAA issue.

Analysis

Although the original analysis assumed the fluence value would bound the period of extended operation considering extended power uprate, a plant-specific fluence analysis was performed to determine fluence values at the core plate rim hold down bolt locations at various Effective Full Power Years (EFPY) values up to 56 EFPY. A plant-specific structural analysis was then performed using the new fluence values and it determined that the pre-load of the rim hold down bolts would be sufficient to prevent lateral motion of the core plate until the plant reaches 43.9 EFPY, which will occur after entry into the period of extended operation.

Since this analysis will not bound 56 EFPY (60 years), additional actions are required. Prior to the period of extended operation, which is prior to the analyzed limit of 43.9 EFPY, the plant will either; (1) install core plate wedges or (2) perform an analysis that demonstrates the component function is maintained.

Disposition: Aging Management, 10 CFR 54.21(c)(1)(iii)

The aging effects of the core plate rim hold-down bolts will be managed by the analysis that projects sufficient preload of the bolts until 43.9 EFPY, and by taking action as described above, prior to the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.3 METAL FATIGUE OF THE REACTOR PRESSURE VESSEL, INTERNALS, AND REACTOR COOLANT PRESSURE BOUNDARY PIPING AND COMPONENTS

Fatigue is the progressive localized permanent structural change that occurs in a material subjected to repeated or fluctuating strains at nominal stresses having maximum values often much less than the tensile strength of the material. A cyclically loaded metal component may fail because of fatigue even though the cyclic stresses are considerably less than the static design limit. Some design codes therefore contain explicit metal fatigue calculations or design limits, such as the ASME Code. Cyclic or fatigue design of other components may not be to this code, but may use similar methods. In the case of the HCGS reactor pressure vessel, fatigue calculations were performed based on the postulated cycles during operation of the plant, the most common of these being the startup/shutdown cycle. These calculations are tied to cycle count limits or to fatigue usage factor limits, and may therefore be TLAAs.

Fatigue TLAAs for HCGS are evaluated in the following groupings:

- Reactor Pressure Vessel Fatigue Analyses (4.3.1)
- Reactor Pressure Vessel Internals Fatigue Analyses (4.3.2)
- Reactor Coolant Pressure Boundary Piping and Component Fatigue Analyses (4.3.3)
- Non-Class 1 Component Fatigue Analyses (4.3.4)
- Effects of Reactor Coolant Environment on Fatigue Life of Components and Piping (Generic Safety Issue 190) (4.3.5)

NUREG-1801 (Reference 4.8.23) identifies numerous fatigue related aging effects that require evaluation as possible TLAAs in accordance with 10 CFR 54.21(c). Each of these is summarized in NUREG-1800 (Reference 4.8.24) and presented in Section 3 of this LRA and referenced to the appropriate TLAA section.

4.3.1 REACTOR PRESSURE VESSEL FATIGUE ANALYSES

Summary Description

Reactor pressure vessel fatigue analyses, including the vessel support skirt, shell, upper and lower heads, closure flanges and studs, nozzles and penetrations, nozzle safe ends, and refueling bellows support depend on the assumed numbers and the severity of normal and upset event pressure and thermal operating cycles to predict end-of-life fatigue usage factors in accordance with Section III of the ASME Code. These assumed cycle counts used to determine fatigue usage factors are based on the original 40-year design life of the plant. The calculation of fatigue usage factors is part of the current licensing basis and is used to support safety determinations. As such the reactor pressure vessel fatigue analyses meet the requirements of 10 CFR 54.3(a) for a TLAA.

Analysis

The original HCGS reactor pressure vessel stress report included fatigue analyses for the reactor pressure vessel components based on a set of design basis duty cycles. These duty cycles are listed in Table 3.9-1 and 3.9-1a of the HCGS UFSAR, and are shown in Table 4.3.1-1. The original 40-year analyses demonstrated that the cumulative usage factors (CUFs) for all critical components would remain below the allowable fatigue usage value of 1.0 specified in Section III of the ASME Code. The HCGS reactor pressure vessel was designed in accordance with ASME Code, Section III, 1968 Edition, with addenda up to and including Winter 1969, as documented in Section 5.3.3.1 of the HCGS UFSAR.

Revised CUF evaluations were also performed to assess the impact of Extended Power Uprate (EPU) on the reactor pressure vessel for HCGS. These evaluations revised the CUF values for some reactor pressure vessel components based on the change in reactor operating conditions resulting from EPU. The revised CUF evaluations were approved by the NRC as a part of the EPU approval process (Reference 4.8.18).

In addition, revised fatigue evaluations were performed for the recirculation inlet nozzle for containment or “new” loads in 1988, for the top head and vessel flanges for asymmetric head spray cooling in 1990, for the main closure region to support reduced-pass stud tensioning in 2000, for the reactor pressure vessel support skirt to evaluate cumulative fatigue loadings in 1996, and for the core spray nozzles to evaluate the impact of additional HPCI injections in 2008.

The list of design transients used in the reactor pressure vessel fatigue analyses was intended to envelope all foreseeable thermal and pressure cycles that could be expected to occur within a nominal 40-year operating period for the plant. The list of controlling transients for HCGS is shown in Table 4.3.1-1. This list encompasses all transients listed in Tables 3.9-1 and 3.9-1a of the HCGS UFSAR for the reactor pressure vessel, but also includes all transients relevant to fatigue accumulation in all reactor pressure vessel, Class 1 piping, and containment components where a fatigue basis exists. The actual numbers of events experienced to-date (12/31/2007) are also listed in Table 4.3.1-1. The number of transients experienced to-date for the reactor pressure vessel and other analyzed components was compiled from the HCGS Cycle Counting program, which has been in place since plant startup. The sources of data used by that program include operator log books, plant instrument data, event reports, NRC correspondence, surveillance test results, equipment logs and operating experience reports. The numbers of occurrences expected for 40 and 60 years of operation were obtained by extrapolating the numbers of occurrences actually incurred to-date, and using the rate of occurrence experienced during the last twelve years of operation (nine operating cycles). The frequency of events, such as scrams and shutdowns, experienced in the last twelve years is significantly less than that experienced during the first ten years of operation, and is expected to remain equal to or less than the trend over the past twelve years through the period of extended operation by maintaining careful attention to good operating practices. Conservatism was added beyond the mathematically projected number of cycles to accommodate potential variation in plant performance late in plant life, as well as to allow for additional events where the projected number of cycles was very low and the likelihood of additional events could not be ruled out.

The projected numbers of occurrences for each event for 40 and 60 years are also included in Table 4.3.1-1, as are the numbers of cycles assumed in the design basis 40-year fatigue analyses. There are several transients in this table whose 60-year Assumed Number of Cycles exceed the Designed Analyzed Cycles for 40 years. The number of design basis cycles does not represent a design limit. The fatigue for a component is normally the result of several different thermal and pressure transients. Exceeding the number of cycles for one transient does not necessarily imply the fatigue usage will exceed an acceptance limit. Those transients that are important to determining a CUF for all critical reactor coolant pressure boundary locations by the Metal Fatigue of Reactor Coolant Pressure Boundary (B.3.1.1) aging management program are noted in Table 4.3.1-1.

The CUFs of the reactor pressure vessel, including the vessel support skirt, shell, upper and lower heads, closure flanges and studs, nozzles and penetrations, nozzle safe ends, and refueling bellows support will be managed by the Metal Fatigue of Reactor Coolant Pressure Boundary (B.3.1.1) aging management program. This program will monitor critical reactor pressure vessel CUFs through the use of a fatigue monitoring software application using either stress-based fatigue (SBF) monitoring or cycle-based fatigue (CBF) monitoring versus the allowable value.

Stressed-based fatigue monitoring consists of computing a “real time” stress history for a given component from actual temperature, pressure, and flow histories via a finite element-based Green’s Function approach. CUF is then computed from the computed stress history using appropriate cycle counting techniques and appropriate ASME Code, Section III fatigue analysis methodology. The NRC concern regarding the simplified input to the Greens’ function of only one value of stress expressed in RIS 2008-30 has been addressed in completion of the work done for Hope Creek by completing a detailed stress analysis using the six stress components as discussed in ASME Code, Section III, Subsection NB, Subarticle NB-3200. SBF monitoring is intended to duplicate the methodology used in the governing ASME Code stress report for the component in question, but uses actual transient severity in place of design basis transient severity. Confirmatory evaluation has been performed to verify the conservatism of the HCGS Green’s Function and associated SBF methodology.

Cycle-based fatigue monitoring consists of a two-step process: (a) automated cycle counting, and (b) CUF computation based on the counted cycles. Automated cycle counting evaluates each transient that is defined in the plant licensing basis based upon the mechanistic process or sequence of events experienced by the plant (as determined from monitored plant instruments). The approach is conservative because it assumes each actual transient has a severity equal to that assumed in the design basis. The unique severity of any transient identified by the aging management program software is captured for each monitored component for ready comparison to design basis transient severity. Transients defined in the HCGS UFSAR are identified and implemented into the fatigue monitoring software. CUF computation calculates fatigue directly from counted transients and parameters for the monitored components. CUF is computed via a design-basis fatigue calculation where the actual numbers of counted cycles are substituted for the assumed design basis number of cycles using the governing stress report methodology.

All locations with CUF ratios (i.e., CUF/allowable) predicted to exceed 0.4 (or 40% of allowable) in the original design basis fatigue analysis will be included in the program. In addition, the locations identified in NUREG/CR-6260 for the newer-vintage General Electric plant, which have been evaluated for environmental fatigue effects as discussed in Section 4.3.5 below, have been included in the program. The list of monitored reactor pressure vessel locations is listed in Table 4.3.1-2.

One of the reactor pressure vessel components, the core spray nozzles, indicated fatigue usage over the allowable value prior to 40 years of operation when using actual numbers of cycles accumulated to-date and projected to 40 years of plant operation. The CUF for this component was re-analyzed in accordance with ASME Code, Section III, 2001 Edition, including addenda up to and including 2003, which have been accepted for use by the NRC through 10 CFR 50.55(a). Reconciliation was performed to justify the use of the later edition of the ASME Code compared to the edition originally used to design the HCGS reactor pressure vessel). The updated CUF value for the core spray nozzles is listed in Table 4.3.1-2.

Disposition: Aging Management, 10 CFR 54.21(c)(1)(iii)

The Metal Fatigue of Reactor Coolant Pressure Boundary program will monitor the numbers of cycles of the design transients and the corresponding CUF for critical reactor pressure vessel components. All necessary plant transient events, as shown in Table 4.3.1-1, will be tracked to ensure that the CUF remains less than the allowable CUF limit for all monitored components. In the event the monitored CUF is predicted to exceed the allowable value for any component prior to 60 years of operation, appropriate corrective action will be taken in accordance with the corrective action process prior to the allowable limits being exceeded. HCGS has an existing program in place to track operating thermal and pressure cycles and to assess their effect on vessel fatigue. The requirements from this program will be incorporated into the Metal Fatigue of Reactor Coolant Pressure Boundary (B.3.1.1) aging management program. The required implementing actions will be completed prior to the period of extended operation. As such, the Metal Fatigue of Reactor Coolant Pressure Boundary program will manage the effects of aging due to fatigue on the reactor pressure vessel in accordance with 10 CFR 54.21(c)(1)(iii).

Table 4.3.1-1
HCGS Reactor Pressure Vessel Design Transients and 60-Year Cycle Projections

Transient	Included in Table 3.9-1 or 3.9-1a of UFSAR?	Design Number of Cycles (1)	Cycles as of 12/31/07	40-Year Projected Number of Cycles (9)	60-Year Projected Number of Cycles (9)	60-Year Number of Cycles Assumed for Analysis
Boltup (8)	Y	44	18	34	50	55
Design Hydrostatic Test (1,250 psig) (8)	Y	44	18	34	50	55
Startup (8)	Y	117	79	125	174	180
Turbine Roll and Increase to Rated Power (8)	Y	117	79	125	174	180
Daily Reduction to 75% Power	Y	6,667	See Note 10			6,667
Weekly Reduction to 50% Power	Y	1,233	See Note 10			1,233
Rod Pattern Change	Y	400	See Note 10			400
Loss of Feedwater Heaters (Turbine Trip with 100% Steam Bypass and Partial Feedwater Heater Bypass) (8)	Y	23	10	16	22	25
SCRAM (Turbine Generator Trip-Feedwater On-Isolation Valves Stay Open and All Other) (8)	Y	136	80	124	169	175
Reduction to 0% Power (8)	Y	111	79	125	174	180
Hot Standby (8)	Y	111	79	125	174	180
Shutdown (8)	Y	111	79	125	174	180
Vessel Flooding (8)	Y	111	79	125	174	180
Hydrostatic Test (1,563 psig) (8)	Y	1	2	2	2	3
Unbolt (8)	Y	44	18	34	50	55
Pre-Op Blowdown (8)	Y	10	1	1	1	2
Loss of Feedwater Pumps, Isolation Valves Close (2,8)	Y	5	6	10	13	15
Reactor Overpressure with Delayed Scram, Feedwater Stays On, Isolation Valves Stay Open (8)	Y	1	0	0	0	See Note 3
Single Relief or Safety Valve Blowdown (8)	Y	8	2	4	6	See Note 3
Automatic Blowdown (8)	Y	1	0	0	0	See Note 3
Improper Start of Cold Recirc. Loop (8)	Y	1	0	0	0	See Note 3
Sudden Start of Pump in Cold Recirc. Loop (8)	Y	1	0	0	0	See Note 3
Improper Startup with Recirculation Pumps Off & Drain Shut Off (8)	Y	1	0	0	0	See Note 3
Pipe Rupture and Blowdown (8)	Y	1	0	0	0	See Note 4
Natural Circulation Startup (8)	Y	3	0	0	0	3
Loss of AC Power Natural Circulation Restart (8)	Y	5	See Note 6			5
RPV Drain Line Flow Transient	N	480	See Note 7			480
Operating Basis Earthquake (OBE) (8)	Y	10 / 50 (5)	0	0	0	10 / 50 (5)
Safe Shutdown Earthquake (SSE) at Rated Operating Conditions (8)	Y	1	0	0	0	See Note 4
Safety Relief Valve (SRV) Actuations (8): + Single + Multiple	N	966 596 370	390 380 10	505 487 18	618 592 26	966 596 370
Core Spray Injection (8)	N	10	3	3	5	5
High Pressure Coolant Injection (HPCI) (8)	N	15	21	25	34	35
RWCU Pump Trip (8)	N	240	85	140	200	240

For notes, see next page.

Table 4.3.1-1 (continued)
HCGS Reactor Pressure Vessel Design Transients and 60-Year Cycle Projections

Transient	Included in Table 3.9-1 or 3.9-1a of UFSAR?	Design Analyzed Number of Cycles (1)	Cycles as of 12/31/07	40-Year Projected Number of Cycles (9)	60-Year Projected Number of Cycles (9)	60-Year Number of Cycles for Assumed for Analysis
Standby Liquid Control (SLC) Injection (8)	N	10	0	0	0	10
Control Rod Drive (CRD) Events (8):	N	360	30	61	94	205
+ CRD Isolation		50	Note 11	Note 11	Note 11	100
+ Single CRD Scram		10	7	12	17	20
+ Single CRD Scram During Refueling		300	23	49	77	85
Low Pressure Coolant Injection (LPCI) (8)	N	11	3	4	5	5
Reactor Recirculation Single Loop Operation (8)	N	50	10	18	26	29
Alternate Flood-up Event (8)	Y	28	2	18	34	38

Notes:

1. Minimum number of events reported from all UFSAR sources.
2. Reclassified from an Emergency event to an Upset event.
3. Emergency event, so not included in fatigue analysis.
4. Faulted event, so not included in fatigue analysis..
5. 50 peak OBE cycles for the NSSS piping; 10 peak OBE cycles for other NSSS equipment and components.
6. Event no longer considered relevant to HCGS, as it is procedurally prevented; events will be included in the Fatigue Monitoring program for any components where this event was included in the fatigue analysis.
7. Event specified on design basis Thermal Cycle Diagram; insignificant impact on fatigue for all critical RPV Class 1 component fatigue analyses, so not tracked in Fatigue Monitoring program.
8. Transient will be tracked by the Metal Fatigue of Reactor Coolant Pressure Boundary (B.3.1.1) aging management program.
9. Projected for 40 and 60 years based on the number of events as of 12/31/07 and the trends from the past twelve years (nine operating cycles) of actual plant operation.
10. This event has an insignificant impact on fatigue, and load following is not practiced at HCGS; events will be included in the Fatigue Monitoring Program for any components where this event was included in the fatigue analysis.
11. CRD isolations are not a normal practice at HCGS and are not tracked as part of the existing fatigue monitoring program. A conservative and bounding number of cycles has been provided for analysis purposes, and an initial bounding number of cycles will be assigned as part of the enhanced Metal Fatigue of Reactor Coolant Pressure Boundary (B.3.1.1) aging management program prior to the period of extended operation.

Table 4.3.1-2
Fatigue Monitoring Locations for HCGS Reactor Pressure Vessel Components and Estimated CUFs

Component	Design Basis 40-Year CUF (1)	Estimated CUF as of 12/31/07 (2)	Estimated 40-Year CUF (3)	Estimated 60-Year CUF (3)	Monitoring Technique (4, 5)
Main Closure Studs	0.872	0.505	0.854	1.221 (8)	CBF
Shroud Support (Shroud Cylinder)	0.672	0.205	0.333	0.465	CBF
CRD Penetrations (CRD Housing @ Weld)	0.021	0.011	0.019	0.034	CBF (NUREG/CR-6260 component)
Core Spray Nozzle (Safe End/Thermal Sleeve)	0.067 (6)	0.038	0.047	0.065	CBF (NUREG/CR-6260 component)
Core Spray Nozzle (Nozzle Body)	0.107 (6)	0.040	0.063	0.087	CBF (NUREG/CR-6260 component)
Top Head Lifting Lug Bracket	0.688	0.260	0.410	0.565	CBF
CRD Penetrations with Excavation (B)	0.456	0.093	0.154	0.216	CBF (NUREG/CR-6260 component)
Recirculation Outlet Nozzle (Nozzle Body)	0.086	0.022	0.036	0.051	CBF (NUREG/CR-6260 component)
Recirculation Inlet Nozzle (Nozzle Body)	0.116	0.036	0.058	0.081	CBF (NUREG/CR-6260 component)
Feedwater Nozzle (Safe End)	0.014	0.084	0.121	0.198	SBF (NUREG/CR-6260 component)
Feedwater Nozzle (Nozzle Forging)	0.118 (7)	0.066 (7)	0.115 (7)	0.168 (7)	SBF (NUREG/CR-6260 component)

Notes:

1. Based on the currently governing design basis 40-year fatigue analysis. Allowable CUF = 1.0 for all components.
2. Estimated CUF as of 12/31/07 is based on the cycles accumulated to-date as of 12/31/07 from Table 4.3.1-1. For the feedwater nozzle (SBF) locations, the estimated CUF as of 12/31/07 is based on a linear ratio of the Design Basis 40-year CUF.
3. Estimated CUF for 40 years or 60-years based on the CUF as of 12/31/07 and the trends from the past twelve years (nine operating cycles) of actual plant operation.
4. CBF = Cycle-Based Fatigue and SBF = Stress-Based Fatigue.
5. All locations with 40-year design basis CUF ratios (i.e., CUF/allowable) expected to exceed 0.4 (or 40% of allowable) based on the original analysis will be included in the program. In addition, the locations identified in NUREG/CR-6260 for the newer-vintage General Electric plant, which have been evaluated for environmental fatigue effects as discussed in Section 4.3.5, have been included in the program.
6. CUF value shown is for 60 years of operation based on updated fatigue analysis.
7. CUF is the sum of system cycling CUF plus rapid cycling CUF.
8. Estimated 60-year CUF exceeds the allowable value of 1.0. As discussed in Section 4.3.1, if the Metal Fatigue of Reactor Coolant Pressure Boundary program predicts the CUF will reach the allowable value prior to 60 years of operation, appropriate action will be taken in accordance with the corrective action process prior to the allowable limit being exceeded, including replacement of the main closure studs.

4.3.2 REACTOR PRESSURE VESSEL INTERNALS FATIGUE ANALYSES

Summary Description

The HCGS reactor pressure vessel internals were not designed in accordance with the codes described in Section 4.3.1 for the reactor pressure vessel. However, per Section 3.9.5.3.5 of the HCGS UFSAR, stress and fatigue criteria for evaluation of the HCGS reactor pressure vessel internals are described, which are summarized in Tables 3.9-21 through 3.9-24 of the HCGS UFSAR. CUF values are reported for three reactor pressure vessel internals components in Table 3.9-4c of the HCGS UFSAR: (1) a value of 0.111 for the core support plate (at stud), (2) a value of 0.435 for the top guide (at beam slot), and (3) a value of < 0.05 for the core differential pressure sensing line (at elbow). As such, the reactor pressure vessel internals fatigue analyses have been identified as TLAAs that meet the requirements of 10 CFR 54.3(a).

Analysis

The reactor pressure vessel internals are not a part of the Class 1 pressure boundary (other than the shroud support and brackets that are attached to the reactor pressure vessel – these components were addressed in the reactor pressure vessel stress report using ASME Code, Section III methodology and are therefore covered by the discussion in Section 4.3.1). To project the fatigue usage for 60 years for the components above, each of the values above was multiplied by a factor of 1.5 (60 years/40 years). The values for CUF obtained were as follows: (1) 0.167 for the core support plate (at stud), (2) 0.653 for the top guide (at beam slot), and (3) <0.08. The calculated fatigue usage factors, when extrapolated to 60 years, indicate acceptable fatigue value for the period of extended operation when compared to the allowable CUF of 1.0.

The primary contributor to fatigue of reactor pressure vessel internals is from non-thermal dynamic loads (such as accident or seismic loads). These loads seldom, if ever, occur. High cycle mechanical fatigue (i.e., due to vibration) is also a possible contributor to fatigue, but, as discussed in the SER for EPU (Reference 4.8.18), adequate fatigue design for vibration was demonstrated as a part of prototype plant startup testing, where confirmatory vibration measurements were made on all major reactor internals to verify that vibration levels are below the material endurance limit.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation and found to be acceptable in accordance with 10 CFR 54.21(c)(1)(ii).

4.3.3 REACTOR COOLANT PRESSURE BOUNDARY PIPING AND COMPONENT FATIGUE ANALYSES

Summary Description

The HCGS reactor coolant pressure boundary (RCPB) piping was designed in accordance with ASME Code, Section III, Class 1, as stated in Section 3.2.2 of the HCGS UFSAR (Reference 4.8.21).

The HCGS piping systems in the scope of license renewal designed to ASME Code, Section III, Class 1 requirements were explicitly analyzed for fatigue. The analyses demonstrated that the 40-year CUFs for the limiting components in the affected systems were below the ASME Code Section III allowable value of 1.0.

High energy line breaks (HELB) in the HCGS piping have been postulated, and based on analyses performed for these breaks, means for avoiding damage to surrounding equipment and systems have been incorporated in the plant. Potential damage could arise from fluid jet impingement, flooding, compartment pressurization, environmental effects, and pipe whip. Section 3.6 of the HCGS UFSAR addresses these effects, provides criteria for determining break locations and types of breaks that could occur, descriptions of analysis methodologies, and results for significant attached piping showing where breaks could develop and where restraints were to be installed. It is noted that cumulative fatigue usage factors (CUFs) for the high energy lines are included in the criteria to determine postulated breaks. The CUFs, as calculated in the design fatigue analyses, account for the design transients assumed for the original 40-year life of the plant. An allowable value below 0.1 is used for the CUF for HELB limiting locations.

The postulated breaks are in piping for systems important to safety and integrity of the reactor coolant pressure boundary. The restraints designed for these potential breaks are significant for protection of systems and equipment important to plant safety. Therefore, the CUF calculations used in the selection of postulated high energy line break locations are a TLAA.

Since these breaks are postulated to occur only once in the lifetime of the plant, and restraints were installed appropriately to mitigate these potential breaks, the results of analyses for the potential breaks and the restraints installed in the plant remain unchanged for the extended life of 60 years. However, it is possible that other locations that had 40-year CUFs below the criteria for postulated breaks could exceed the CUF criteria in 60 years. The possibility of these additional postulated breaks will need to be managed based on the actual fatigue accumulation encountered as the plant ages.

Because the number of cycles increases with the operating life of the plant, the above piping design satisfies the requirements of 10 CFR 54.3 and is therefore considered to be a TLAA.

Analysis

The HCGS RCPB piping component stress reports include fatigue analyses for all Class 1 piping components based on a set of design basis duty cycles. The original 40-year analyses demonstrated that the CUFs for all critical piping components would remain below the allowable fatigue usage value of 1.0 specified in Section III of the ASME Code.

The limiting high energy line break locations were considered as a part of the Class 1 piping screening evaluation for identifying locations to monitor in the HCGS Metal Fatigue of Reactor Coolant Pressure Boundary program. High Energy Line Break locations selected for monitoring are identified in Table 4.3.3-1 with allowable CUFs of 0.1. As such, all critical High Energy Line Break locations are encompassed by the HCGS Metal Fatigue of Reactor Coolant Pressure Boundary program.

Revised CUF evaluations have been performed on the piping since the time of original plant construction. These evaluations revised the CUF values for some piping components based on the change in piping configuration or the change in reactor and piping operating conditions.

The list of design transients used in the piping component fatigue analyses was intended to envelope all foreseeable thermal and pressure cycles that could be expected to occur within a nominal 40-year operating period for the plant. The list of controlling transients for HCGS is shown in Table 4.3.1-1. This list encompasses all transients listed in Tables 3.9-1 and 3.9-1a of the HCGS UFSAR for the reactor pressure vessel, but also includes all transients relevant to fatigue accumulation in all piping components where a fatigue basis exists. The actual numbers of events experienced to-date (12/31/2007), the numbers of occurrences expected for 40 and 60 years of operation, and the numbers of cycles assumed in the design basis 40-year fatigue analyses are also listed in Table 4.3.1-1. The development of these values is discussed in Section 4.3.1. Those transients that are important to determining CUF for all critical RCPB component locations by the Metal Fatigue of Reactor Coolant Pressure Boundary (B.3.1.1) aging management program are noted in Table 4.3.1-1.

The CUFs of the bounding piping components will be managed by the Metal Fatigue of Reactor Coolant Pressure Boundary (B.3.1.1) aging management program. This program will monitor critical piping component CUFs through the use of a fatigue monitoring software application, using CBF monitoring versus the allowable value. CBF monitoring is discussed in Section 4.3.1.

All bounding Class 1 piping component locations with CUF ratios (i.e., CUF/allowable) predicted to exceed 0.4 (or 40% of allowable) in the original design basis fatigue analysis will be included in the program. In addition, the locations identified in NUREG/CR-6260 for the newer-vintage General Electric plant, which have been evaluated for environmental fatigue effects as discussed in Section 4.3.5 below, have been included in the program. The list of monitored piping component locations is listed in Table 4.3.3-1.

Disposition: Aging Management, 10 CFR 54.21(c)(1)(iii)

The Metal Fatigue of Reactor Coolant Pressure Boundary program will monitor the numbers of cycles of the design transients and the corresponding CUF for critical Class 1 piping components including high energy line break limiting locations. All necessary plant transient events, as shown in Table 4.3.1-1, will be tracked to ensure that the CUF remains less than the allowable CUF limit for all monitored components. In the event the monitored CUF is predicted to exceed the allowable value for any component prior to 60 years of operation, appropriate corrective action will be taken in accordance with the corrective action process prior to the allowable limits being exceeded.

HCGS has an existing program in place to track operating thermal and pressure cycles and to assess their effect on vessel fatigue. The requirements from this program will be incorporated into the Metal Fatigue of Reactor Coolant Pressure Boundary (B.3.1.1) aging management program. The required implementing actions will be completed prior to the period of extended operation. As such, the Metal Fatigue of Reactor Coolant Pressure Boundary program will manage the effects of aging due to fatigue on the RCPB piping in accordance with 10 CFR 54.21(c)(1)(iii).

Table 4.3.3-1
Fatigue Monitoring Locations for HCGS RCPB Piping Components and Estimated CUFs

Component	Design Basis 40-Year CUF (1)	Allowable CUF (2)	Estimated CUF as of 12/31/07 (3)	Estimated 40-Year CUF (4)	Estimated 60-Year CUF (4)	Monitoring Technique (5,6)
Main Steam Line A (Node 200)	0.041	0.1	0.047	0.073	0.099	CBF
Main Steam Line B (Node 200)	0.081	0.1	0.034	0.052	0.069	CBF
Main Steam Line C (Node 100)	0.051	0.1	0.029	0.044	0.059	CBF
Main Steam Line D (Node 300)	0.097	0.1	0.059	0.091	0.124 (8)	CBF
Reactor Recirculation A Node 204 28” Discharge Gate Valve)	 0.015 0.111	 1.0 1.0	 0.008 (9)	 0.013 (9)	 0.017 (9)	 CBF CBF
Reactor Recirculation B Node 204 28” Discharge Gate Valve	 0.016 0.111	 1.0 1.0	 0.009 (9)	 0.015 (9)	 0.021 (9)	 CBF CBF
Feedwater Line No. AE-035 Node 200 Node 315 Node 265 Node 270	 0.602 0.484 0.471 0.096	 1.0 1.0 1.0 0.1	 0.370 0.322 0.313 0.049	 0.582 0.508 0.493 0.071	 0.808 0.705 0.684 0.094	 CBF CBF CBF CBF
Feedwater Line No. AE-036 Node 200 Node 315 Node 265 Node 197 Node 130	 0.573 0.481 0.472 0.095 0.214	 1.0 1.0 1.0 0.1 1.0	 0.385 0.322 0.314 0.062 0.103	 0.606 0.507 0.494 0.098 0.147	 0.841 0.704 0.685 0.136 (8) 0.192	 CBF CBF CBF CBF CBF (7)
Reactor Water Cleanup Node 570 Node 575 Node 905	 0.609 0.639 0.523	 1.0 1.0 1.0	 0.309 0.321 0.268	 0.492 0.512 0.430	 0.689 0.717 0.603	 CBF CBF CBF
Head Vent Line (Node 320)	0.648	1.0	0.001	0.001	0.001	CBF
RHR Shutdown Cooling Suction (Node 535)	0.0365	0.1	0.025	0.039	0.055	CBF (7)
RHR SDC Return A Node 601 Node 608	 0.094 0.080	 0.1 0.1	 0.077 0.061	 0.095 0.082	 0.113 (8) 0.106 (8)	 CBF CBF
RHR SDC Return B (Node 601)	0.2264	1.0	0.196	0.217	0.240	CBF (7)
Nuclear Boiler Instrument. Line No. BB-230-CCA-1” (Node 25B)	0.483	1.0	0.032	0.050	0.068	CBF

Notes:

1. Based on the currently governing design basis 40-year fatigue analysis.
2. Allowable CUF is 1.0, except for High Energy Line Break (HELB) locations, as discussed in Section 4.3.3.
3. Estimated CUF as of 12/31/07 is based on the events accumulated to-date as of 12/31/07 from Table 4.3.1-1.
4. Estimated CUF for 40 years or 60-years based on the CUF as of 12/31/07 and the trends from the past twelve years (nine operating cycles) of actual plant operation.
5. CBF = Cycle-Based Fatigue.

Notes cont'd:

6. All locations with 40-year design basis CUF ratios (i.e., CUF/allowable) expected to exceed 0.4 (or 40% of allowable) based on the original analysis will be included in the program. In addition, the locations identified in NUREG/CR-6260 for the newer-vintage General Electric plant, which have been evaluated for environmental fatigue effects as discussed in Section 4.3.4, have been included in the program.
7. NUREG/CR-6260 component.
8. Estimated 60-year CUF exceeds the allowable value of 0.1. As discussed in Section 4.3.3, if the Metal Fatigue of Reactor Coolant Pressure Boundary program predicts the CUF will reach the allowable value prior to 60 years of operation, appropriate action will be taken in accordance with the corrective action process prior to the allowable limit being exceeded.
9. This location will be incorporated into the Metal Fatigue of Reactor Coolant Pressure Boundary program prior to the period of extended operation.

4.3.4 NON-CLASS 1 COMPONENT FATIGUE ANALYSES

Summary Description

Non-Class 1 components include pipe, tubing, fittings, tanks, vessels, heat exchangers, valve bodies, pump casings, and miscellaneous process components. As listed in UFSAR Tables 3.2-1, 3.2-2, and 3.2-3, these components were generally designed in accordance with appropriate ASME Section III subsections or American National Standards Institute (ANSI) B31.1, or B31.7, depending on their function.

Calculation of cumulative fatigue usage is not required for non-Class 1 components. For non-Class 1 components, stresses due to thermal expansion and anchor movement, which are important for fatigue evaluations, are analyzed using stress intensification factors and stress allowables. Allowable stresses are defined for 7000 full temperature cycles with reductions in allowable stresses as cycles increase beyond 7000.

Analysis

The following HCGS piping systems in the scope of license renewal designed to B31.1 or ASME Code, Section III, Class 2 and 3; Core Spray, Feedwater, High Pressure Coolant Injection (HPCI), Main Steam, Reactor Recirculation, Reactor Water Cleanup, and Residual Heat Removal (RHR) systems. For these systems, the assumed thermal cycle count can conservatively be approximated by the thermal cycles expected for the reactor pressure vessel. The expected 60-year numbers of cycles for these events are listed in Table 4.3.1-1. When combined, the total expected count of the thermal cycles in Table 4.3.1-1 is less than 2,700 for 60 years of plant operation, which is a fraction of the 7,000-cycle threshold. Therefore, the existing piping analyses designed to B31.1 or ASME Code, Section III, Class 2 and 3 within the scope of license renewal are valid for the period of extended operation.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The expected 60-year numbers of cycles for non-class 1 piping and piping components has been demonstrated to be within the allowed number of cycles assumed in the design for these components and the fatigue design remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.3.5 EFFECTS OF REACTOR COOLANT ENVIRONMENT ON FATIGUE LIFE OF COMPONENTS AND PIPING (GENERIC SAFETY ISSUE 190)

Summary Description

Generic Safety Issue (GSI) 166, later renumbered as GSI 190 (Reference 4.8.25), was identified by the NRC because of concerns about the effects of reactor water environment on the fatigue life of components and piping during the period of extended operation. GSI-190 was closed in December of 1999 (Reference 4.8.26), and concluded that environmental effects have a negligible impact on core damage frequency and, as such, no generic regulatory action was required. However, as part of the closure of GSI 190, the NRC concluded that licensees who apply for license renewal should address the effects of coolant environment on component fatigue life as part of their aging management programs.

NUREG-1801, Revision 1, Generic Aging Lessons Learned, contains recommendations on specific areas for which existing programs should be augmented for license renewal. The program description for Aging Management Program Section X.M1, “Metal Fatigue of Reactor Coolant Pressure Boundary,” requires detailed, vintage-specific, fatigue calculations for plants applying for license renewal for the locations identified in NUREG/CR-6260, “Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components.” Since such calculations do not form a part of the HCGS current licensing basis and therefore do not satisfy the requirements of 10 CFR 54.3, they are not TLAA. However, since the environmental fatigue calculations for HCGS are related to the reactor pressure vessel and piping fatigue analyses covered in Sections 4.3.1 and 4.3.3, they are addressed in this section.

Analysis

As a part of the NRC's Fatigue Action Plan, incorporation of environmental fatigue effects originally involved a reduced set of fatigue design curves, such as those proposed by Argonne National Laboratory (ANL) in NUREG/CR-5999 (Reference 4.8.27). As a part of the effort to close GSI 166 (later GSI 190) for operating nuclear power plants during the current 40-year licensing term, Idaho National Engineering Laboratory (INEL) evaluated fatigue-sensitive component locations at plants designed by all four U.S. nuclear steam supply system (NSSS) vendors. The ANL fatigue curves were used by INEL to recalculate the CUFs for fatigue-sensitive component locations in older and newer vintage Combustion Engineering (CE) pressurized water reactors (PWRs), older and newer vintage Westinghouse PWRs, older and newer vintage General Electric (GE) boiling water reactors (BWRs), and Babcock & Wilcox Company (B&W) PWRs. The results of the INEL calculations were published in NUREG/CR-6260 (Reference 4.8.28). The INEL calculations took advantage of conservatisms present in governing ASME Code fatigue calculations, including the numbers of actual plant transients relative to the numbers of design basis transients, but did not recalculate stress ranges based on actual plant transient profiles.

The BWR calculations in NUREG/CR-6260, especially the newer-vintage General Electric plant calculations, are directly relevant to HCGS. The newer-vintage General Electric plant evaluated in NUREG/CR-6260 is the most appropriate comparison to HCGS, since the HCGS piping design is in accordance with ASME Code, Section III. Although the newer vintage plant evaluated in NUREG/CR-6260 was a BWR-6 that has some systems that differ from HCGS (which is a BWR-4), the NUREG/CR-6260 locations were identified for HCGS by considering both vintage GE plants in NUREG/CR-6260. Accounting for BWR-type differences, the specific locations selected for each of the GE vintage plants in NUREG/CR-6260 were based on selecting the limiting (highest fatigue usage) location for each of the same six identical reactor pressure vessels and Class 1 piping regions. Therefore, detailed environmental fatigue calculations were performed for HCGS primarily based on the locations associated with the newer-vintage General Electric plant.

From NUREG/CR-6260 for the newer-vintage General Electric plant, the following locations require evaluation:

- Reactor pressure vessel shell and lower head
- Reactor pressure vessel feedwater nozzle
- Reactor recirculation piping (including reactor pressure vessel inlet and outlet nozzles)
- Core spray line reactor pressure vessel nozzle and associated Class 1 piping
- Residual heat removal nozzles and associated Class 1 piping
- Feedwater Class 1 piping

Per Section X.M1 of the GALL Report, the environmental fatigue evaluation must use the appropriate environmental fatigue multiplier, or F_{en}, relationships from NUREG/CR-6583 (Reference 4.8.29) for carbon/low alloy steels, and NUREG/CR-5704 (Reference 4.8.30) for stainless steels, as appropriate for the material for each location. Therefore, the methodology documented in NUREG/CR-6583 and NUREG/CR-5704 was used to evaluate environmental effects for HCGS components.

The results of the environmental fatigue calculations performed for all HCGS locations are shown in Table 4.3.5-1. The locations selected for HCGS and presented in Table 4.3.5-1 represent the most limiting locations at HCGS represented by the above list of six items for environmental effects and, therefore, the results are bounding for the HCGS RCPB. The environmental fatigue calculations make use of the 60-year cycles for HCGS as listed in Table 4.3.5-1. The results demonstrate that CUF values, including appropriate environmental effects, are less than 1.0 for 60 years of plant operation for all locations except for the reactor pressure vessel feedwater nozzle safe end. Corrective action will be taken prior to exceeding the environmental assisted fatigue CUF value of 1.0.

Disposition: Aging Management, 10 CFR 54.21(c)(1)(iii)

As noted in Sections 4.3.1 and 4.3.3, all of the locations shown in Table 4.3.5-1 will be included in the Metal Fatigue of Reactor Coolant Pressure Boundary (B.3.1.1) aging management program, and the CUF for these locations will be managed in accordance with 10 CFR 54.21(c)(1)(iii).

Table 4.3.5-1
Environmental Fatigue Results for HCGS for NUREG/CR-6260 Components

NUREG/CR-6260 Location	Equivalent HCGS Location(s) [(1)]	Material	60-Year Fatigue Usage Factor [(2)]	60-Year Fatigue Usage Factor with Environmental Effects [(3)]	Overall Environmental Fatigue Multiplier [(4)]
Reactor pressure vessel shell and lower head	CRD Penetration Drive Housing	Stainless Steel	0.0393	0.5615	14.30
	CRD Penetration with Excavation	Alloy 600	0.2765	0.4119	1.49
Reactor pressure vessel feedwater nozzle	Safe End	Stainless Steel	0.1982	2.3810 [(5)]	12.01
	Nozzle Forging	Low Alloy Steel	0.1031	0.8096 [(6)]	7.22
Reactor recirculation piping (including inlet and outlet nozzles)	RHR Return Tee	Stainless Steel	0.2405	0.6250	2.60
	RPV inlet nozzle forging	Low Alloy Steel	0.1033	0.3589	3.48
	RPV outlet nozzle forging	Low Alloy Steel	0.0701	0.2457	3.51
Core spray line reactor pressure vessel nozzle and associated Class 1 piping	Core Spray Nozzle	Low Alloy Steel	0.1063	0.7678	7.22
	Core Spray Nozzle Safe End	Alloy 600	0.0202	0.0301	1.49
Residual heat removal nozzles and associated Class 1 piping	RHR Supply Piping	Stainless Steel	0.0252	0.2105	8.36
	RHR Supply Piping	Carbon Steel	0.0547	0.3551	6.49
Feedwater Class 1 piping	Tee on header to RPV Nozzle N4E	Carbon Steel	0.074	0.350	4.73

Notes:

1. Locations shown are the bounding locations for HCGS.
2. Revised fatigue usage factors were computed for all of the NUREG/CR-6260 components based on the assumed number of cycles for 60 years of plant operation.
3. Environmental fatigue usage was computed using the methodology of NUREG/CR-6583 (for carbon/low alloy steels) and NUREG/CR-5704 (for stainless steels), as appropriate for the material for each location.
4. Environmental multipliers (F_{en}s) were calculated based on the assumption that Hydrogen Water Chemistry (HWC) conditions exist for 85% of the overall 60-year operating period, and Normal Water Chemistry (NWC) conditions exist for 15% of the overall 60-year operating period. The following dissolved oxygen (DO) conditions were used based on review of historical DO data:
   - Feedwater line DO is 31 ppb for pre-HWC and 86 ppb for post-HWC conditions.
   - Recirculation line DO is 266 ppb pre-HWC and 57 ppb post-HWC.
   - RPV Upper Region DO is 103 ppb pre-HWC and 81 ppb post-HWC.
   - RPV Beltline DO is 106 ppb pre-HWC and 4 ppb post-HWC.
   - RPV Bottom Head Region DO is 109 ppb pre-HWC and 33 ppb post-HWC.
5. The estimated 60-year CUF with environmental effects exceeds the allowable value of 1.0. As discussed in Section 4.3.5, corrective action will be taken prior to exceeding the environmental assisted fatigue CUF value of 1.0.
6. Rapid cycling effects are included in the 60-year Environmental CUF value, but are not multiplied by the Overall Environmental Multiplier based on guidance of Section 4.2.6 of MRP-47, Revision 1.

4.4 ENVIRONMENTAL QUALIFICATION OF ELECTRICAL EQUIPMENT

Environmental Qualification of Electrical Equipment

Summary Description

Thermal, radiation, and cyclical aging analyses of plant electrical and I&C components, developed to meet 10 CFR 50.49 requirements, have been identified as time-limited aging analyses (TLAAs) for Hope Creek. The NRC has established nuclear station environmental qualification (EQ) requirements in 10 CFR 50.49 and 10 CFR 50, Appendix A, Criterion 4. 10 CFR 50.49 specifically requires that an EQ program be established to demonstrate that certain electrical components located in harsh plant environments are qualified to perform their safety function in those harsh environments after the effects of in-service aging. Harsh environments are defined as those areas of the plant that could be subject to the harsh environmental effects of a loss-of-coolant accident (LOCA), high energy line break (HELB), or post-LOCA radiation. 10 CFR 50.49 requires that the effects of significant aging mechanisms be addressed as part of environmental qualification.

Environmental Qualification Program Background

The Hope Creek Environmental Qualification (EQ) of Electric Components program meets the requirements of 10 CFR 50.49 for the applicable electrical components important to safety. 10 CFR 50.49 defines the scope of components to be included, requires the preparation and maintenance of a list of in-scope components, and requires the preparation and maintenance of a qualification file that includes component performance specifications, electrical characteristics and the environmental conditions to which the components could be subjected.

Aging evaluations for electrical components in the Hope Creek Environmental Qualification (EQ) of Electric Components program that specify a qualification of at least 40 years are TLAAs for license renewal because the criteria contained in 10 CFR 54.3 are met.

Analysis

Under 10 CFR 54.21(c)(1)(iii), the Hope Creek Environmental Qualification (EQ) of Electric Components program, which implements the requirements of 10 CFR 50.49 (as further defined and clarified by NUREG-0588, and RG 1.89, Rev. 1), is viewed as an aging management program for License Renewal.

Additionally, reanalysis of an aging evaluation to extend the qualifications of components is performed on a routine basis as part of the Hope Creek Environmental Qualification (EQ) of Electric Components program. Important attributes for the reanalysis of an aging evaluation include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). TLAA demonstration option (iii), which states that the effects of aging will be adequately managed for the period of extended operation, is chosen and the Hope Creek Environmental Qualification (EQ) of Electric Components program will manage the aging effects of the components associated with the environmental qualification TLAA.

NUREG-1800 states that the staff evaluated the EQ program (10 CFR 50.49) and determined that it is an acceptable aging management program to address environmental qualification according to 10 CFR 54.21(c)(1)(iii). The evaluation referred to in the Standard Review Plan for License Renewal contains sections on "EQ Component Reanalysis Attributes, Evaluation, and Technical Basis" that is the basis of the description provided below.

Component Reanalysis Attributes

The reanalysis of an aging evaluation is normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation. Reanalysis of an aging evaluation to extend the qualification of a component is performed on a routine basis pursuant to 10 CFR 50.49(e) as part of the Hope Creek Environmental Qualification (EQ) of Electric Components program. While a component life-limiting condition may be due to thermal, radiation or cyclical aging, the vast majority of component aging limits are based on thermal conditions. Conservatism may exist in aging evaluation parameters, such as the assumed ambient temperature of the component, unrealistically low activation energy, or in the application of a component (de-energized versus energized). The reanalysis of an aging evaluation is documented according to Hope Creek quality assurance program requirements, which require the verification of assumptions and conclusions. As already noted, important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). These attributes are discussed below.

Analytical Methods

The Hope Creek Environmental Qualification (EQ) of Electric Components program uses the same analytical models in the reanalysis of an aging evaluation as those previously applied during the prior evaluation. The Arrhenius methodology is an acceptable thermal model for performing a thermal aging evaluation. The analytical method used for a radiation aging evaluation is to demonstrate qualification for the total integrated dose, which is the normal radiation dose for the projected installed life plus accident radiation dose. For license renewal, one acceptable method of establishing the 60-year normal radiation dose is to multiply the 40-year normal radiation dose by 1.5 (that is, 60 years/40 years). The result is added to the accident radiation dose to obtain the total integrated dose for the component. For cyclical aging, a similar approach may be used. Other models may be justified on a case-by-case basis.

Data Collection & Reduction Methods

The chief method used for a reanalysis per the Hope Creek Environmental Qualification (EQ) of Electric Components program is reduction of excess conservatism in the component service conditions used in the prior aging evaluation, including temperature, radiation, and cycles. Temperature data used in an aging evaluation should be based on plant design temperatures or on actual plant temperature data. When used, plant temperature data can be obtained in several ways, including monitors used for technical specification compliance, other installed monitors, measurements made by plant operators during rounds, and temperature sensors on large motors. A representative number of temperature measurements are evaluated to establish the temperatures used in an aging evaluation. Plant temperature data may be used in an aging evaluation in different ways, such as: (a) directly applying the plant temperature data in the evaluation or (b) using the plant temperature data to demonstrate conservatism when using plant design temperatures for an evaluation. Any changes to material activation energy values as part of a reanalysis must be justified. Similar methods of reducing excess conservatism in the component service conditions used in prior aging evaluations can be used for radiation and cyclical aging.

Underlying Assumptions

The Hope Creek Environmental Qualification (EQ) of Electric Components program component aging evaluations contain sufficient conservatism. Additionally, plant modifications that have potential impact to the Hope Creek Environmental Qualification (EQ) of Electric Components program are evaluated during the modification process to determine the impact of the plant modification on the Hope Creek Environmental Qualification (EQ) of Electric Components program. When unexpected adverse conditions are identified during operational or maintenance activities that affect the normal operating environment of a qualified component, the affected EQ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions.

Acceptance Criteria and Corrective Action

Under the Hope Creek Environmental Qualification (EQ) of Electric Components program, the reanalysis of an aging evaluation could extend the qualification of the component. If the qualification cannot be extended by reanalysis, the component must be refurbished, replaced, or requalified prior to exceeding the period for which the current qualification remains valid. A reanalysis is to be performed in a timely manner such that sufficient time is available to refurbish, replace, or requalify the component if the reanalysis is unsuccessful.

Disposition: Aging Management, 10 CFR 54.21(c)(1)(iii)

The effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The Hope Creek Environmental Qualification (EQ) of Electric Components program has been demonstrated to be capable of programmatically managing the qualified lives of the components falling within the scope of the program for License Renewal in accordance with 10 CFR 54.21(c)(1)(iii).

4.5 LOSS OF PRESTRESS IN CONCRETE CONTAINMENT TENDONS

The HCGS containment does not have pre-stressed tendons. As such, this topic is not a TLAA.

4.6 CONTAINMENT LINER PLATE, METAL CONTAINMENTS, AND PENETRATIONS FATIGUE ANALYSES

4.6.1 FATIGUE ANALYSIS OF PRIMARY CONTAINMENT, ATTACHED PIPING, AND COMPONENTS

Summary Description

The HCGS containment vessel is a Mark I design with a drywell and toroidal suppression chamber. The suppression chamber assembly is often referred to as the “torus”, and is used interchangeably with the phrase “suppression chamber” in the discussions that follow. The HCGS primary containment was designed in accordance with the ASME Code, Section III. Subsequently, during large scale testing for the Mark III containment system and the in-plant testing for Mark I primary containment systems, new suppression chamber hydrodynamic loads were identified. These loads result from blowdown into the suppression chamber during a postulated Loss of Coolant Accident (LOCA) and during Safety Relief Valve (SRV) operation for plant transients. Re-evaluation of the primary containment structure was performed in two parts: generic analyses applicable to each of the several classes of BWR containments, and Mark I Containment Program plant-unique analyses. The scope of the analyses included the pressure suppression chamber (shells and welds), the drywell-to-pressure suppression chamber vents (header and downcomers), SRV discharge piping, other piping attached to the pressure suppression chamber, penetrations, and vent bellows.

The Mark I analyses are detailed in the HCGS Plant Unique Analysis Report (PUAR) and assume 370 multiple SRV lifts and 596 single SRV lifts. Since these analyses include fatigue evaluations based on the occurrence of a limited number of transient cycles during the current licensed term of operation (40 years), they satisfy the requirements of 10 CFR 54.3 and are TLAAs.

Analysis

To address license renewal requirements, the historical number of SRV Lifts was researched to determine the number of SRV lifts from 1986 (initial plant startup testing) through the end of 2007. Relevant documentation that was reviewed for this effort included plant start-up tests, post trip logs, surveillance tests, and annual reports required by Technical Specifications. Using this information and projecting the results for 60 years of operation provided a projected number of 592 single SRV lifts for 60 years, and a projected number of 26 multiple lifts for 60 years (see Table 4.3.1-1). Both of these numbers are below the values assumed in the Mark I analyses (596 single SRV lifts and 370 multiple SRV lifts).

Containment fatigue analyses exist for the following component groups:

- Drywell shell and vent line penetrations
- Suppression Chamber Components and Welds
- Vent System Components and Welds

- Suppression Chamber Penetrations
- SRV Discharge Piping
- Other Torus Attached Piping

Table 4.6.1-1 summarizes the design basis fatigue CUF values from the analyses described above.

For all primary containment system components, the majority of the CUF is caused by Design Basis Accident (DBA) or Small Break Accident (SBA) and Operating Basis Earthquake (OBE) loadings, all of which are not expected to occur during the operating lifetime of HCGS. The contribution to CUF by SRV Actuations is generally small, and will remain small for the number of events anticipated for the 60-year life of the plant. Because the projected number of actual events for 60 years of operation is less than the number assumed in the design basis (40-year) analysis, this 40-year design basis analysis remains bounding for the period of extended operation. Therefore, CUFs for these locations are expected to remain below the allowable value of 1.0 for the 60-year life of the plant.

Even though the projected number of cycles and the associated CUF are projected to be within the original design assumptions, all relevant plant transient events will be tracked to ensure that the CUF remains less than 1.0 for all monitored components. Validation for primary containment locations will be performed by monitoring the high CUF limiting containment locations. All governing fatigue analyses have been reviewed to establish a comprehensive and bounding set of primary containment locations for inclusion in the Metal Fatigue of Reactor Coolant Pressure Boundary (B.3.1.1) aging management program.

Bounding locations with design basis CUFs that exceed 0.4 (or 40% of the allowable value) will be included in the program, as identified in Table 4.6.1-1. As identified in Table 4.3.1-1, SRV lifts will be monitored to ensure that the CUFs remain less than 1.0.

For locations with a CUF less than 0.4 in Table 4.6.1-1, a 20-year increase in service life will not raise the CUF significantly close to the allowable value of 1.0. Therefore, these locations are not included in the Metal Fatigue of Reactor Coolant Pressure Boundary (B.3.1.1) aging management program.

In the event fatigue usage for any component is predicted to exceed 1.0 as a result of monitoring prior to 60 years of operation, appropriate corrective action will be taken in accordance with the corrective action process. The required implementing actions will be completed prior to the period of extended operation.

Disposition: Aging Management, 10 CFR 54.21(c)(1)(iii)

The Metal Fatigue of Reactor Coolant Pressure Boundary program will monitor the numbers of cycles of the design transients and the corresponding CUF for critical primary containment components. All necessary plant transient events, as shown in Table 4.3.1-1, will be tracked to ensure that the CUF remains less than the allowable CUF limit for all monitored components. In the event the monitored CUF is predicted to exceed the allowable value for any component prior to 60 years of operation, appropriate corrective action will be taken in accordance with the corrective action process prior to the allowable limits being exceeded. HCGS has an existing program in place to track operating thermal and pressure cycles and to assess their effect on vessel fatigue. The requirements from this program will be incorporated into the Metal Fatigue of Reactor Coolant Pressure Boundary (B.3.1.1) aging management program. The required implementing actions will be completed prior to the period of extended operation. As such, the Metal Fatigue of Reactor Coolant Pressure Boundary program will manage the effects of aging due to fatigue on the primary containment in accordance with 10 CFR 54.21(c)(1)(iii).

Table 4.6.1-1
Fatigue Monitoring Locations for HCGS Primary Containment and Estimated CUFs

Component	Design Basis 40-Year CUF (1)	Estimated CUF as of 12/31/07 (2)	Estimated 40-Year CUF (3)	Estimated 60-Year CUF (3)	Monitoring Technique (4,5)
Suppression Chamber Components and Welds					
+ Torus Shell	0.725	0.230	0.299	0.366	CBF
+ Weld	0.801	0.207	0.271	0.334	CBF
Vent System Components and Welds					
+ Vent Header (at Downcomer-Vent Header Intersection)	0.630	0.132	0.169	0.206	CBF
+ Weld (at Downcomer-Vent Header Intersection)	0.791	0.182	0.233	0.283	CBF
Drywell Shell at Vent Line Penetration	0.98	(8)	(8)	(8)	CBF
Suppression Chamber Penetrations	< 1.0	(7)	(7)	(7)	Not monitored -- bounded by other locations (6)
SRV Discharge Piping	< 0.5	(7)	(7)	(7)	Not monitored -- bounded by other locations (6)
Other Torus Attached Piping	< 0.5	(7)	(7)	(7)	Not monitored -- bounded by other locations (6)

Notes:
1. Based on the currently governing design basis 40-year fatigue analysis, the allowable CUF for all components is 1.0.
2. Estimated CUF as of 12/31/07 is based on the events accumulated to-date as of 12/31/07 from Table 4.3.1-1.
3. Estimated CUF for 40 years or 60-years based on the CUF as of 12/31/07 and the trends from the past twelve years (nine operating cycles) of actual plant operation.
4. CBF = Cycle-Based Fatigue.
5. All locations with 40-year design basis CUF ratios (i.e., CUF/allowable) expected to exceed 0.4 (or 40% of allowable) based on the original analysis will be included in the program.
6. If fatigue monitoring results for other components approaches or exceeds a CUF of 0.8, monitoring of this component will be implemented.
7. Component fatigue is bounded by other locations because suppression chamber and vent system components and welds are limiting to the associated piping and penetrations.
8. This location will be included into the fatigue monitoring program prior to the period of extended operation.

4.6.2 PRIMARY CONTAINMENT PROCESS PENETRATIONS AND BELLOWS FATIGUE ANALYSIS

Summary Description

The primary containment process piping penetrations use flued heads to connect the process piping to the drywell sleeves. The primary containment process piping penetrations meet ASME Section III, Class I or II requirements, as applicable. The flued heads for the ASME Section III, Class 1 process piping systems have been analyzed for fatigue. These Class 1 fatigue analyses are based upon thermal cycles specified for the 40-year life for the plant and have therefore been identified as TLAAs requiring evaluation for the period of extended operation. The primary containment process piping penetrations with triple flued heads are anchored to the concrete shield wall around the drywell. As a result, the penetration design includes a flexible bellows to seal the triple flued head to the drywell penetration sleeve. The single and double flued heads are sealed directly to the drywell sleeves, without a flexible bellows. The flexible bellows were designed in accordance with ASME Section III, Class 2 requirements, but this included CUF analyses that have also been identified as TLAA's requiring evaluation for 60 years. The drywell penetration sleeves were evaluated for cyclic loads under the ASME Section III, Class II requirements, and it was determined that the penetration sleeves were exempt from a detailed fatigue evaluation.

Analysis

Containment Process Penetrations: The maximum 40-year CUF ratio (CUF/allowable) identified for any of these penetrations is 0.957 for feedwater penetrations P-2A and P-2B. Since these two penetration locations have CUF ratios that exceed 0.4 (or 40% of the allowable value), the triple flued heads will be included in the Metal Fatigue of Reactor Coolant Pressure Boundary program (B.3.1.1) as a program enhancement. All relevant plant transient events will be tracked to ensure that the CUF remains less than 0.1 for these two triple flued heads. All other governing penetration fatigue analyses have been reviewed, and the CUF ratios for all other penetrations are well less than 0.4 (maximum value of 0.057).

Flexible Bellows:

Analyses for the flexible bellows were reviewed. It was determined the fatigue usage experienced by the flexible bellows was bounded by the corresponding attached triple flued head. Monitoring of the fatigue usage for the triple flued heads will provide assurance that no flexible bellows will exceed its allowable value.

Disposition: Aging Management, 10 CFR 54.21(c)(1)(iii)

The Metal Fatigue of Reactor Coolant Pressure Boundary program will monitor the numbers of cycles of the design transients and the corresponding CUF for the triple flued head. All necessary plant transient events, as shown in Table 4.3.1-1, will be tracked to ensure that the CUF remains less than the allowable CUF limit for all monitored components. In the event the monitored CUF is predicted to exceed the allowable value for any component prior to 60 years of operation, appropriate corrective action will be taken in accordance with the corrective action process prior to the allowable limits being exceeded. HCGS has an existing program in place to track operating thermal and pressure cycles and to assess their effect on vessel fatigue. The requirements for monitoring these components will be incorporated into the Metal Fatigue of Reactor Coolant Pressure Boundary (B.3.1.1) aging management program as a program enhancement. The required implementing actions will be completed prior to the period of extended operation. As such, the Metal Fatigue of Reactor Coolant Pressure Boundary program will manage the effects of aging due to fatigue on the containment process penetrations and the flexible bellows in accordance with 10 CFR 54.21(c)(1)(iii).

4.6.3 VENT LINE BELLOWS

Summary Description

Fatigue was evaluated for the vent line bellows that seal the drywell shell to the vent lines, which connect to the torus. The fatigue evaluation for these bellows is based on the number of cycles assumed for the 40-year life of the plant; therefore these analyses satisfy the criteria 10 CFR 54.3(a) and are evaluated as TLAA in accordance with 10 CFR 54.21(c).

Analysis

The maximum differential displacements of the vent line bellows are determined using the results of the torus reanalysis. The displacements at the attachment points of the bellows to the drywell side of the vent line and to the torus side of the vent line are determined for each load case. The differential displacement is computed from these values. The results of each load case are combined to determine the total differential displacements for the controlling load combinations. The results are compared to the allowable bellows displacements. The loads that cause the highest number of displacement cycles at the vent line bellows are seismic loads, SRV loads, and LOCA related loads such as pool swell, condensation oscillation, and chugging. The bellows displacements for these loads are small compared to the maximum allowable displacement and their effect on fatigue is negligible. The thermal loads and internal pressure loads are the largest contributors to bellows displacements. The originally specified number of thermal load and internal pressure cycles was 150. Since the bellows have a rated capacity of 230 cycles at maximum displacements for normal operating conditions, their adequacy for fatigue is not a concern.

As listed in Table 4.3.1-1, the maximum number of startup and shutdown cycles expected for 60 years of operations at Hope Creek is 180 for startup and shutdown. Since the allowable number of cycles, at maximum displacements for normal operating conditions, are greater than those projected for 60 years, the fatigue evaluation for the vent line bellows remain valid for the period of extended operation.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The fatigue evaluation for the vent line bellows remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.7 OTHER PLANT-SPECIFIC TIME LIMITED AGING ANALYSES

4.7.1 CRANE LOAD CYCLE LIMIT

Summary Description

The load cycle limits for cranes was identified as a potential TLAA. The following Hope Creek cranes are in the scope of License Renewal and have been identified as having a TLAA, which requires evaluation for 60 years:

- Reactor Building Polar Crane
- Service Water Intake Structure Gantry Crane

The method of review applicable to the crane cyclic load limit TLAA involves (1) reviewing the existing 40-year design basis to determine the number of load cycles considered in the design of each of the cranes in the scope of License Renewal, (2) developing 60-year projections for load cycles for each of the cranes in the scope of License Renewal and compare with the number of design cycles for 40 years.

Analysis

<u>Reactor Building Polar Crane</u>

The Reactor Building Polar Crane at Hope Creek is designed to meet or exceed the design fatigue requirements of the Crane Manufacturers Association of America (CMAA) Specification 70. This evaluation of cycles over the 40-year life is the basis of a safety determination and is therefore a TLAA Analysis.

The Reactor Building Polar Crane is designed in accordance with CMAA Specification 70 for a minimum of 100,000 load cycles. A review of Reactor Building Polar Crane operation during the current life of the plant, including an estimated 200 lifts during original construction, indicates that the total number of lifts above 25 tons to date is less than 800. Using an average rate of 42 lifts per year over the course of 60 years results in the Polar Crane experiencing 2,520 lifts. Additionally, the Polar Crane will be used in the handling of casks, which are projected to be less than 200 lifts from campaign initiation through the period of extended operation. Therefore, the total number of lifts for the Polar Crane has been estimated to be 2,720 for the total life of plant, including the extended period of operation associated with license renewal. This is less than the minimum allowable design value of 100,000 cycles and is therefore acceptable. Therefore, the Reactor Building Polar Crane load cycle fatigue analysis remains valid for 60 years of plant operation.

<u>Service Water Intake Structure Gantry Crane</u>

The Hope Creek Service Water Intake Structure Gantry Crane purchasing specification required that the crane conform to the latest edition of

CMAA, Specification 70 for Electric Overhead Traveling Cranes and was designed for 100,000 to 500,000 load cycles.

A review of Service Water Intake Structure Gantry Crane operation during the current life of the plant, including an estimated 200 lifts during original construction, indicates that the total number of lifts is less than 600. Using an average rate of 32 lifts per year over the course of 60 years results in the Service Water Intake Structure Gantry Crane experiencing 1,920 lifts. This is less than the minimum allowable design value of 100,000 cycles, and is therefore acceptable. Therefore, the Service Water Intake Structure Gantry Crane load cycle fatigue analysis remains valid for 60 years of plant operation.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

Based on the above information, the number of design cycles assumed in the designs associated with the Reactor Building Polar Crane and Service Water Intake Structure Gantry Crane remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.7.2 REFUELING BELLOWS FATIGUE

Summary Description

A fatigue analysis was performed for each of the two bellows that seal the drywell bulkhead and reactor vessel and the drywell bulkhead and drywell shell for refueling operations. The fatigue analysis for each of these bellows is based on the number of cycles assumed for the 40-year life of the plant; therefore these analyses satisfy the criteria 10 CFR 54.3(a) and are evaluated as TLAA in accordance with 10 CFR 54.21(c).

Analysis

The bulkhead-to-drywell bellows exhibited the highest calculated fatigue usage of 0.124. The fatigue usage for both bellows was determined by the number of cycles of startup and shutdown and the number flood-up events at each refueling outage. The fatigue analysis assumed 360 cycles for startup and shutdown and reflood over the life of the plant. As listed in Table 4.3.1-1 the maximum number of startup and shutdown cycles expected for 60 years of operations at Hope Creek is 180 for startup and shutdown and 55 for refueling operations, for a total of 235 cycles. Since the number of cycles used in the analyses for these events are greater than those projected for 60 years, the fatigue analyses for the refueling bellows remain valid for the period of extended operation. The refueling bellows support is addressed in Section 4.3.1.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The fatigue analysis for the refueling bellows remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i)

4.7.3 NEUTRON FLUENCE-INDUCED BOLT STRESS RELAXATION - JET PUMP AUXILIARY SPRING WEDGES AND SLIP JOINT CLAMPS

Summary Description

Auxiliary Spring Wedges and a Slip Joint Clamp have been installed on jet pumps at the Hope Creek Generating Station. The auxiliary spring wedges were installed during refueling outage R14 (2007) and R15 (2009), and the slip joint clamp was installed during refueling outage R13 (2006). Structural analysis of the repair devices evaluated the loss of preload for structural bolting due to exposure to neutron fluence during the 40 years of operation after their installation. The analysis for each of these devices is based on the fluence assumed for the 40-year life of the device; therefore these analyses satisfy the criteria 10 CFR 54.3(a) and are evaluated as a TLAA in accordance with 10 CFR 54.21(c).

<u>Auxiliary Spring Wedges Bolts:</u>

Analysis

The auxiliary spring wedge bolts were previously evaluated for neutron exposure up to a fluence of 1.07E20 n/cm^2 for a 40-year life. To disposition this TLAA, a fluence analysis was performed to determine the fluence values at the locations of the installed devices after 60 years of plant operation. The analysis determined that the bolts fluence levels remained below the analyzed value of 1.07E20 n/cm^2. Since the fluence bounds that which would be experienced within the period of extended operation, the analysis remains valid for 60 years of plant operation.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

Based on the above information, the current analysis (TLAA) remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

<u>Slip Joint Clamp Bolt:</u>

Analysis

The slip joint clamp bolt was previously evaluated for neutron exposure up to a fluence of 1.50E18 n/cm^2 for a 40-year life. To disposition this TLAA, a fluence analysis was performed to determine the fluence value at the location of the installed device at 60 years of plant operation. This analysis determined the slip joint clamp experiences a fluence greater than that previously evaluated prior to reaching 35.4 Effective Full Power Years (EFPY). Since the analysis does not bound the remaining 60 years of operation, additional actions are required. Prior to the period of extended operation, or prior to reaching the analyzed limit of 35.4 EFPY, whichever comes first, the plant will either; (1) replace the slip joint clamp or (2) perform an analysis that demonstrates the component function is maintained.

Disposition: Aging Management, 10 CFR 54.21(c)(1)(iii)

The slip joint clamp TLAA will be dispositioned in accordance with 10 CFR 54.21(c)(1)(iii) by managing the aging effects with the analysis and taking action as described above prior to the period of extended operation, or prior to reaching the analyzed limit of 35.4 EFPY, whichever comes first.

4.8 REFERENCES

4.8.1 Structural Integrity Associates Calculation No. 0800118.317, Revision 0, “Validation of Beltline Materials,” 9/12/2008.

4.8.2 TransWare Enterprises Inc. Document No. PSE-FLU-002-R-001, Revision 0, “Hope Creek Generating Station Reactor Pressure Vessel Fluence Evaluation at 56 EFPY,” August 2008.

4.8.3 “BWRVIP-126: BWR Vessel and Internals Project, RAMA Fluence Methodology Software,” Version 1.0, EPRI, Palo Alto, CA, 2003, 1007823.

4.8.4 U.S. NRC Regulatory Guide 1.190, “Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence,” March 2001.

4.8.5 Letter from William H. Bateman (U. S. NRC) to Bill Eaton (BWRVIP), “Safety Evaluation of Proprietary EPRI Reports BWRVIP-114, -115, -117, and -121 and TWE-PSE-001-R-001,” May 13, 2005.

4.8.6 U.S. Code of Federal Regulations, Title 10, Energy, Part 50, “Domestic Licensing of Production and Utilization Facilities.”

4.8.7 BWRVIP-74-A, EPRI Report TR 1008872, BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal (Proprietary).

4.8.8 BWRVIP-74 SER, USNRC Final License Renewal Safety Evaluation Report of EPRI Proprietary Report TR 113596, “BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines (BWRVIP 74),” and Appendix A, Demonstration of Compliance with the Technical Information Requirements of the License Renewal Rule (10 CFR Part 54.21)”. Attached to a letter from Christopher I. Grimes, USNRC License Renewal and Standardization Branch, to Carl Terry, BWRVIP Chairman, “Acceptance for Referencing of EPRI Proprietary Report TR 113596, ‘BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines (BWRVIP 74),’ and Appendix A, ‘Demonstration of Compliance with the Technical Information Requirements of the License Renewal Rule (10 CFR Part 54.21),’” October 18, 2001.

4.8.9 U.S. NRC Regulatory Guide 1.99, Revision 2, “Radiation Embrittlement of Reactor Vessel Materials,” May 1988.

4.8.10 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, “Rules for In-Service Inspection of Nuclear Power Plant Components,” 2001 Edition including the 2003 Addenda.

4.8.11 U.S. Nuclear Regulatory Commission, “Safety Evaluation for Hope Creek Generating Station, Request for Authorization of Alternate Examination of Reactor Pressure Vessel Circumferential Welds (TAC No. MA6037),” November 1, 1999.

4.8.12 U.S. NRC Generic Letter 98-05, “Boiling Water Reactor Licensees Use of the BWRVIP-05 Report to Request relief from Augmented Examination Requirements on Reactor Pressure Vessel Circumferential Shell Welds,” November 10, 1998.

4.8.13 BWRVIP-05, EPRI Report TR-105697, *BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations (BWRVIP-05).* For the Boiling Water Reactor Owners Group (Proprietary), September 29, 1995, with supplementing letters of June 24 and October 29, 1996, May 16, June 4, June 13, and December 18, 1997, and January 13, 1998. Cited by the SRP-LR [NUREG 1800] as Section 4.2 of Reference 4.8.8 (EPRI Proprietary Information)

4.8.14 U.S. NRC Safety Evaluation Report, “Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC No. M93925),” Office of Nuclear Reactor Regulation, May 1998.

4.8.15 BWRVIP-05 SER (Final), U.S. NRC letter from Gus C. Lainas to Carl Terry, Niagara Mohawk Power Company, BWRVIP Chairman, “Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report,” (TAC No. M93925), July 28, 1998.

4.8.16 BWRVIP-05 SER (Supplement), U.S. NRC letter from Jack R. Strosnider, Jr., to Carl Terry, BWRVIP Chairman, “Supplement to Final Safety Evaluation of the BWRVIP Vessel and Internals Project BWRVIP-05 Report,” (TAC No. MA3395), March 7, 2000.

4.8.17 U.S. NRC Regulatory Guide 1.174, Revision 1, “An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant Specific Changes to the Licensing Basis,” July 1998.

4.8.18 Letter dated May 14, 2008, from John G. Lamb, U.S. NRC to William Levis, “Hope Creek Generating Station-Issuance of Amendment RE: Extended Power Uprate” (TAC No. MD3002).

4.8.19 Letter LR-N990250 dated July 12, 1999 from PSEG to the U.S. NRC, “Relief Request Regarding Augmented Reactor Vessel Inspection, Hope Creek Generating Station, Facility Operating License NPF-57, Docket No. 50-354.”

4.8.20 General Electric Report No. NEDO-10029, “An Analytical Study on Brittle Fracture of GE-BWR Vessels Subject to the Design Basis Accident,” June 1969.

4.8.21 Hope Creek Generating Station Updated Final Safety Analysis Report, Revision 16, June 2009.

4.8.22 Ranganath, S., “Fracture Mechanics Evaluation of a Boiling Water Reactor Vessel Following a Postulated Loss of Coolant Accident,” Fifth International Conference on Structural Mechanics in Reactor Technology, Berlin, Germany, August 1979, Paper Gi/5.

4.8.23 U. S. Nuclear Regulatory Commission, NUREG-1801, Revision 1, “Generic Aging Lessons Learned (GALL) Report,” September 2005.

4.8.24 U. S. Nuclear Regulatory Commission, NUREG-1800, Revision 1, “Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,” September 2005.

4.8.25 NUREG-0933, A Prioritization of Generic Safety Issues, Section 3, “Issue 190: Fatigue Evaluation of Metal Components for 60-Year Plant Life (Rev. 2),” U. S. Nuclear Regulatory Commission, September 2007.

4.8.26 NRC Memorandum from Ashok C. Thadani to William D. Travers, “Closeout of Generic Safety Issue 190, Fatigue Evaluation of Metal Components for 60-Year Plant Life,” December 26, 1999.

4.8.27 NUREG/CR-5999 (INEL-95/0045), “Interim Fatigue Design Curves for Carbon, Low-Alloy, and Austenitic Stainless Steels in LWR Environments,” April 1993.

4.8.28 NUREG/CR-6260 (INEL-95/0045), “Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components,” March 1995.

4.8.29 NUREG/CR-6583 (ANL-97/18), “Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels,” March 1998.

4.8.30 NUREG/CR-5704 (ANL-98/31), “Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels,” April 1999.

4.8.31 U.S. NRC Safety Evaluation Report, “Safety Evaluation of the Proprietary EPRI Reports, “BWR Vessel and Internals Project, RAMA Fluence Methodology Manual (BWRVIP-114), “RAMA Fluence Methodology Benchmark Manual Evaluation of Regulatory Guide 1.190 Benchmark Problems (BWRVIP-115)”, “RAMA Fluence Methodology-Susquehanna Unit 2 Surveillance Capsule Fluence Evaluation for Cycles 1-5 (BWRVIP-117)”, and “RAMA Fluence Methodology Procedures Manual (BWRVIP-121)”, and “Hope Creek Flux Wire Dosimeter Activation Evaluation for Cycle 1 (TWE-PSE-001-R-001)”,(TAC NO. MB9765), May 13, 2005.

4.8.32 U.S. Nuclear Regulatory Commission, “Reactor Vessel Integrity Database Version 2.0.1,” September 7, 2000

4.8.33 BWRVIP-86-A, EPRI Report TR1003346, Updated BWR Integrated Surveillance Program (ISP) Implementation Plan, October 2002

4.8.34 BWRVIP-116, EPRI Report TR1007824, Integrated Surveillance Program (ISP) Implementation For License Renewal, July 2003

APPENDIX A FINAL SAFETY ANALYSIS REPORT SUPPLEMENT
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A.1 Introduction

The application for a renewed operating license is required by 10 CFR 54.21(d) to include a FSAR Supplement. This appendix, which includes the following sections, comprises the FSAR supplement:

- Section A.1.1 contains a listing of the aging management programs that correspond to NUREG-1801 Chapter XI programs, including the status of the programs at the time the License Renewal Application was submitted.
- Section A.1.2 contains a listing of the plant-specific aging management programs, including the status of the programs at the time the License Renewal Application was submitted.
- Section A.1.3 contains a listing of aging management programs that correspond to NUREG-1801 Chapter X programs associated with Time-Limited Aging Analyses, including the status of the programs at the time the License Renewal Application was submitted.
- Section A.1.4 contains a listing of the Time-Limited Aging Analyses summaries (TLAAs).
- Section A.1.5 contains a discussion of the Quality Assurance Program and Administrative Controls.
- Section A.2 contains a summarized description of the aging management programs.
- Section A.2.1 contains a summarized description of the NUREG-1801 Chapter XI programs for managing the effects of aging.
- Section A.2.2 contains a summarized description of the plant-specific programs for managing the effects of aging.
- Section A.3 contains a summarized description of the NUREG-1801 Chapter X programs that support the TLAAs.
- Section A.4 contains a summarized description of the TLAAs applicable to the period of extended operation.
- Section A.5 contains the License Renewal Commitment List.

The integrated plant assessment for license renewal identified new and existing aging management programs necessary to provide reasonable assurance that systems, structures, and components within the scope of license renewal will continue to perform their intended functions consistent with the Current Licensing Basis (CLB) for the period of extended operation. The period of extended operation is defined as 20 years from the unit's current operating license expiration date.

A.1.1 NUREG-1801 Chapter XI Aging Management Programs

The NUREG-1801 Chapter XI Aging Management Programs (AMPs) are described in the following sections. The AMPs are either consistent with generally accepted industry methods as discussed in NUREG-1801 or require enhancements.

The following list reflects the status of these programs at the time of the License Renewal Application (LRA) submittal. Commitments for program additions and enhancements are identified in the Appendix A.5 License Renewal Commitment List.

1. ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (Section A.2.1.1) [Existing]
2. Water Chemistry (Section A.2.1.2) [Existing]
3. Reactor Head Closure Studs (Section A.2.1.3) [Existing]
4. BWR Vessel ID Attachment Welds (Section A.2.1.4) [Existing]
5. BWR Feedwater Nozzle (Section A.2.1.5) [Existing]
6. BWR Control Rod Drive Return Line Nozzle (Section A.2.1.6) [Existing]
7. BWR Stress Corrosion Cracking (Section A.2.1.7) [Existing – Requires Enhancement]
8. BWR Penetrations (Section A.2.1.8) [Existing]
9. BWR Vessel Internals (Section A.2.1.9) [Existing]
10. Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) (Section A.2.1.10) [New]
11. Flow-Accelerated Corrosion (Section A.2.1.11) [Existing]
12. Bolting Integrity (Section A.2.1.12) [Existing – Requires Enhancement]
13. Open-Cycle Cooling Water System (Section A.2.1.13) [Existing]
14. Closed-Cycle Cooling Water System (Section A.2.1.14) [Existing – Requires Enhancement]
15. Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (Section A.2.1.15) [Existing – Requires Enhancement]
16. Compressed Air Monitoring (Section A.2.1.16) [Existing]

17. Fire Protection (Section A.2.1.17) [Existing – Requires Enhancement]

18. Fire Water System (Section A.2.1.18) [Existing – Requires Enhancement]

19. Aboveground Steel Tanks (Section A.2.1.19) [Existing – Requires Enhancement]

20. Fuel Oil Chemistry (Section A.2.1.20) [Existing – Requires Enhancement]

21. Reactor Vessel Surveillance (Section A.2.1.21) [Existing – Requires Enhancement]

22. One-Time Inspection (Section A.2.1.22) [New]

23. Selective Leaching of Materials (Section A.2.1.23) [New]

24. Buried Piping Inspection (Section A.2.1.24) [Existing – Requires Enhancement]

25. External Surfaces Monitoring (Section A.2.1.25) [New]

26. Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (Section A.2.1.26) [New]

27. Lubricating Oil Analysis (Section A.2.1.27) [Existing]

28. ASME Section XI, Subsection IWE (Section A.2.1.28) [Existing – Requires Enhancement]

29. ASME Section XI, Subsection IWF (Section A.2.1.29) [Existing]

30. 10 CFR Part 50, Appendix J (Section A.2.1.30) [Existing]

31. Masonry Wall Program (Section A.2.1.31) [Existing – Requires Enhancement]

32. Structures Monitoring Program (Section A.2.1.32) [Existing – Requires Enhancement]

33. RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants (Section A.2.1.33) [Existing – Requires Enhancement]

34. Protective Coating Monitoring and Maintenance Program (Section A.2.1.34) [Existing]

35. Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (Section A.2.1.35) [New]

36. Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits (Section A.2.1.36) [New]

37. Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (Section A.2.1.37) [New]

38. Metal Enclosed Bus (Section A.2.1.38) [New]

39. Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (Section A.2.1.39) [New]

A.1.2 Plant-Specific Aging Management Programs

The plant-specific aging management programs are described in the following sections. The following list reflects the status of these programs at the time of the License Renewal Application (LRA) submittal. Commitments for program additions and enhancements are identified in Appendix A.5 License Renewal Commitment List.

1. High Voltage Insulators (Section A.2.2.1) [New]

2. Periodic Inspection (Section A.2.2.2) [New]

3. Aboveground Non-Steel Tanks (Section A.2.2.3) [New]

4. Buried Non-Steel Piping Inspection (Section A.2.2.4) [Existing – Requires Enhancement]

5. Boral Monitoring Program (Section A.2.2.5) [Existing]

6. Small-Bore Class 1 Piping Inspection (Section A.2.2.6) [New]

A.1.3 NUREG-1801 Chapter X Aging Management Programs

The NUREG-1801 Chapter X Aging Management Programs (AMP) associated with Time-Limited Aging Analyses are described in the following sections. The AMPs are either consistent with generally accepted industry methods as discussed in NUREG-1801 Chapter X or require enhancements. The following list reflects the status of these programs at the time of the License Renewal Application (LRA) submittal. Commitments for program additions and enhancements are identified in Appendix A.5 License Renewal Commitment List.

1. Metal Fatigue of Reactor Coolant Pressure Boundary (Section A.3.1.1) [Existing – Requires Enhancement]

2. Environmental Qualification (EQ) of Electric Components (Section A.3.1.2) [Existing]

A.1.4 Time-Limited Aging Analyses

Summaries of the Time-Limited Aging Analyses applicable to the period of extended operation are included in the following sections:

1. Neutron Embrittlement of the Reactor Vessel and Internals (Section A.4.2)
2. Metal Fatigue of the Reactor Pressure Vessel, Internals, and Reactor Coolant Pressure Boundary Piping and Components (Section A.4.3)
3. Environmental Qualification of Electrical Equipment (EQ) (Section A.4.4)
4. Loss of Prestress in Concrete Containment Tendons (Section A.4.5)
5. Containment Liner Plate, Metal Containment, and Penetrations Fatigue Analyses (Section A.4.6)
6. Other Plant-Specific Time Limited Aging Analyses (Section A.4.7)

A.1.5 Quality Assurance Program and Administrative Controls

The Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Appendix A.2, “Quality Assurance For Aging Management Programs (Branch Technical Position IQMB-1)” of NUREG-1800. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls, and these elements are applicable to the safety-related and nonsafety-related systems, structures, and components (SSCs) that are subject to Aging Management Review (AMR). In many cases, existing activities were found adequate for managing aging effects during the period of extended operation.

A.2 Aging Management Programs

A.2.1 NUREG-1801 Chapter XI Aging Management Programs

This section provides summaries of the NUREG-1801 programs credited for managing the effects of aging.

A.2.1.1 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD

The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD aging management program is an existing program that consists of periodic volumetric and visual examinations of components for assessment, identification of signs of degradation, and establishment of corrective actions. The program includes inspections performed to manage cracking, loss of fracture toughness and loss of material in Class 1, 2, and 3 piping and components exposed to reactor coolant, steam and treated water environments. The inspections will be implemented in accordance with 10 CFR 50.55(a). These activities include inspections, and monitoring and trending of results to confirm that aging effects are managed.

A.2.1.2 Water Chemistry

The Water Chemistry aging management program is an existing program whose activities consist of monitoring and control of water chemistry to manage the aging of reactor vessel, reactor internals, piping, piping elements and piping components, heat exchangers and tanks that are exposed to treated water. The Water Chemistry aging management program keeps peak levels of various contaminants below system-specific limits based on industry-recognized guidelines of EPRI, BWR Vessel and Internals Project BWR Water Chemistry Guidelines for the prevention or mitigation of loss of material, reduction of heat transfer, reduction of neutron-absorbing capacity and cracking aging effects. In addition, the water chemistry program is also credited for mitigating loss of material and cracking for components exposed to sodium pentaborate, steam and reactor coolant environments. To mitigate aging effects on component surfaces the chemistry program is used to control water chemistry for impurities that accelerate corrosion.

A.2.1.3 Reactor Head Closure Studs

The Reactor Head Closure Studs program is an existing program that provides for condition monitoring and preventive activities to manage reactor head closure stud cracking, loss of material and coolant leakage. The program is implemented through station procedures based on the examination and inspection requirements specified in ASME Section XI, Table IWB-2500-1 and preventive measures described in NRC Regulatory Guide 1.65, “Materials and Inspection for Reactor Vessel Closure Studs.”

A.2.1.4 BWR Vessel ID Attachment Welds

The BWR Vessel ID Attachment Welds program is an existing aging management program that incorporates the inspection and evaluation recommendations of BWRVIP-48-A, as well as the water chemistry recommendations of BWRVIP-130. The program is implemented through station procedures that provide for mitigation of cracking through water chemistry and monitoring for cracking through in-vessel examinations of the reactor vessel internal attachment welds. Reactor vessel attachment weld inspections are implemented through station procedures that are part of in-service inspection and incorporate the requirements of ASME, Section XI.

A.2.1.5 BWR Feedwater Nozzle

The BWR Feedwater Nozzle aging management program is an existing program that manages the effects of cracking in the feedwater nozzles by enhanced inservice inspection (ISI) in accordance with the requirements of the American Society of Mechanical Engineers (ASME) Code, Section XI, Subsection IWB, Table IWB-2500-1 and the recommendations GE-NE-523-A71-0594-A, Rev. 1. Inspections of the feedwater nozzles are performed in accordance with the Hope Creek ISI Program Plan.

A.2.1.6 BWR Control Rod Drive Return Line Nozzle

The BWR Control Rod Drive Return Line Nozzle aging management program is an existing program that provides for condition monitoring of the N9 nozzle (originally intended to be used as the CRD Return Line Nozzle) for cracking through station ISI procedures based on the ASME Section XI requirements. Hope Creek has capped the N9 nozzle to mitigate fatigue cracking. The program performs Inservice Inspection (ISI) examinations to monitor the effects of cracking on the intended function of the N9 nozzle. ISI examinations include ultrasonic inspection of the nozzle inside radius section and nozzle-to-vessel weld. Future inspections of the inside radius of the N9 nozzle will be performed using EVT-1 in accordance with NRC accepted Code case N648-1, subject to the conditions specified in Regulatory Guide 1.147. Hope Creek also conducts UT examinations of the N9 nozzle-to-cap weld in accordance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) document BWRVIP-75-A as part of the BWR Stress Corrosion Cracking program. The inspection methods used in the program have been proven effective in detecting cracking in RPV nozzles. The frequency of the inspection program is adequate to prevent significant degradation before loss of the intended function of the N9 nozzle.

A.2.1.7 BWR Stress Corrosion Cracking

The BWR Stress Corrosion Cracking aging management program is an existing program that manages intergranular stress corrosion cracking (IGSCC) in coolant pressure boundary piping and piping components made of stainless steel (SS) and nickel based alloy components as delineated in NUREG-0313, Rev. 2, and Generic Letter (GL) 88-01 and its Supplement 1. The program includes preventive measures to mitigate IGSCC, and inspection and flaw evaluation to monitor IGSCC and its effects. The schedule and extent of the inspections are performed in accordance with the NRC staff-approved BWRVIP-75-A report. To reduce the effects of IGSCC Hope Creek has also applied mechanical stress improvement process (MSIP) to several reactor pressure vessel nozzle welds. Similarly, Hope Creek has implemented Hydrogen Water Chemistry (HWC) and Noble Metals Chemical Addition (NMCA) to mitigate the environment that promotes IGSCC.

The program will be enhanced to clarify that:

1. For the components within the scope of the BWR Stress Corrosion Cracking program, resistant materials will be used for new and replacement components. This includes low carbon stainless piping and stainless steel weld material limited to a maximum carbon content 0.035 wt. % and a minimum ferrite content of 7.5%.

This enhancement will be implemented prior to the period of extended operation.

A.2.1.8 BWR Penetrations

The BWR Penetrations aging management program is an existing program that manages the effects of cracking of reactor vessel instrumentation penetrations (nozzles) exposed to reactor coolant through water chemistry and inservice inspections. The scope of the program includes beltline instrumentation nozzles and other instrumentation nozzles; except for the Standby Liquid Control/core plate differential pressure (dP) nozzle and the jet pumps instrumentation nozzles, which are in the scope of program B.2.1.1, ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD. The BWR Penetrations aging management program incorporates the inspection and evaluation recommendations BWRVIP-49-A, “Instrument Penetration Inspection and Flaw Evaluation Guidelines,“ as well as the water chemistry recommendations of BWRVIP-130, “BWR Vessel and Internals Project BWR Water Chemistry Guidelines.”

BWRVIP-27-A addresses the Standby Liquid Control (SLC) system nozzle or housing. The guidelines of BWRVIP-27-A are applicable to plants in which the SLC system injects sodium pentaborate into the bottom head region of the vessel. The SLC system at Hope Creek injects pentaborate into the vessel through the core spray system, not through a bottom head penetration. As stated in the BWRVIP document the guidelines of BWRVIP-27-A do not apply to plants such as Hope Creek where SLC injects through the Core Spray piping. Plants that inject SLC through a bottom head penetration also used this penetration for the core plate differential pressure (dP) instrumentation. At Hope Creek inspections of the core plate dP penetration is implemented through station ISI procedures, which incorporate the requirements of ASME Section XI. The requirements of ASME Section XI are implemented in accordance with 10 CFR 50.55(a).

A.2.1.9 BWR Vessel Internals

The Hope Creek BWR Vessel Internals program is an existing program that manages the effects of cracking and loss of material of reactor pressure vessel internals through condition monitoring activities that consist of examinations implemented through station procedures consistent with the recommendations of the BWRVIP guidelines, as well as the requirements of ASME Section XI. The program also mitigates these aging effects through water chemistry activities that are implemented through station procedures that implement the guidelines of BWRVIP-130: "BWR Vessel and Internals Project BWR Water Chemistry Guidelines."

Hope Creek is committed to following the BWRVIP guidelines for managing reactor internal components. Inspections and evaluations of the Hope Creek reactor internal components are consistent with the current BWRVIP guidelines, which include but are not limited to the following BWRVIP reports:

- BWRVIP-18-A, BWR Core Spray Internals Inspection and Evaluation Flaw Guidelines.
- BWRVIP-25, BWR Core Plate Inspection and Flaw Evaluation Guidelines.
- BWRVIP-26-A, BWR Top Guide Inspection and Flaw Evaluation Guidelines.
- BWRVIP-38, BWR Shroud Support Inspection and Flaw Evaluation guidelines.
- BWRVIP 41, Jet Pump Assembly Inspection and flaw Evaluation Guidelines.
- BWRVIP-42-A LPCI Coupling Inspection and flaw Evaluation Guidelines.
- BWRVIP-47-A, BWR Lower Plenum Inspection and Flaw Evaluation Guidelines.
- BWRVIP-76, BWR Core Shroud Inspection and Flaw Evaluation Guidelines.
- BWRVIP-139, BWR Vessel and Internals Project Steam Dryer Inspection and Flaw Evaluation Guidelines.
- BWRVIP-180, BWR Vessel and Internals Project, Access Hole Cover Inspection and Flaw Evaluation Guidelines.
- BWRVIP-183, BWR Top guide Grid Beam Inspection and Flaw Evaluation Guidelines

A.2.1.10 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)

The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless steel (CASS) aging management program is a new program that will provide for aging management of CASS reactor internal components within the scope of license renewal. The program will include a component specific evaluation of the loss of fracture toughness in accordance with the specified criteria. For those components where loss of fracture toughness may affect function of the component, a supplemental inspection will be performed. This program will verify the integrity of the CASS components exposed to the high temperature and neutron fluence present in the reactor environment.

This new aging management program will be implemented prior to the period of extended operation.

A.2.1.11 Flow-Accelerated Corrosion

The Flow-Accelerated Corrosion (FAC) aging management program is an existing program based on EPRI guidelines in NSAC-202L, “Recommendations for an Effective Flow Accelerated Corrosion Program.” The program provides for predicting, detecting, and monitoring wall thinning in piping and fittings, valve bodies, and heat exchangers due to FAC. Analytical evaluations and periodic examinations of locations that are most susceptible to wall thinning due to FAC are used to predict the amount of wall thinning in pipes, fittings, and feedwater heater shells. Program activities include analyses to determine critical locations, baseline inspections to determine the extent of thinning at these critical locations, and follow-up inspections to confirm the predictions. Repairs and replacements are performed as necessary.

A.2.1.12 Bolting Integrity

The Bolting Integrity aging management program is an existing program that provides for condition monitoring of pressure retaining bolted joints within the scope of license renewal. The Bolting Integrity program incorporates NRC and industry recommendations delineated in NUREG-1339, “Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants,” EPRI TR-104213, “Bolted Joint Maintenance & Applications Guide,” and EPRI NP 5769, “Degradation and Failure of Bolting in Nuclear Power Plants,” as part of the comprehensive corporate component pressure retaining bolting program. The program provides for managing cracking, loss of material and loss of preload by performing visual inspections for pressure retaining bolted joint leakage in the following environments: air, air with steam or water leakage, raw water, soil, steam and treated water.

The Bolting Integrity aging management program will be enhanced to include:

1. In the following cases, bolting material should not be reused:

    a. Galvanized bolts and nuts,

    b. ASTM A490 bolts; and

c. Any bolt and nut tightened by the turn of nut method.

This enhancement will be implemented prior to the period of extended operation.

A.2.1.13 Open-Cycle Cooling Water System

The Open-Cycle Cooling Water System aging management program is an existing program that includes mitigative, performance-monitoring, and condition-monitoring activities to manage the internal corrosion of piping to minimize susceptibility of corrosion and to verify that corrosion has not exceeded acceptance limits. More than one type of aging management program is necessary to ultimately ensure that the aging effects are adequately managed and the intended function(s) are maintained for the extended period of operation. These activities provide assurance that cracking, material loss, and heat transfer reduction aging effects are maintained at acceptable levels for systems and components within the scope of license renewal. The GL 89-13 activities provide for management of aging effects in raw water cooling systems through tests and inspections per the guidelines of NRC Generic Letter 89-13. System and component testing, visual inspections, other non-destructive examination (e.g., RT-Radiographic Testing, UT-Ultrasonic Testing, and/or ECT-Eddy Current Testing), and sodium hypochlorite injection are conducted to ensure that aging effects are managed such that system and component intended functions and integrity are maintained. Major component types include pumps, piping, piping elements, piping components, heat exchangers and tanks.

The Open-Cycle Cooling Water System aging management program primarily consists of station GL 89-13 activities that include sodium hypochlorite injection, system testing, periodic inspections and non-destructive examination. The program includes surveillance and control techniques to manage aging effects caused by bio-fouling, corrosion, erosion, protective coating failures, and silting in the Service Water System components and on the systems, structures, and components supported by the Service Water System. Other activities include station maintenance inspections, component preventive maintenance (PM), plant surveillance testing, and inspections. These activities provide for management of loss of material (without credit for protective coatings) and heat transfer reduction (including fouling from biological, corrosion product, and external sources) aging effects where applicable in system components exposed to a raw water environment.

A.2.1.14 Closed-Cycle Cooling Water System

The Closed-Cycle Cooling Water System aging management program is an existing program that manages aging of piping, piping components, piping elements, and heat exchangers that are included in the scope of license renewal for stress corrosion cracking, loss of material and reduction of heat transfer and are exposed to a closed cooling water environment at Hope Creek. The Closed-Cycle Cooling Water System aging management program relies on preventive measures to minimize corrosion by maintaining inhibitors and by performing non-chemistry monitoring consisting of inspection and nondestructive examinations (NDEs) based on industry-recognized guidelines of EPRI 1007820 for closed-cycle cooling water systems. Station maintenance inspections and NDE provide condition monitoring of heat exchangers exposed to closed-cycle cooling water environments.

The following enhancements will be incorporated to the Closed-Cycle Cooling Water System program.

1. New recurring tasks will be established for enhancing the performance monitoring of the Closed Cycle Cooling Water System.

2. New recurring tasks will be established for enhancing the performance monitoring of the Chilled Water System.

3. A one-time inspection of selected Closed-Cycle Cooling Water program components in stagnant flow areas will be conducted to confirm the effectiveness of the Closed-Cycle Cooling Water program. These inspections will be performed prior to the period of extended operation.

4. A one-time inspection of selected Closed-Cycle Cooling Water program chemical mixing tanks and associated piping will be conducted to confirm the effectiveness of the Closed-Cycle Cooling Water program on the interior surfaces of the tanks and associated piping. These inspections will be performed prior to the period of extended operation.

5. The program will be enhanced such that the plant auxiliary building chilled water system, which is part of the Control Area Chilled Water System, will comply with the pure water control program in accordance with EPRI 1007820 prior to the period of extended operation.

6. A one-time inspection of selected Control Area Chilled Water System components, including the plant auxiliary building chilled water system, will be conducted to confirm the effectiveness of the Closed-Cycle Cooling Water program. These inspections will be performed prior to the period of extended operation.

These enhancements will be implemented prior to the period of extended operation. In addition, the one-time inspections will be performed prior to the period of extended operation.

A.2.1.15 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems aging management program is an existing program that is credited for managing aging effects of cranes and hoists in the scope of license renewal. Administrative controls ensure that only allowable loads are handled. Cranes and hoists structural components, including the bridge, the trolley, bolting, lifting devices, and the rail system are visually inspected periodically for loss of material. Bolting is also monitored for loss of preload by inspecting for missing, detached, or loosened bolts. The program relies on procurement controls and installation practices, defined in plant procedures, to ensure that only approved lubricants and proper torque are applied to bolting.

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will be enhanced to include:

1. The program will be enhanced to include visual inspection of structural components and structural bolts for loss of material due to general, pitting, and crevice corrosion and structural bolting for loss of preload due to self-loosening.

2. The program will be enhanced to require visual inspection of the rails in the rail system for loss of material due to wear.

3. The acceptance criteria will be enhanced to require evaluation of significant loss of material due to corrosion for structural components and structural bolts, and significant loss of material due to wear of rail in the rail system.

These enhancements will be implemented prior to the period of extended operation.

A.2.1.16 Compressed Air Monitoring

The Compressed Air Monitoring aging management program is an existing program that manages piping, piping components, and piping elements, compressor housings, and tanks for loss of material due to general, pitting and crevice corrosion in the compressed air systems. The Compressed Air Monitoring aging management activities consist of preventive maintenance and condition-monitoring measures to manage the aging effects.

A.2.1.17 Fire Protection

The Fire Protection aging management program is an existing program that includes a fire barrier inspection, diesel-driven fire pump inspection and Halon and carbon dioxide systems inspections and functional tests. These inspections and functional tests provide assurance that the fire protection components within the scope of license renewal are maintained operational. The fire protection components are comprised of piping, piping elements, piping components, doors, dampers and fire barriers. The Fire Protection program provides for visual inspections of fire barrier penetration seals for signs of degradation such as change in material properties, loss of materials, cracking, and hardening, through periodic inspection and functional testing. These components within the scope of license renewal are maintained in accordance to the guidance contained within the NFPA Codes and Standards. The fire barrier inspections require periodic visual inspections of fire barrier penetration seals, fire barrier walls, ceilings, and floors, and periodic visual inspection. Functional testing and inspections of the fire rated doors and dampers is performed to ensure that their operability is maintained. The program includes surveillance tests of fuel oil systems for the diesel-driven fire pumps to ensure that the fuel supply lines can perform their intended functions. The program also includes visual inspections and periodic operability tests of Halon and carbon dioxide fire suppression systems using the NFPA Codes and Standards for guidance.

The Fire Protection aging management program will be enhanced to include:

1. The Hope Creek routine inspection procedures will be enhanced to provide additional inspection guidance to identify degradation of fire barrier walls, ceilings, and floors for aging effects such as cracking, spalling and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates.

2. The Hope Creek fire pump supply line functional tests will be enhanced to provide specific guidance for examining exposed external surfaces of the fire pump diesel fuel oil supply line for corrosion during pump tests.

These enhancements will be implemented prior to the period of extended operation.

A.2.1.18 Fire Water System

The Fire Water System aging management program is an existing program that provides for system pressure monitoring, fire system header flushing and flow testing, pump performance testing, hydrant flushing, and visual inspection activities. System flow tests measure hydraulic resistance and compare results with previous testing, as a means of evaluating the internal piping conditions. Major component types include piping and fittings, heat exchangers, tanks and pumps. Monitoring system piping flow characteristics ensures that signs of loss of material will be detected in a timely manner. Pump performance tests, hydrant flushing and system inspections are based on guidance from the applicable NFPA standards. Fire system main header flow tests, sprinkler system inspections, visual yard hydrant inspections, fire hydrant hose inspections, hydrostatic tests, gasket inspections, volumetric inspections, and fire hydrant flow tests and pump capacity tests are performed periodically to assure that the aging effect of loss of material due to corrosion, microbiologically influenced corrosion (MIC), or biofouling are managed such that the system intended functions are maintained.

The Fire Water System program will be enhanced as follows:

1. The Fire Water System aging management program will be enhanced to inspect selected portions of the water based fire protection system piping located aboveground and exposed to the fire water internal environment by non-intrusive volumetric examinations. These inspections shall be performed prior to the period of extended operation and will be performed every 10 years thereafter.

2. The Fire Water System aging management program will be enhanced to replace or perform 50-year sprinkler head inspections and testing using the guidance of NFPA-25 “Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems” (2002 Edition), Section 5-3.1.1. These inspections will be performed prior to the 50-year in-service date and every 10-years thereafter.

These enhancements will be implemented prior to the period of extended operation, with the inspections and testing performed in accordance with the schedule described above.

A.2.1.19 Aboveground Steel Tanks

The Aboveground Steel Tanks aging management program is an existing program that will manage loss of material aging effects of outdoor carbon steel tanks (Fire Water Storage Tanks, Fire Diesel Fuel Oil Tank and 17-Ton CO_2 Storage Tank). Paint is a corrosion preventive measure, and periodic visual inspections will monitor degradation of the paint and any resulting metal degradation of carbon steel tanks.

The Aboveground Steel Tanks program will be enhanced as follows:

1. The program will be enhanced to include internal UT measurements to measure the wall thickness on the bottom of the tanks supported on a fiber pad on top of the concrete foundation (Fire Water Storage Tanks). Measured wall thickness will be monitored and trended if significant material loss is detected. These thickness measurements of the tank bottom will be taken and evaluated against design thickness and corrosion allowance to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period of operation.

2. The program will be enhanced to provide routine visual inspections of the carbon steel tanks external surfaces (Fire Water Storage Tanks, Fire Diesel Fuel Oil Tank and17-Ton CO_2 Storage Tank), including removal of tank insulation from the Fire Water Storage Tank to detect degradation. These inspections will be performed to detect degraded paint and coatings, and any resulting metal degradation, prior to loss of the tank intended function.

These enhancements will be implemented prior to the period of extended operation. Tank bottom UT inspections will also be performed prior to the period of extended operation.

A.2.1.20 Fuel Oil Chemistry

The Fuel Oil Chemistry aging management program is an existing program that includes preventive activities to provide assurance that contaminants are maintained at acceptable levels in fuel oil for systems and components within the scope of License Renewal, to prevent loss of material. The fuel oil tanks within the scope of License Renewal are maintained by monitoring and controlling fuel oil contaminants in accordance with the guidelines of the American Society for Testing and Materials (ASTM). Fuel oil sampling and analysis is performed in accordance with approved procedures for new fuel oil and stored fuel oil. Fuel oil tanks are periodically drained of accumulated water and sediment, cleaned, and internally inspected. These activities effectively manage the effects of aging by providing reasonable assurance that potentially harmful contaminants are maintained at low concentrations.

The Fuel Oil Chemistry aging management program will be enhanced to include:

1. Equivalent requirements for fuel oil purity and fuel oil testing as described by the Standard Technical Specifications.

2. Addition of biocides, stabilizers and inhibitors as determined by fuel oil sampling or inspection activities.

3. Internal inspection of the Diesel Fire Pump Fuel Oil 280-gallon tank (T-565) using visual inspections and ultrasonic thickness examination of tank bottom.

4. Quarterly water and sediment multilevel sampling on the Diesel Fuel Oil Storage 26,500-gallon Tanks (1A-T-403, 1B-T-403, 1C-T-403, 1D-T-403, 1E-T-403, 1F-T-403, 1G-T-403, 1H-T-403) in accordance with ASTM Standard D 2709.

5. Internal inspection of the Diesel Fuel Oil Storage 26,500-gallon Tanks (1A-T-403, 1B-T-403, 1C-T-403, 1D-T-403, 1E-T-403, 1F-T-403, 1G-T-403, 1H-T-403) using visual inspections and ultrasonic thickness examination of tank bottoms.

6. Quarterly particulate sampling of the Diesel Fire Pump Fuel Oil tank (T-565) in accordance with modified ASTM 2276-00, Method A.

7. To confirm the absence of any significant aging effects, a one-time inspection of each of the 550-gallon Diesel Fuel Oil Day Tanks will be performed.

These enhancements will be implemented prior to the period of extended operation. In addition, the one-time inspections will be performed prior to the period of extended operation.

A.2.1.21 Reactor Vessel Surveillance

The Reactor Vessel Surveillance Program is an existing program that manages the loss of fracture toughness due to neutron irradiation embrittlement of the reactor vessel beltline materials. The program meets the requirements of 10 CFR 50, Appendix H. The program evaluates neutron embrittlement by projecting Upper Shelf Energy (USE) for reactor materials and impact on Adjusted Reference Temperature for the development of pressure-temperature limit curves. Embrittlement evaluations are performed in accordance with Regulatory Guide 1.99, Rev.2. The Hope Creek Reactor Vessel Surveillance Program is also part of the BWRVIP Integrated Surveillance Program (ISP) described in BWRVIP-86-A and BWRVIP-116, and approved by the NRC staff. The schedule for removing surveillance capsules is in accordance with the timetable specified in BWRVIP-86-A for the current operating term and in accordance with BWRVIP-116 for the period of extended operation.

Hope Creek is a host plant for the ISP and will remove one capsule in the current operating term as part of the ISP schedule. Hope Creek will also participate in the ISP during the period of extended operation [designated as the ISP(E)]. As described in BWRIP-116, Hope Creek's third and last capsule will be removed during the period of extended operation for testing as part of the ISP(E). If the capsule is withdrawn for some other reason, it will be stored in a manner that maintains it in a condition that would permit its future use.

The program monitors plant operating conditions to ensure appropriate steps are taken if reactor vessel exposure conditions are altered; such as the review and updating of 60-year fluence projections to support upper shelf energy calculations and pressure-temperature limit curves. The program also includes condition monitoring by removal and analysis of surveillance capsules as part of the BWRVIP ISP. These measures are effective in detecting the extent of embrittlement to prevent significant degradation of the reactor pressure vessel during the period of extended operation.

The Reactor Vessel Surveillance Program will be enhanced to include:

1. Hope Creek will implement the requirements of BWRVIP-116, "BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal," including the conditions specified by the NRC in its Safety Evaluation dated February 24, 2006.

2. If future plant operations exceed the limitations specified in RG 1.99, the impact of plant operation changes on the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified. Similarly, if future plant operation exceeds the bounds established by surveillance data that are to determine Upper Shelf Energy or P-T limits, then the impact of plant operation changes on the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified. Additionally, when all the surveillance capsules are removed, then operating restrictions will be established to ensure that the plant is operated within the conditions to which the surveillance capsules were exposed. If the reactor vessel exposure conditions (neutron flux, spectrum, irradiation temperature, etc.) are altered, then the basis for the projection to 60 years is reviewed; and, if deemed appropriate, a revised fluence projection is prepared and the effects of the revised fluence analysis on neutron embrittlement calculations will be evaluated. If necessary, an active surveillance program will be re-instituted for Hope Creek. The employment of additional surveillance specimens will be coordinated through the BWRVIP Integrated Surveillance Program (ISP). Any changes to the reactor vessel exposure conditions and the potential need to re-institute a vessel surveillance program will be discussed with the NRC staff prior to changing the plant's licensing basis.

These enhancements will be implemented prior to the period of extended operation.

A.2.1.22 One-Time Inspection

The One-Time Inspection aging management program is a new program that will provide reasonable assurance that an aging effect is not occurring, or that the aging effect is occurring slowly enough to not affect a component intended function during the period of extended operation, and therefore will not require additional aging management. The program will be credited for cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out, (b) an aging effect is expected to progress very slowly in the specified environment, but the local environment may be more adverse than that generally expected, or (c) the characteristics of the aging effect include a long incubation period. Major component types covered by the program include piping, piping elements and piping components, reactor vessel and nozzles, heat exchangers and tanks.

The One-Time Inspection aging management program will be used for the following:

1. To confirm the effectiveness of the Water Chemistry program to manage the loss of material, cracking, and the reduction of heat transfer aging effects for aluminum, copper alloy, ductile cast iron, gray cast iron, nickel alloy, steel, stainless steel and cast austenitic stainless steel in treated water, steam, sodium pentaborate, and reactor coolant environments.

2. To confirm the effectiveness of the Fuel Oil Chemistry program to manage the loss of material aging effect for copper alloy, steel, galvanized steel and stainless steel in a fuel oil environment.

3. To confirm the effectiveness of the Lubricating Oil Analysis program to manage the loss of material and the reduction of heat transfer aging effects for copper alloy, gray cast iron, steel and stainless steel in a lubricating oil environment.

4. To confirm loss of material in carbon steel piping and fittings is insignificant in an air/gas-wetted (internal) environment.

Inspection methods will include visual examination or volumetric examinations. Acceptance criteria are in accordance with industry guidelines, codes, and standards, including the applicable edition of ASME Boiler and Pressure Vessel Code, Section XI. The One-Time Inspection program provides for the evaluation of the need for follow-up examinations to monitor the progression of aging if age-related degradation is found that could jeopardize an intended function before the end of the period of extended operation. Should aging effects be detected, the program triggers actions to characterize the nature and extent of the aging effect and determines what subsequent monitoring is needed to ensure intended functions are maintained during the period of extended operation.

The new program, including performance of physical inspections and evaluation of results, will be implemented prior to the period of extended operation to manage the effects of aging for selected components within the scope of license renewal.

A.2.1.23 Selective Leaching of Materials

The Selective Leaching of Materials aging program is a new program that will include one-time inspections of a representative sample of susceptible components to determine if loss of material due to selective leaching is occurring. Components include valve bodies, heat exchanger components, pump casings, piping and fittings, strainer bodies, and tanks. One-time inspections will include visual examinations, supplemented by hardness tests, and other examinations, as required. If selective leaching is found, the condition will be evaluated to determine the need to expand inspection scope.

These one-time inspections will be performed in the last 10 years of the current term, prior to entering the period of extended operation.

A.2.1.24 Buried Piping Inspection

The Buried Piping Inspection aging management program is an existing program that manages the external surface aging effects of loss of material for piping and components in a soil (external) environment. The Hope Creek buried component activities consist of preventive and condition-monitoring measures to manage, detect and monitor the loss of material due to external corrosion for piping and components in the scope of license renewal that are in a soil (external) environment.

External inspections of buried components will occur opportunistically when they are excavated during maintenance. The Buried Piping Inspection aging management program will be enhanced to include:

1. At least one opportunistic or focused excavation and inspection of carbon steel, galvanized steel, ductile cast iron and gray cast iron piping and components within ten years prior to entering the period of extended operation. Also, upon entering the period of extended operation, a focused inspection of each of the above materials shall be performed within the first ten years, unless an opportunistic inspection occurs within this ten-year period.

This enhancement will be implemented prior to the period of extended operation, with the inspections performed in accordance with the schedule described above.

A.2.1.25 External Surfaces Monitoring

The External Surfaces Monitoring aging management program is a new program that directs visual inspections that are performed during system walkdowns. The program consists of periodic visual inspection of components such as piping, piping components, ducting, and other components within the scope of license renewal. The program manages aging effects through visual inspection of external surfaces for evidence of loss of material. The external surfaces of components that are buried are inspected via the Buried Piping Inspection and Buried Non-Steel Piping Inspection programs. The external surfaces of above ground tanks are inspected via the Aboveground Steel Tanks and Aboveground Non-Steel Tanks programs.

This new aging management program will be implemented prior to the period of extended operation.

A.2.1.26 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components aging management program is a new program that manages the aging of the internal surfaces of steel piping, piping components and piping elements, tanks and ducting components. This program will manage the aging effect of loss of material. The program includes provisions for visual inspections of the internal surfaces of components not managed under other aging management programs. Identified deficiencies due to age related degradation are evaluated under the Corrective Action Program.

This new aging management program will be implemented prior to the period of extended operation.

A.2.1.27 Lubricating Oil Analysis

The Lubricating Oil Analysis aging management program is an existing program that provides oil condition monitoring activities to manage the loss of material and the reduction of heat transfer in piping, piping components, piping elements, heat exchangers, and tanks within the scope of license renewal exposed to a lubricating oil environment. Sampling, analysis, and condition monitoring activities identify specific wear products and contamination and determine the physical properties of lubricating oil within operating machinery. These activities are used to verify that the wear product and contamination levels and the physical properties of lubricating oil are maintained within acceptable limits to ensure that intended functions are maintained.

A.2.1.28 ASME Section XI, Subsection IWE

The ASME Section XI, Subsection IWE aging management program is an existing program based on ASME Code and complies with the provisions of 10 CFR 50.55a. The program consists of periodic inspection of the primary containment surfaces and components, including its integral attachments, penetration sleeves, pressure retaining bolting, personnel airlock and equipment hatches, and other pressure retaining components for loss of material, loss of preload, and fretting or lockup.

Examination methods include visual and volumetric testing as required by ASME Section XI, Subsection IWE. Observed conditions that have the potential for impacting an intended function are evaluated for acceptability in accordance with ASME requirements or corrected in accordance with corrective action process.

The program will be enhanced to include:

1. Install an internal moisture barrier at the junction of the drywell concrete floor and the steel drywell shell prior to the period of extended operation.

2. Revise the Hope Creek ASME Section XI, Subsection IWE implementing documents to require inspection of the moisture barrier for loss of sealing in accordance with IWE 2500, after it is installed. The original design for Hope Creek did not require an internal moisture barrier at the junction of the drywell concrete floor and steel drywell shell.

3. Verify that the reactor cavity seal rupture drain lines are clear from blockage once prior to the period of extended operation, and one additional time during the first 10 years of the period of extended operation.

4. Verify that drains at the bottom of the drywell air gap are clear from blockage once prior to the period of extended operation, and one additional time during the first 10 years of the period of extended operation.

5. Investigate the source of any leakage detected by the reactor cavity seal rupture drain line instrumentation and assess its impact on the drywell shell.

6. Monitor the drains at the bottom of the drywell air gap for leakage in the event leakage is detected by the reactor cavity seal rupture drain line instrumentation.

These enhancements will be implemented prior to the period of extended operation, with the inspections performed in accordance with the schedule described above.

A.2.1.29 ASME Section XI, Subsection IWF

The ASME Section XI, Subsection IWF aging management program is an existing program that consists of periodic visual examinations of ASME Class 1, 2, 3, and MC piping and component supports for identification of signs of degradation such as loss of material, loss of mechanical function and loss of pre-load. The inspections are in accordance with American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code, Section XI, Subsection IWF as approved in 10 CFR 50.55(a). The program activities are relied upon to detect and confirm that aging effects of ASME Class 1, 2, 3, and MC piping and component supports are adequately managed.

A.2.1.30 10 CFR Part 50, Appendix J

The 10 CFR Part 50, Appendix J aging management program is an existing program that monitors leakage rates through the containment pressure boundary, including penetrations, fittings and other access openings, in order to detect age related degradation of the containment pressure boundary. Corrective actions are taken if leakage rates exceed acceptance criteria. The Primary Containment Leakage Rate Testing Program (LRT) provides for aging management of pressure boundary degradation due to aging effects from the loss of leakage tightness, loss of sealing, loss of material, cracking, or loss of preload in various systems penetrating containment. The 10 CFR Part 50 Appendix J program also detects age related degradation in material properties of gaskets, o-rings and packing materials for the containment pressure boundary access points. Consistent with the current licensing basis, the containment leakage rate tests are performed in accordance with the regulations and guidance provided in 10 CFR Part 50 Appendix J Option B, Regulatory Guide 1.163, “Performance-Based Containment Leak-Testing Program,” NEI 94-01 “Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50 Appendix J”, and ANSI/ANS 56.8, “Containment System Leakage Testing Requirements.”

A.2.1.31 Masonry Wall Program

The Masonry Wall aging management program is an existing program implemented as part of the Structures Monitoring Program. The Masonry Wall Program was developed to meet the regulatory requirements of 10 CFR 50.65, Maintenance Rule, USNRC Regulatory Guide 1.160, and NUMARC 93-01, Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants. Hope Creek has no safety-related masonry walls or masonry walls whose failure during a seismic event could adversely impact a safety-related function. As a result, NRC IE Bulletin 80-11, “Masonry Wall Design”, does not apply to Hope Creek. The Masonry Wall aging management program addresses loss of material, and cracking due to age-related degradation of concrete for masonry walls. The program relies on periodic visual inspections to monitor and maintain the condition of masonry walls within the scope of license renewal.

The Masonry Wall Program will be enhanced as follows:

1. Add buildings, and masonry walls that have been determined to be in the scope of license renewal.
    a. Auxiliary Boiler Building
    b. Fire Water Pump House
    c. Masonry Wall Fire Barriers
    d. Switchyard
    e. Turbine Building
2. Add an Examination Checklist for masonry wall inspection requirements.
3. Specify an inspection frequency of not greater than 5 years for masonry walls.

These enhancements will be implemented prior to the period of extended operation.

A.2.1.32 Structures Monitoring Program

The Structures Monitoring aging management program is an existing program that was developed to implement the requirements of 10 CFR 50.65 and is based on NUMARC 93-01, “Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” Rev. 2, and Regulatory Guide 1.160, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” Rev. 2. The program includes the Masonry Wall Program and the RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants aging management program.

The program relies on periodic visual inspections to monitor the condition of structures and structural components, structural bolting, component supports, masonry block walls, and water control structures. The inspections are conducted on a frequency not greater than 5 years.

The Structures Monitoring Program will be enhanced to include:

1. The scope of the program will be enhanced to include the following structures and components:
   a. Auxiliary Boiler Building
   b. Fire Water Pump House
   c. Shoreline Protection Dike, and Sheet piles (Reg. Guide 1.127)
   d. Switchyard
   e. Turbine Building
   f. Transmission towers
   g. Yard Structures (Foundations for fire water tanks, manholes, transformer foundations credited for SBO)
   h. Masonry walls, including fire barriers
   i. Building penetrations that perform flood barrier, pressure boundary, shelter and protection intended functions
   j. Miscellaneous steel (catwalks, vents, louvers, platforms, etc.)
   k. Pipe whip restraints, jet impingement and missile shields
   l. Ice barrier, trash rack (Reg. Guide 1.127)
   m. Panels, racks, cabinets, and other enclosures
   n. Metal-enclosed bus
   o. Components supports including, electrical cable trays, electrical conduit, tubing, HVAC ducts, instrument racks, battery racks, and supports for piping and components that are not within the scope of ASME Section XI, Subsection IWF
   p. Duct banks that contain safety-related cables, and cables credited for SBO or ATWS

2. Concrete structures will be observed for a reduction in equipment anchor capacity due to local concrete degradation. This will be accomplished by visual inspection of concrete surfaces around anchors for cracking and spalling.

3. Clarify that inspections are performed for loss of material due to corrosion and pitting of additional steel components, such as embedments, panels and enclosures, doors, siding, metal deck, and anchors.

4. Perform a one-time inspection of the external stainless steel surfaces of the expansion bellows at Condensate Storage Tank Dike for loss of material due to corrosion, within the ten-year period prior to the period of extended operation.

5. Require inspection of penetration seals, structural seals, and elastomers, for degradations that will lead to a loss of sealing by visual inspection of the seal for hardening, shrinkage and loss of strength.

6. Require monitoring of vibration isolators, associated with component supports other than those covered by ASME XI, Subsection IWF.

7. Add an Examination Checklist for masonry wall inspection requirements.

8. Parameters monitored for wooden components will be enhanced to include: change in material properties, loss of material due to insect damage and moisture damage.

9. Specify an inspection frequency of not greater than 5 years for structures including submerged portions of the Service Water Intake Structure.

10. Require individuals responsible for inspections and assessments for structures to have a B.S. Engineering degree and/or Professional Engineer license, and a minimum of four years experience working on building structures.

11. Perform periodic sampling, testing, and analysis of ground water chemistry for pH, chlorides, and sulfates on a frequency of 5 years.

12. Require supplemental inspections of the in scope structures within 30 days following extreme environmental or natural phenomena (large floods, significant earthquakes, hurricanes, and tornadoes).

13. Perform a chemical analysis of ground or surface water in-leakage when there is significant in-leakage or there is reason to believe that the in-leakage may be damaging concrete elements or reinforcing steel.

14. Implementing procedures will be enhanced to include additional acceptance criteria details specified in ACI 349.3R-96.

These enhancements will be implemented prior to the period of extended operation. The one-time inspection in enhancement 4 will be performed within the ten-year period prior to the period of extended operation.

A.2.1.33 RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants

The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants is implemented through the Structures Monitoring Program. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program is an existing program that will be enhanced to require inspection of water control structures and components that are in scope for license renewal. These structures include the Service Water Intake Structure and Shoreline Protection and Dike structures. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants aging management program addresses age-related deterioration, degradation due to extreme environmental conditions, and the effects of natural phenomena that may affect the safety function of the water control structures. The program will be used to manage loss of material, cracking, and change in material properties for concrete components, loss of material and loss of preload for steel and metal components, and loss of material and loss of form for earthen water control structures. Elements of the program are designed to detect degradations and take corrective actions to prevent a loss of an intended function.

The RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants Program will be enhanced to include:

1. Shoreline Protection and Dike structures will be added to the program.

2. Parameters monitored for wooden components will be enhanced to include change in material properties and loss of material due to insect damage and moisture damage.

3. The inspection requirement for submerged concrete structural components will be enhanced to require that inspections be performed by dewatering a pump bay or by a diver if the pump bay is not dewatered.

4. Specify an inspection frequency of not greater than 5 years for structures including submerged portions of the Service Water Intake Structure.

5. Require supplemental inspections of the in scope structures within 30 days following extreme environmental or natural phenomena (large floods, significant earthquakes, hurricanes, and tornadoes).

These enhancements will be implemented prior to the period of extended operation.

A.2.1.34 Protective Coating Monitoring and Maintenance Program

The Protective Coating Monitoring and Maintenance Program is an existing program that provides for aging management of Service Level 1 coatings inside the drywell and torus. Service Level 1 coatings are used in areas where coating failure could adversely affect the operation of post-accident fluid systems and thereby impair safe shutdown. The Protective Coating Monitoring and Maintenance Program provides for inspections, assessments, and repairs for any condition that adversely affects the ability of Service Level 1 coatings to function as intended.

A.2.1.35 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements aging management program is a new program that will be used to manage aging of non-EQ cables and connections during the period of extended operation. A representative sample of accessible cables and connections located in adverse localized environments will be visually inspected at least once every 10 years for indications of accelerated insulation aging such as embrittlement, discoloration, cracking, swelling, or surface contamination. An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service environment for the cable or connection.

This new aging management program, including performance of initial inspections, will be implemented prior to the period of extended operation.

A.2.1.36 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits aging management program is a new program that will be implemented to manage the aging of the cable and connection insulation of the in-scope portions of the Leak Detection and Radiation Monitoring System, and the Neutron Monitoring System. This program applies to sensitive instrumentation cable and connection circuits with low-level signals that are in scope for license renewal and are located in areas where the cables and connections could be exposed to adverse localized environments caused by heat, radiation, or moisture. These adverse localized environments can result in reduced insulation resistance causing increases in leakage currents.

Calibration results and findings of surveillance programs will be assessed for cable aging degradation prior to the period of extended operation and at least once every 10 years afterwards for the in-scope portions of the Leak Detection and Radiation Monitoring System. Cable testing results will be assessed for cable aging degradation prior to the period of extended operation and at least once every 10 years afterwards for the in-scope portions of the Neutron Monitoring System.

This new program will be implemented prior to the period of extended operation.

A.2.1.37 Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements aging management program is a new program that will be used to manage the aging effects and mechanisms of non-EQ, in scope inaccessible medium voltage cables. These cables may at times be exposed to significant moisture simultaneously with significant voltage. The Hope Creek cables in the scope of this aging management program will be tested using a proven test for detecting deterioration of the insulation system due to wetting, that is state-of-the-art at the time the test is performed. The cables will be tested at least once every 10 years, and the first tests will be completed prior to the period of the extended operation.

Manholes and cable vaults associated with the cables included in this aging management program will be inspected for water collection. The frequency of inspections for accumulated water and subsequent pumping will be adjusted based on inspection results. The objective of the inspections, as a preventive action, is to keep the cables infrequently submerged, thereby minimizing their exposure to significant moisture. This approach to determining inspection frequency recognizes that a recurring inspection, set at the optimum frequency, would result in the cables being submerged only as a result of event driven, rain and drain, type occurrences. As a limit on the amount of time between inspections, the maximum time between inspections will be no more than 2 years.

This new program will be implemented prior to the period of extended operation. In addition, the first tests and inspections will be completed prior to the period of extended operation.

A.2.1.38 Metal Enclosed Bus

The Metal Enclosed Bus aging management program is a new condition monitoring program that will manage the aging of in-scope metal enclosed busses at Hope Creek.

The internal portions of the in-scope metal enclosed bus enclosures will be visually inspected for cracks, corrosion, foreign debris, excessive dust build-up and evidence of moisture intrusion. The bus insulation will be visually inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. The internal bus supports will be visually inspected for structural integrity and signs of cracks. Bolted connections are not accessible, but will be checked (sampled) for loose connection using thermography from outside the metal enclosed bus.

Metal enclosed busses are to be free from unacceptable visual indications of surface anomalies, which suggest that conductor insulation degradation exists. In addition no unacceptable indication of corrosion, cracks, foreign debris, excessive dust buildup or evidence of moisture intrusion is to exist. An unacceptable indication is defined as a noted condition or situation that, if left unmanaged, could lead to a loss of intended function. Thermography results will be confirmed to be within the acceptance criteria of administrative program procedures.

This new aging management program will be implemented prior to the period of extended operation. In addition, the first inspections will be completed prior to the period of extended operation and every 10-years thereafter.

A.2.1.39 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

The Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is a new program that will be used to confirm the absence of an aging effect with respect to electrical cable connection stressors. A representative sample of non-EQ electrical cable connections will be selected for one-time testing considering application (medium and low voltage), circuit loading (high loading) and location, with respect to connection stressors. The technical basis for the sample selected will be documented. The specific type of test performed will be a proven test for detecting loose connections, such as thermography or contact resistance measurement, as appropriate to the application.

This aging management program will be implemented and the one-time tests will be completed prior to the period of extended operation.

A.2.2 Plant-Specific Aging Management Programs

This section provides summaries of the plant-specific programs credited for managing the effects of aging.

A.2.2.1 High Voltage Insulators

The High Voltage Insulators program is a new program that manages the degradation of insulator quality due to the presence of salt deposits or surface contamination. This aging effect will be identified through visual inspections of the external surfaces of the high voltage insulators. The visual inspections will be performed on a twice per year frequency.

This new aging management program will be implemented prior to the period of extended operation.

A.2.2.2 Periodic Inspection

The Periodic Inspection aging management program is a new condition-monitoring program that manages the aging of piping, piping components, piping elements, ducting components, tanks and heat exchanger components. This program will manage the aging effects of loss of material, cracking, reduction of heat transfer and hardening and loss of strength. The program includes provisions for visual inspections of stainless steel, aluminum, copper alloy and elastomer components not managed under other aging management programs. The program also includes provisions for ultrasonic wall thickness measurements to detect loss of material. Identified deficiencies due to age related degradation are evaluated under the corrective action program.

This new aging management program will be implemented prior to the period of extended operation.

A.2.2.3 Aboveground Non-Steel Tanks

The Aboveground Non-Steel Tanks aging management program is a new program that will manage loss of material of outdoor non-steel tanks in the scope of license renewal. The tank within the scope of this program is the stainless steel condensate storage tank. Periodic visual inspections will monitor for degradation of the tank external surface. Periodic visual inspections will also monitor for degradation of the seal at the interface between the tank bottom and the concrete foundation.

The Aboveground Non-Steel Tanks program will include a UT wall thickness inspection of the bottom of the tank. The UT measurements will be taken to ensure that significant degradation is not occurring and that the component intended function will be maintained during the extended period of operation.

This new program will be implemented prior to the period of extended operation. Tank bottom UT inspections will also be performed prior to the period of extended operation.

A.2.2.4 Buried Non-Steel Piping Inspection

The Buried Non-Steel Piping Inspection aging management program is an existing condition monitoring program that manages the buried reinforced concrete piping and components in the Service Water System that are exposed to an external soil or groundwater environment for cracking, loss of bond, increase in porosity and permeability and loss of material. These aging effects will be identified through visual inspections of the external surfaces of the piping and components.

The Buried Non-Steel Piping Inspection aging management program also inspects the buried stainless steel piping and components in the Condensate Storage and Transfer System and the Fire Protection System for loss of material. These aging effects will be identified through visual inspections of the external surfaces of the piping and components. The Buried Non-Steel Piping Inspection will be enhanced to include:

1. At least one opportunistic or focused excavation and inspection of buried reinforced concrete piping and components will be performed within ten years prior to entering the period of extended operation. Upon entering the period of extended operation at least one focused excavation and inspection of buried reinforced concrete piping and components will be performed within the first ten years, unless an opportunistic excavation and inspection occurs within this ten year period.

2. At least one opportunistic or focused excavation and inspection of buried stainless steel piping and components will be performed within ten years prior to entering the period of extended operation. Upon entering the period of extended operation, at least one focused excavation and inspection of buried stainless steel piping and components will be performed within the first ten years, unless an opportunistic excavation and inspection occurs within this ten year period.

3. Guidance for inspection of concrete aging effects.

These enhancements will be implemented prior to the period of extended operation, with the inspections performed in accordance with the schedule described above.

A.2.2.5 Boral Monitoring Program

The Boral Monitoring Program is an existing program that monitors the Boral test coupon inspection and/or testing results at other boiling water reactor (BWR) sites. If these results indicate a problem with Boral neutron absorbing material potentially affecting its intended function (i.e., absorb neutrons), Hope Creek will initiate inspection and/or testing of its Boral test coupons in the Hope Creek spent fuel pool (SFP).

A.2.2.6 Small-Bore Class 1 Piping Inspection

The Small-Bore Class 1 Piping Inspection program is a new program that will manage the aging effect of cracking in small-bore (greater than or equal to NPS 1 and less than NPS 4) Class 1 piping through the use of a combination of volumetric examinations and visual inspections. This new program is comprised of the existing ASME Section XI ISI (Risk Informed Inservice Inspection, RI-ISI) program that performs volumetric and visual examinations for selected Class 1 small-bore butt welds and other selected small-bore socket welds, and a 100% inspection of all accessible Class 1 socket welds in the recirculation system using volumetric or other industry approved techniques. The RI-ISI program provides a robust inspection selection process and is based upon the susceptibility to degradation and the consequences of a piping failure, which is founded on actual service experience with nuclear plant piping failure data. The RI-ISI program requires volumetric and VT-2 examinations on a frequency and number determined by ASME Code Case N-578-1 and the Hope Creek ISI Program Plan. These ongoing inspections combined with a 100% inspection of all accessible Class 1 socket welds in the recirculation system using volumetric or other industry approved techniques will be effective in identifying any age related or underlying deficiencies. Any deficiencies identified are evaluated under the corrective action program.

The Small-Bore Class 1 Piping Inspection program will effectively manage the aging effect of cracking in small-bore (greater than or equal to NPS 1 and less than NPS 4) Class 1 piping by identifying and evaluating cracking prior to loss of intended function.

This new program will be implemented prior to the period of extended operation.

A.3 NUREG-1801 Chapter X Aging Management Programs

A.3.1 Evaluation of Chapter X Aging Management Programs

Aging Management Programs evaluated in Chapter X of NUREG-1801 are associated with Time-Limited Aging Analysis for metal fatigue of the reactor coolant pressure boundary, concrete containment tendon prestress, and environmental qualification (EQ) of electrical components. These programs, where applicable, are evaluated in this section.

A.3.1.1 Metal Fatigue of Reactor Coolant Pressure Boundary

The Metal Fatigue of Reactor Coolant Pressure Boundary Program is an existing program that manages cumulative fatigue damage in the selected reactor coolant components subject to the reactor coolant and treated water environments.

The Metal Fatigue of Reactor Coolant Pressure Boundary Program is a preventive program that monitors and tracks the number of critical thermal and pressure transients to ensure that the cumulative usage factors for selected reactor coolant pressure boundary components remain less than 1.00 through the period of extended operation. The program determines the number of transients that occur and updates the 60-year projections as required on an annual basis. A software program, FatiguePro, computes cumulative usage factors for select locations.

The effect of the reactor coolant environment on fatigue usage, known as environmental fatigue, has been evaluated for the period of extended operation using the formulae contained in NUREG/CR-6583 for carbon and low-alloy steels and NUREG/CR-5704 for austenitic stainless steels. The fatigue usage associated with the effects of the reactor coolant environment will be included into the ongoing monitoring program.

The program requires the generation of a periodic fatigue monitoring report, including a listing of transient events, cycle summary event details, cumulative usage factors, a detailed fatigue analysis report, and a cycle projection report. If the fatigue usage for any location has had an unanticipated increase based on cycle accumulation trends or if the number of cycles is approaching their limit, the corrective action program is used to evaluate the condition and determine the corrective action. Acceptable corrective actions include repair of the component, replacement of the component, and a more rigorous analysis of the component to demonstrate that the design code limit will not be exceeded during the period of extended operation. Corrective actions include a review of additional affected reactor coolant pressure boundary locations.

There are several enhancements identified for this existing program as follows.

1. The Metal Fatigue of Reactor Coolant Pressure Boundary program will be enhanced to include additional transients beyond those defined in the Technical Specifications and the UFSAR, and expanding the fatigue monitoring program to encompass other components identified to have fatigue as an analyzed aging effect, which require monitoring.
2. The Metal Fatigue of Reactor Coolant Pressure Boundary program will be enhanced to use a software program to automatically count transients and calculate cumulative usage on select components.
3. The Metal Fatigue of Reactor Coolant Pressure Boundary program will be enhanced to address the effects of the reactor coolant environment on component fatigue life by assessing the impact of the reactor coolant environment on a sample of critical components for the plant identified in NUREG/CR-6260.
4. The Metal Fatigue of Reactor Coolant Pressure Boundary program will be enhanced to require a review of additional reactor coolant pressure boundary locations if the usage factor for one of the environmental fatigue sample locations approaches its design limit.

These enhancements will be implemented prior to the period of extended operation.

A.3.1.2 Environmental Qualification (EQ) of Electric Components

The Environmental Qualification (EQ) of Electric Components is an existing program that manages the aging of electrical equipment within the scope of 10 CFR 50.49, “Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants.” The program establishes, demonstrates, and documents the level of qualification, qualified configurations, maintenance, surveillance and replacements necessary to meet 10 CFR 50.49. A qualified life is determined for components within the scope of the program and appropriate actions such as replacement or refurbishment, or reanalysis, are taken prior to or at the end of the qualified life of the components so that the aging limit is not exceeded. The aging effects are adequately managed so that the intended functions of components within the scope of 10 CFR 50.49 are maintained consistent with the current licensing basis during the period of extended operation.

A.4 Time-Limited Aging Analyses

A.4.1 Introduction

As part of the application for a renewed license, 10 CFR 54.21(c) requires that an evaluation of Time-Limited Aging Analyses (TLAAs) for the period of extended operation be provided. The following TLAAs have been identified and evaluated to meet this requirement.

A.4.2 Neutron Embrittlement of the Reactor Pressure Vessel and Internals

The reactor vessel embrittlement calculations for Hope Creek that evaluated reduction of fracture toughness of the Hope Creek reactor vessel beltline materials for 40 years are based upon a predicted End of License fluence of 32 Effective Full Power Years (EFPY). These analyses are considered Time-Limited Aging Analyses (TLAAs) as defined in 10 CFR 54.21(c) and they must be evaluated for the increased neutron fluence associated with 60 years of operation.

High energy neutron fluence for the welds and shells of the reactor pressure vessel beltline region was calculated using the RAMA fluence methodology. The RAMA methodology was developed for the Electric Power Research Institute and the Boiling Water Reactor Vessel and Internals Project and is approved by the NRC for use at Hope Creek. Use of this methodology for evaluations of fluence for Hope Creek was performed in accordance with guidelines presented in Regulatory Guide 1.190. The evaluations determined values for neutron fluence for extended power uprate (EPU) conditions and for extended operation out to 56 effective full power years (EFPY), i.e., at the end of 60 years of operation.

A.4.2.1 Reactor Pressure Vessel Materials Upper-Shelf Energy Reduction Due to Neutron Embrittlement

The regulations governing reactor pressure vessel integrity are in 10 CFR 50. 10 CFR 50.60 requires that all light-water reactors meet the fracture toughness, pressure-temperature limits, and material surveillance program requirements for the reactor coolant pressure boundary as set forth in 10 CFR 50 Appendices G and H. The Hope Creek current licensing basis analyses evaluating reduction of fracture toughness of the reactor pressure vessel for 40 years are TLAAs. 10 CFR 50 Appendix G requires the predicted end-of-life Charpy impact test USE for reactor pressure vessel materials to be at least 50 ft-lb (absorbed energy), unless an approved analysis supports a lower value. The predicted USE drop is determined in accordance with RG 1.99. Predicted USE drop for each reactor pressure vessel material in the beltline region exposed to fluence greater than 1.0×10^{17} n/cm^2 for 56 EFPY was determined in accordance with RG 1.99, Revision 2.

The 50 ft-lb criterion was met for all materials evaluated and therefore, the analyses are projected for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.4.2.2 Adjusted Reference Temperature for Reactor Pressure Vessel Materials Due to Neutron Embrittlement

The adjusted reference temperature (ART) of the limiting beltline material is used to adjust the beltline P-T curves to account for irradiation effects. RG 1.99 Revision 2 provides the methods for determining the ART. The initial nil-ductility reference temperature, RT_{NDT}, is the temperature at which a non-irradiated metal (ferritic steel) changes in fracture characteristics going from ductile to brittle behavior. RT_{NDT} is evaluated according to the procedures in the ASME Code, Section III. 10 CFR 50 Appendix G defines the fracture toughness requirements for the life of the vessel. The ART is defined as Initial RT_{NDT} + ΔRT_{NDT} + Margin. The Margin term is defined in RG 1.99 Revision 2. The current P-T curves are developed from limiting ART values for the vessel materials and are valid for 32 EFPY. Since the ART values are determined by adding the unirradiated RT_{NDT} and the ΔRT_{NDT} values for the 40-year licensed operating period, these ART calculations meet the criteria of 10 CFR 54.3(a) and have been identified as TLAAs requiring evaluation for 60 years.

56 EFPY fluence values were calculated for the Hope Creek reactor pressure vessel for the extended 60-year licensed operating period, using the RAMA Fluence Methodology software package. The 56 EFPY ΔRT_{NDT} values for all beltline materials (i.e., those materials with a fluence exposure greater than $1x10^{17}$ n/cm^2) were calculated based on the embrittlement correlation found in RG 1.99. Hope Creek will re-project, as necessary, the 56 EFPY ΔRT_{NDT} and ART values in conjunction with the surveillance capsule results from the BWRVIP Integrated Surveillance Program (ISP) as described in reports BWRVIP-86 and BWRVIP-116.

The analysis for the adjusted reference temperature has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.4.2.3 Reactor Pressure Vessel Analyses: Pressure – Temperature Limits

10 CFR Part 50 Appendix G requires reactor pressure vessel analyses to determine operating P-T limits for boltup, hydrotest, pressure tests and normal operating and anticipated operational occurrences. The ART of the limiting beltline material is used to adjust the beltline P-T limits to account for irradiation effects. Operating limits for pressure and temperature are required for three categories of operation: 1) hydrostatic pressure tests and leak tests, referred to as Curve A; 2) non-nuclear heat-up / cooldown and low-level physics tests, referred to as Curve B; and 3) core critical operation, referred to as Curve C. P-T limits are developed for three bounding vessel regions: the upper vessel region (non-beltline, including the head flange region), the core beltline region, and the vessel bottom head region. The calculations associated with generation of the P-T curves satisfy the criteria of 10 CFR 54.3(a). As such, these calculations are a TLAA.

The current HCGS Technical Specifications contain P-T curves for hydrostatic pressure and leak tests, non-nuclear heat-up/cooldown and low-level physics tests, and critical operation. Technical Specifications also limit the maximum rate of change of the reactor coolant temperature. These P-T curves provide limits up to 32 EFPY. The P-T curves were developed to present steam dome pressure versus minimum vessel metal temperature, incorporating appropriate non-beltline limits and irradiation embrittlement effects in the beltline. Because of the relationship between the P-T limits and the fracture toughness transition of the HCGS reactor pressure vessel, new P-T limits are required to be calculated and will be submitted as updates to the NRC, in compliance with 10 CFR Part 50, Appendix G.

HCGS will re-project the P-T curves using approved fluence calculations when there are changes in power or significant changes in core design in conjunction with surveillance capsule results from the BWRVIP Integrated Surveillance Program (ISP) (BWRVIP -86-A and BWRVIP-116).

Reactor Pressure Vessel Analyses for P-T limits, considering the effects of aging on the intended function will be adequately managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

A.4.2.4 Reactor Pressure Vessel Circumferential Weld Examination Relief

ASME Code, Section XI governs inspection of the reactor pressure vessel circumferential welds, as implemented by the Hope Creek In-service Inspection Program. These welds are required to be inspected at regular intervals described in Table IWB-2500-1, Examination Category B-A of ASME Code, Section XI. Hope Creek has received inspection relief for the circumferential welds for the time remaining in the current 40 year licensed operating period. This inspection relief is based upon NRC Generic Letter 98-05, which is based on probabilistic assessments that predict an acceptably low probability of failure per reactor operating year.

The analysis is based on reactor pressure vessel metallurgical conditions as well as flaw indication sizes and frequencies of occurrence that are expected through the end of the current licensed operating period. The basis for this relief request was an analysis that satisfied the limiting conditional failure probability for the circumferential welds at the expiration of the current license, based on BWRVIP-05 and the extent of neutron embrittlement expected through 40 years of operation. The anticipated metallurgical effects due to increased fluence expected during the period of extended operation require evaluation for 56 EFPY (corresponding to 60 years) and approval by the NRC to extend this relief request. The circumferential volumetric weld examination relief analysis meets the requirements of 10CFR54.3(a) and is a TLAA.

The failure frequency of circumferential welds for Hope Creek was calculated for Hope Creek for the period of extended operation and was projected to be less than the criteria established in the NRC’s SER for BWRVIP-05. A request for extension of this relief for Hope Creek for the extended operating period will be submitted to the NRC, in accordance with 10 CFR 50.55(a), prior to the period of extended operation.

The analysis for the circumferential weld examination relief has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.4.2.5 Reactor Pressure Vessel Axial Weld Failure Probability

The BWRVIP recommendations for inspection of reactor pressure vessel shell welds in BWRVIP-05 contain generic analyses supporting a conclusion in the NRC SER that the generic-plant axial weld failure rate is no more than 5×10^{-6} per reactor year.

The probability of a failure event, PoF, calculated by the NRC in the BWRVIP-05 SER and its supplements depends in part on an assumption that essentially 100% (≥90%) of axial welds can be inspected. At Hope Creek, greater than 90% of the axial welds can be examined.

The anticipated changes in metallurgical conditions expected over the extended licensed operating period require an additional analysis for 56 EFPY. As such, this analysis meets the requirements of 10 CFR 54.3(a) and has been identified as a TLAA requiring evaluation for the period of extended operation.

Since the comparison of neutron fluence, initial RT_{NDT}, chemistry factor amounts of copper and nickel, delta RT_{NDT}, and the projected mean RT_{NDT} of the limiting axial weld at the end of the period of extended operation has been projected to be less than that found in the reference case in the BWRVIP and NRC analyses, the axial weld failure probability continues to be bounded by the previously approved value of less than 5E-6 per reactor year.

The analysis for the axial weld failure probability has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.4.2.6 Reactor Pressure Vessel Core Reflood Thermal Shock Analysis

General Electric Report No. NEDO-10029 addressed the concern for brittle fracture of the reactor pressure vessel due to reflood following a postulated Loss of Coolant Accident (LOCA). The thermal shock analysis documented in the report assumed a design basis LOCA followed by a low pressure coolant injection accounting for the full effects of neutron embrittlement at the end of 40 years. This analysis bounded only 40 years of operation. Therefore, reflood thermal shock of the reactor pressure vessel is considered a TLAA for the Hope Creek.

Since the time of the NEDO-10029 analysis, another analysis has been performed for BWR-6 vessels in “Fracture Mechanics Evaluation of a Boiling Water Vessel Following a Postulated Loss of Coolant Accident”. The more recent BWR-6 analysis was reevaluated for the Hope Creek BWR-4 reactor pressure vessel and found to be bounding for the period of extended operation. Because the available fracture toughness was found to be greater than the peak stress intensity calculated for the event evaluated, brittle fracture of the Hope Creek reactor pressure vessel due to vessel reflood following a design basis LOCA is not possible during the period of extended operation.

The core reflood thermal shock analysis relief has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

A.4.2.7 Reactor Internals Components

A number of the reactor internals components are subject to high fluence because of their proximity to the core. This high fluence can lead to stress relaxation for bolting. Stress relaxation of the core plate rim hold-down bolts is a TLAA issue.

A plant specific analysis demonstrates that the pre-load of the core plate rim hold-down bolts is sufficient to prevent lateral motion of the core plate until the plant reaches 43.9 EFPY. Prior to the period of extended operation, which is prior to the analyzed limit of 43.9 EFPY, the plant will either; (1) install core plate wedges or (2) perform an analysis that demonstrates the component function is maintained.

The core plate rim hold-down bolts TLAA will be dispositioned in accordance with 10 CFR 54.21(c)(1)(iii), by managing the aging effects with the analysis that projects loss of preload at 43.9 EFPY and taking action as described above, prior to the period of extended operation.

A.4.3 Metal Fatigue of the Reactor Pressure Vessel, Internals, and Reactor Coolant Pressure Boundary Piping and Components

Metal fatigue was considered explicitly in the design process for pressure boundary components designed in accordance with ASME Section III, Class A or Class 1 requirements. Metal fatigue was evaluated implicitly for components designed in accordance with ASME Section III, Class 2 or 3 requirements or ANSI B31.1 requirements. Each of these fatigue analyses and evaluations are considered to be Time-Limited Aging Analyses (TLAAs) requiring evaluation for the period of extended operation in accordance with 10 CFR 54.21(c).

A.4.3.1 Reactor Pressure Vessel Fatigue Analyses

Reactor pressure vessel fatigue analyses depend on the assumed numbers and the severity of normal and upset event pressure and thermal operating cycles to predict end-of-life fatigue usage factors in accordance with Section III of the ASME Code. These assumed cycle counts used to determine fatigue usage factors are based on the 40-year life of the plant. The calculation of fatigue usage factors is part of the current licensing basis and is used to support safety determinations. As such the reactor pressure vessel fatigue analyses meet the requirements of 10 CFR 54.3(a) for a TLAA.

The original Hope Creek reactor pressure vessel stress report included fatigue analyses for the reactor pressure vessel components based on a set of design basis duty cycles. The original 40-year analyses demonstrated that the cumulative usage factors (CUFs) for all critical components would remain below the allowable fatigue usage value of 1.0 specified in Section III of the ASME Code.

Revised CUF evaluations were also performed to assess the impact of Extended Power Uprate (EPU) on the reactor pressure vessel for Hope Creek. These evaluations revised the CUF values for some reactor pressure vessel components based on the change in reactor operating conditions resulting from EPU. The revised CUF evaluations were approved by the NRC as a part of the EPU approval process.

In addition, revised fatigue evaluations were performed for the recirculation inlet nozzle for containment or “new” loads in 1988, for the top head and vessel flanges for asymmetric head spray cooling in 1990, for the main closure region to support reduced-pass stud tensioning in 2000, for the reactor pressure vessel support skirt to evaluate cumulative fatigue loadings in 1996, and for the core spray nozzles to evaluate the impact of additional High Pressure Coolant Injection (HPCI) injections in 2008.

The list of design transients used in the reactor pressure vessel fatigue analyses was intended to envelope all anticipated thermal and pressure cycles that could be expected to occur within a nominal 40-year operating period for the plant. The number of transients experienced to-date for the reactor pressure vessel and other analyzed components was compiled from the Hope Creek Cycle Counting Program. The numbers of occurrences expected for 40 and 60 years of operation were obtained by extrapolating the numbers of occurrences actually incurred to-date, and using the rate of occurrence experienced during the last twelve years of operation (nine operating cycles). Conservatism was added beyond the mathematically projected number of cycles to accommodate potential variation in plant performance late in plant life, as well as to allow for additional events where the projected number of cycles was very low and the likelihood of additional events could not be ruled out.

The CUFs of the reactor pressure vessel, including the vessel support skirt, shell, upper and lower heads, closure flanges, nozzles and penetrations, nozzle safe ends, refueling bellows support, and closure studs will be managed by the Metal Fatigue of Reactor Coolant Pressure Boundary aging management program. The program includes monitoring and recording transient events and periodic updating to current and projected CUF values.

All locations with CUF ratios (i.e., CUF/allowable) predicted to exceed 0.4 (or 40% of allowable) in the original design basis fatigue analysis will be included in the program. In addition, the locations identified in NUREG/CR-6260 for the newer-vintage General Electric plant, which have been evaluated for environmental fatigue effects have been included in the program.

The Metal Fatigue of Reactor Coolant Pressure Boundary program will monitor the numbers of cycles of the design transients and the corresponding CUF for critical reactor pressure vessel components. All necessary plant transient events will be tracked to ensure that the CUF remains less than the allowable CUF limit for all monitored components. In the event the monitored CUF is predicted to exceed the allowable value for any component prior to 60 years of operation, appropriate corrective action will be taken in accordance with the corrective action process prior to the allowable limits being exceeded.

The Metal Fatigue of Reactor Coolant Pressure Boundary program will manage the effects of aging due to fatigue on the reactor pressure vessel in accordance with 10 CFR 54.21(c)(1)(iii).

A.4.3.2 Reactor Pressure Vessel Internals Fatigue Analyses

The Hope Creek reactor pressure vessel internals were not designed in accordance with the codes for the reactor pressure vessel. However, the Hope Creek UFSAR reports CUF values for three reactor pressure vessel internals components as follows:

(1) 0.111 for the core support plate (at stud),

(2) 0.435 for the top guide (at beam slot), and

(3) Less than 0.05 for the core differential pressure sensing line (at elbow).

As such, the reactor pressure vessel internals fatigue analyses have been identified as TLAAs that meet the requirements of 10 CFR 54.3(a).

The reactor pressure vessel internals are not a part of the Class 1 pressure boundary. The above calculated fatigue usage factors when extrapolated to 60 years indicate acceptable fatigue performance for the period of extended operation.

The analysis has been projected through the period of extended operation and found to be acceptable in accordance with 10 CFR 54.21(c)(1)(ii).

A.4.3.3 Reactor Coolant Pressure Boundary Piping and Component Fatigue Analyses

The Hope Creek reactor coolant pressure boundary (RCPB) piping was designed in accordance with ASME Code, Section III, Class 1, as stated in Section 3.2.2 of the Hope Creek UFSAR.

The Hope Creek piping systems in the scope of license renewal designed to ASME Code, Section III, Class 1 requirements were explicitly analyzed for fatigue. The analyses demonstrated that the 40-year CUFs for the limiting components in the affected systems were below the ASME Code Section III allowable value of 1.0.

High energy line breaks (HELB) in the Hope Creek piping have been postulated, and based on analyses performed for these breaks, means for avoiding damage to surrounding equipment and systems have been incorporated in the plant. Potential damage could arise from fluid jet impingement, flooding, compartment pressurization, environmental effects, and pipe whip. It is noted that cumulative fatigue usage factors (CUF <0.1) for the high energy lines are included in the criteria to determine postulated breaks. The CUFs, as calculated in the design fatigue analyses, account for the design transients assumed for the original 40-year life of the plant. The CUF calculations used in the selection of postulated high energy line break locations are TLAAs.

Since these breaks are postulated to occur only once in the lifetime of the plant, and restraints were installed appropriately to mitigate these potential breaks, the results of analyses for the potential breaks and the restraints installed in the plant remain unchanged for the extended life of 60 years. However, it is possible that other locations that had 40-year CUFs below the criteria for postulated breaks could exceed the CUF criteria in 60 years. The possibility of these additional postulated breaks will need to be managed based on the actual fatigue accumulation encountered as the plant ages.

The Hope Creek RCPB piping stress reports include fatigue analyses for all Class 1 piping components based on a set of design basis duty cycles. The original 40-year analyses demonstrated that the CUFs for all critical piping components would remain below the allowable fatigue usage value of 1.0 specified in Section III of the ASME Code.

The HELB locations were considered as a part of the Class 1 piping screening evaluation for identifying locations to monitor in the Hope Creek Metal Fatigue of Reactor Coolant Pressure Boundary program. As such, all critical HELB locations are encompassed by the Hope Creek Metal Fatigue of Reactor Coolant Pressure Boundary program. Revised CUF evaluations have been performed on the piping since the time of original plant construction. These evaluations revised the CUF values for some piping components based on the change in piping configuration or the change in reactor and piping operating conditions. The CUFs of the piping will be managed by the Metal Fatigue of Reactor Coolant Pressure Boundary aging management program. This program will monitor critical piping component cycle based fatigue (CBF) through the use of a fatigue monitoring software application, using CBF monitoring versus the allowable value. All bounding Class 1 piping locations with CUF ratios (i.e., CUF/allowable) predicted to exceed 0.4 (or 40% of allowable) in the original design basis fatigue analysis will be included in the program. In addition, the locations identified in NUREG/CR-6260 for the newer-vintage General Electric plant, which have been evaluated for environmental fatigue effects have been included in the program.

The Metal Fatigue of Reactor Coolant Pressure Boundary program will monitor the numbers of cycles of the design transients and the corresponding CUF for critical Class 1 piping components including high energy line break limiting locations. In the event the monitored CUF is predicted to exceed the allowable value for any component prior to 60 years of operation, appropriate corrective action will be taken in accordance with the corrective action process prior to the allowable limits being exceeded. As such, the Metal Fatigue of Reactor Coolant Pressure Boundary program will manage the effects of aging due to fatigue on the RCPB piping in accordance with 10 CFR 54.21(c)(1)(iii).

A.4.3.4 Non-Class 1 Component Fatigue Analyses

Non-Class 1 components include pipe, tubing, fittings, tanks, vessels, heat exchangers, valve bodies, pump casings, and miscellaneous process components. These components were generally designed in accordance with appropriate ASME Section III subsections or American National Standards Institute (ANSI) B31.1, or B31.7, depending on their function.

Calculation of cumulative fatigue usage is not required for non-Class 1 components. For non-Class 1 components, stresses due to thermal expansion and anchor movement, which are important for fatigue evaluations, are analyzed using stress intensification factors and stress allowables. Allowable stresses are defined for 7,000 full temperature cycles with reductions in allowable stresses as cycles increase beyond 7,000.

For the Hope Creek piping systems in the scope of license renewal designed to B31.1, or ASME Code, Section III, Class 2 and 3, the assumed thermal cycle count can conservatively be approximated by the thermal cycles expected for the reactor pressure vessel, which is less than 2,700 for 60 years of plant operation. This is a fraction of the 7,000-cycle threshold. Therefore, the existing piping analyses designed to B31.1, or ASME Code, Section III, Class 2 and 3 within the scope of license renewal are valid for the period of extended operation in accordance 10 CFR 54.21(c)(1)(i).

A.4.3.5 Effects of Reactor Coolant Environment on Fatigue Life of Components and Piping (Generic Safety Issue 190)

The NRC concluded that licensees who apply for license renewal should address the effects of coolant environment on component fatigue life as part of their aging management programs. NUREG-1801, Revision 1, Generic Aging Lessons Learned, contains recommendations on specific areas for which existing programs should be augmented for license renewal. The program description for Aging Management Program Section X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary," requires detailed, vintage-specific, fatigue calculations for plants applying for license renewal for the locations identified in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components". Since such calculations do not form a part of the Hope Creek current licensing basis and therefore do not satisfy the requirements of 10 CFR 54.3, they are not TLAA.

From NUREG/CR-6260 for the newer-vintage General Electric plant, the following locations require evaluation:

- Reactor pressure vessel shell and lower head
- Reactor pressure vessel feedwater nozzle

- Reactor recirculation piping (including reactor pressure vessel inlet and outlet nozzles)
- Core spray line reactor pressure vessel nozzle and associated Class 1 piping
- Residual heat removal nozzles and associated Class 1 piping
- Feedwater Class 1 piping

The cumulative usage factors (CUF) were calculated for each of these locations, accounting using the appropriate environmental fatigue multiplier, or F_{en}, relationships from NUREG/CR-6583 for carbon/low alloy steels, and NUREG/CR-5704 for stainless steels, as appropriate for the material for each location. The results demonstrate that CUF values, including appropriate environmental effects, are less than 1.0 for 60 years of plant operation for all locations except for the reactor pressure vessel feedwater nozzle safe end. Corrective action will be taken prior to exceeding the environmental assisted fatigue CUF value of 1.0.

All of the locations discussed will be included in the Metal Fatigue of Reactor Coolant Pressure Boundary aging management program, and the CUF for these locations will be tracked in accordance with 10 CFR 54.21(c)(1)(iii).

A.4.4 Environmental Qualification of Electrical Equipment

Thermal, radiation, and cyclical aging analyses of plant electrical and I&C equipment, developed to meet 10 CFR 50.49 requirements, have been identified as time-limited aging analyses (TLAAs) for Hope Creek. The NRC has established nuclear station environmental qualification (EQ) requirements in 10 CFR 50.49 and 10 CFR 50, Appendix A, Criterion 4. 10 CFR 50.49 specifically requires that an EQ program be established to demonstrate that certain electrical components located in harsh plant environments are qualified to perform their safety function in those harsh environments after the effects of in-service aging. Harsh environments are defined as those areas of the plant that could be subject to the harsh environmental effects of a loss-of-coolant accident (LOCA), high energy line break (HELB), or post-LOCA radiation. 10 CFR 50.49 requires that the effects of significant aging mechanisms be addressed as part of environmental qualification. The qualification evaluations of electrical equipment with a qualified life of at least 40 years are considered TLAA for license renewal.

The Hope Creek Environmental Qualification (EQ) of Electric Components program will manage the effects of aging effects for the components associated with the environmental qualification TLAA. The reanalysis of an aging evaluation is normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation. Reanalysis of an aging evaluation to extend the qualification of a component is performed on a routine basis pursuant to 10 CFR 50.49(e) as part of the Hope Creek Environmental Qualification (EQ) of Electrical Components program. Important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met).

Under the Hope Creek Environmental Qualification (EQ) of Electric Components program, the reanalysis of an aging evaluation could extend the qualification of the component. If the qualification cannot be extended by reanalysis, the component must be refurbished, replaced, or requalified prior to exceeding the period for which the current qualification remains valid. A reanalysis is to be performed in a timely manner such that sufficient time is available to refurbish, replace, or requalify the component if the reanalysis is unsuccessful. The effects of aging on the intended function(s) will be adequately managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

A.4.5 Loss of Prestress in Concrete Containment Tendons

The Hope Creek containment does not have pre-stressed tendons, therefore this topic is not a TLAA for Hope Creek.

A.4.6 Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analyses

A.4.6.1 Fatigue Analyses of Primary Containment, Attached Piping, and Components

The Hope Creek containment vessel is a Mark I design with a drywell and toroidal suppression chamber. The Hope Creek primary containment was designed in accordance with the ASME Code, Section III. The Mark I analyses are detailed in the Hope Creek Plant Unique Analysis Report (PUAR) and assume 370 multiple SRV lifts and 596 single SRV lifts. Since these analyses include fatigue evaluations based on the occurrence of a limited number of transient cycles during the current licensed term of operation (40 years), they satisfy the requirements of 10 CFR 54.3 and are TLAAs.

Using historical information and projecting the results for 60 years provided a projected number of 592 single SRV lifts for 60 years, and a projected number of 26 multiple lifts for 60 years. Both of these numbers are below the values assumed in the Mark I analyses. Even though the projected number of cycles and the associated cumulative usage factor (CUF) are projected to be within the original design assumptions, all relevant plant transient events will be tracked to ensure that the CUF remains less than 1.0 for all monitored components. Validation for primary containment locations will be performed by monitoring the high CUF limiting containment locations.

All governing fatigue analyses have been reviewed to establish a comprehensive and bounding set of primary containment locations for inclusion in the Metal Fatigue of Reactor Coolant Pressure Boundary aging management program in accordance with 10 CFR 54.21(c)(1)(iii).

A.4.6.2 Primary Containment Process Penetrations and Bellows Fatigue Analysis

The primary containment process piping penetrations use flued heads to connect the process piping to the drywell sleeves. The flued heads for the ASME Section III, Class 1 process piping systems have been analyzed for fatigue. These Class 1 fatigue analyses are based upon thermal cycles specified for the 40-year life for the plant and have therefore been identified as TLAAs requiring evaluation for the period of extended operation. The primary containment process piping penetrations with triple flued heads are anchored to the concrete shield wall around the drywell. As a result, the penetration design includes a flexible bellows to seal the triple flued head to the drywell penetration sleeve. The single and double flued heads are sealed directly to the drywell sleeves, without a flexible bellows. The flexible bellows were designed in accordance with ASME Section III, Class 2 requirements, but this included CUF analyses that have also been identified as TLAA's requiring evaluation for 60 years. The drywell penetration sleeves were evaluated for cyclic loads under the ASME Section III, Class II requirements, and it was determined that the penetration sleeves were exempt from a detailed fatigue evaluation.

For the Containment Process Penetrations, the maximum 40-year CUF ratio (CUF/allowable) identified for any of these penetrations is 0.957 for feedwater penetrations P-2A and P-2B. All other governing penetration fatigue analyses have been reviewed, and the CUF ratios for all other penetrations are well less than 0.4 (maximum value of 0.057).

The fatigue usage experienced by the flexible bellows was bounded by the corresponding attached triple flued head, therefore, monitoring of the fatigue usage for the triple flued heads will provide assurance that no flexible bellows will exceed its allowable value.

The Metal Fatigue of Reactor Coolant Pressure Boundary Program will manage the effects of aging due to fatigue on the containment process penetrations and the flexible bellows in accordance with 10 CFR 54.21(c)(1)(iii).

A.4.6.3 Vent Line Bellows

Fatigue was evaluated for the vent line bellows that seal the drywell shell to the vent lines, which connect to the torus. The fatigue evaluation for these bellows is based on the number of cycles assumed for the 40-year life of the plant; therefore these analyses satisfy the criteria 10CFR54.3(a) and are evaluated as TLAA in accordance with 10CFR54.21(c).

The maximum differential displacements of the vent line bellows are determined using the results of the torus reanalysis. The displacements at the attachment points of the bellows to the drywell side of the vent line and to the torus side of the vent line are determined for each load case. The differential displacement is computed from these values. The results of each load case are combined to determine the total differential displacements for the controlling load combinations. The results are compared to the allowable bellows displacements. The loads that cause the highest number of displacement cycles at the vent line bellows are seismic loads, SRV loads, and LOCA related loads such as pool swell, condensation oscillation, and chugging. The bellows displacements for these loads are small compared to the maximum allowable displacement and their effect on fatigue is negligible. The thermal loads and internal pressure loads are the largest contributors to bellows displacements. The bellows have a rated capacity of cycles at maximum displacements for normal operating conditions greater than the originally specified (allowable) number of thermal load and internal pressure cycles.

The allowable number of cycles, at maximum displacements for normal operating conditions, are greater than those projected for 60 years, therefore the fatigue evaluation for the vent line bellows remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.4.7 Other Plant–Specific Time Limited Aging Analyses

A.4.7.1 Crane Load Cycle Limit

The load cycle limits for cranes was identified as a potential TLAA. The method of review applicable to the crane cyclic load limit TLAA involves (1) reviewing the existing 40-year design basis to determine the number of load cycles considered in the design of each of the cranes in the scope of license renewal, (2) developing 60-year projections for load cycles for each of the cranes in the scope of license renewal and compare with the number of design cycles for 40 years.

Reactor Building Polar Crane

The Reactor Building Polar Crane at Hope Creek is designed to meet or exceed the design fatigue requirements of the Crane Manufacturers Association of America (CMAA) Specification 70. This evaluation of cycles over the 40-year life is the basis of a safety determination and is therefore a TLAA Analysis.

The Reactor Building Polar Crane is designed in accordance with CMAA Specification 70 for a minimum of 100,000 load cycles. A review of Reactor Building Polar Crane operation during the current life of the plant, including an estimated 200 lifts during original construction, indicates that the total number of lifts above 25 tons to date is less than 800. Using an average rate of 42 lifts per year over the course of 60 years results in the Polar Crane experiencing 2,520 lifts. Additionally, the Polar Crane will be used in the handling of casks, which are projected to be less than 200 lifts from campaign initiation through the period of extended operation. Therefore, the total number of lifts for the Polar Crane has been estimated to be 2,720 for the total life of plant, including the extended period of operation associated with license renewal. This is less than the minimum allowable design value of 100,000 cycles and is therefore acceptable. Therefore, the Reactor Building Polar Crane load cycle fatigue analysis remains valid for 60 years of plant operation in accordance with 10 CFR 54.21(c)(1)(i).

Service Water Intake Structure Gantry Crane

A review of Service Water Intake Structure Gantry Crane operation during the current life of the plant, including an estimated 200 lifts during original construction, indicates that the total number of lifts is less than 600. Using an average rate of 32 lifts per year over the course of 60 years results in the Service Water Intake Structure Gantry Crane experiencing 1,920 lifts. This is less than the minimum allowable design value of 100,000 cycles, and is therefore acceptable. Therefore, the Service Water Intake Structure Gantry Crane load cycle fatigue analysis remains valid for 60 years of plant operation in accordance with 10 CFR 54.21(c)(1)(i).

A.4.7.2 Refueling Bellows Fatigue

A fatigue analysis was performed for each of the two bellows that seal the drywell bulkhead and reactor vessel and the drywell bulkhead and drywell shell for refueling operations. The fatigue analysis for each of these bellows is based on the number of cycles assumed for the 40-year life of the plant; therefore these analyses satisfy the criteria 10 CFR 54.3(a) and are evaluated as TLAA in accordance with 10 CFR 54.21(c).

The bulkhead-to-drywell bellows exhibited the highest calculated fatigue usage. The fatigue usage for both bellows was determined by the number of cycles of startup and shutdown and the number of flood-up events at each refueling outage. The fatigue analysis assumed 360 cycles for startup and shutdown and reflood over the life of the plant. The maximum number of startup and shutdown cycles expected for 60 years of operations at Hope Creek is 180 for startup and shutdown and 55 for refueling operations, for a total of 235 cycles. Since the number of cycles used in the analyses for these events are greater than those projected for 60 years, the fatigue analyses for the refueling bellows remain valid for the period of extended operation.

The fatigue analysis for the refueling bellows remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A.4.7.3 Neutron Fluence-Induced Stress Relaxation - Jet Pump Auxiliary Spring Wedges and Slip Joint Clamp

Auxiliary Spring Wedges and a Slip Joint Clamp have been installed on jet pumps at the Hope Creek. Structural analysis of the repair devices evaluated the loss of preload for structural bolting due to exposure to neutron fluence during 40 years of operation. The analysis for each of these devices is based on the fluence assumed for the 40-year life of the device; therefore these analyses satisfy the criteria 10 CFR 54.3(a) and are evaluated as a TLAA in accordance with 10 CFR54.21(c).

Auxiliary Spring Wedges Bolts

Based on an analysis, the auxiliary spring wedge bolts were determined to not experience a fluence level above the analyzed value. Since the fluence bounds that which would be experienced within the period of extended operation, the analysis has been successfully projected for 60 years of plant operation. The current analysis for the auxiliary spring wedges remains valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

Slip Joint Clamp Bolt

The fluence analysis for the slip joint clamp bolt determined a fluence value greater than that previously evaluated prior to reaching 35.4 Effective Full Power Years (EFPY). Prior to the period of extended operation, or prior to reaching the analyzed limit of 35.4 EFPY, whichever comes first, the plant will either; (1) replace the slip joint clamp or (2) perform an analysis that demonstrates the component function is maintained. The slip joint clamp TLAA will be dispositioned in accordance with 10 CFR 54.21(c)(1)(iii) by managing the aging effects with the analysis and taking action as described above prior to the period of extended operation, or prior to reaching the analyzed limit of 35.4 EFPY, whichever comes first.

A.5 License Renewal Commitment List

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	Existing program is credited.	A.2.1.1	Ongoing	Section B.2.1.1
2	Water Chemistry	Existing program is credited.	A.2.1.2	Ongoing	Section B.2.1.2
3	Reactor Head Closure Studs	Existing program is credited.	A.2.1.3	Ongoing	Section B.2.1.3
4	BWR Vessel ID Attachment Welds	Existing program is credited.	A.2.1.4	Ongoing	Section B.2.1.4
5	BWR Feedwater Nozzle	Existing program is credited.	A.2.1.5	Ongoing	Section B.2.1.5
6	BWR Control Rod Drive Return Line Nozzle	Existing program is credited.	A.2.1.6	Ongoing	Section B.2.1.6
7	BWR Stress Corrosion Cracking	BWR Stress Corrosion Cracking is an existing program that will be enhanced to include: 1. For the components within the scope of the BWR Stress Corrosion Cracking program, resistant materials will be used for new and replacement components. This includes low carbon stainless piping and stainless steel weld material limited to a maximum carbon content 0.035 wt.% and a minimum ferrite content of 7.5%.	A.2.1.7	Program to be enhanced prior to the period of extended operation.	Section B.2.1.7
8	BWR Penetrations	Existing program is credited.	A.2.1.8	Ongoing	Section B.2.1.8

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
9	BWR Vessel Internals	Existing program is credited. PSEG is committed to implement the BWRVIP guidelines for Hope Creek as follows: • PSEG will inform the NRC staff of any decision to not fully implement a BWRVIP guideline approved by the staff. • PSEG will notify the staff if changes are made to the RPV and its internals' programs that affect the implementation of the BWRVIP guideline. • PSEG will submit any deviation from the existing flaw evaluation guidelines that are specified in the BWRVIP guideline.	A.2.1.9	Ongoing	Section B.2.1.9
10	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless steel (CASS) is a new program that will provide for aging management of CASS reactor internal components within the scope of license renewal. The program will include a component specific evaluation of the loss of fracture toughness in accordance with the specified criteria. For those components where loss of fracture toughness may affect function of the component, a supplemental inspection will be performed.	A.2.1.10	Program to be implemented prior to the period of extended operation.	Section B.2.1.10
11	Flow-Accelerated Corrosion	Existing program is credited.	A.2.1.11	Ongoing	Section B.2.1.11

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
12	Bolting Integrity	Bolting Integrity Program is an existing program that will be enhanced to include: 1. In the following cases, bolting material should not be reused: a. Galvanized bolts and nuts, b. ASTM A490 bolts; and c. Any bolt and nut tightened by the turn of nut method.	A.2.1.12	Program to be enhanced prior to the period of extended operation.	Section B.2.1.12
13	Open-Cycle Cooling Water System	Existing program is credited.	A.2.1.13	Ongoing	Section B.2.1.13
14	Closed-Cycle Cooling Water System	Closed-Cycle Cooling Water System is an existing program that will be enhanced to include: 1. New recurring tasks will be established for enhancing the performance monitoring of the Closed Cycle Cooling Water System. 2. New recurring tasks will be established for enhancing the performance monitoring of the Chilled Water System. 3. A one-time inspection of selected Closed-Cycle Cooling Water program components in stagnant flow areas will be conducted to confirm the effectiveness of the Closed-Cycle Cooling Water program. 4. A one-time inspection of selected Closed-Cycle Cooling Water program chemical mixing tanks and associated	A.2.1.14	Program to be enhanced and one-time inspections to be performed prior to the period of extended operation.	Section B.2.1.14

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
		piping will be conducted to confirm the effectiveness of the Closed-Cycle Cooling Water program on the interior surfaces of the tanks and associated piping. 5. The program will be enhanced such that the plant auxiliary building chilled water system, which is part of the Control Area Chilled Water System, will comply with the pure water control program in accordance with EPRI 1007820 prior to the period of extended operation. 6. A one-time inspection of selected Control Area Chilled Water System components, including the plant auxiliary building chilled water system, will be conducted to confirm the effectiveness of the Closed-Cycle Cooling Water program.			
15	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems is an existing program that will be enhanced to include: 1. Visual inspection of structural components and structural bolts for loss of material due to general, pitting, and crevice corrosion and structural bolting for loss of preload due to self-loosening. 2. Visual inspection of the rails in the rail system for loss of material due to wear.	A.2.1.15	Program to be enhanced prior to the period of extended operation.	Section B.2.1.15

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
		3. The acceptance criteria will be enhanced to require evaluation of significant loss of material due to corrosion for structural components and structural bolts, and significant loss of material due to wear of rail in the rail system.			
16	Compressed Air Monitoring	Existing program is credited	A.2.1.16	Ongoing	Section B.2.1.16
17	Fire Protection	Fire Protection is an existing program that will be enhanced to include: 1. The routine inspection procedures will be enhanced to provide additional inspection guidance to identify degradation of fire barrier walls, ceilings, and floors for aging effects such as cracking, spalling and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates. 2. The fire pump supply line functional tests will be enhanced to provide specific guidance for examining exposed external surfaces of the fire pump diesel fuel oil supply line for corrosion during pump tests.	A.2.1.17	Program to be enhanced prior to the period of extended operation.	Section B.2.1.17

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
18	Fire Water System	Fire Water System is an existing program that will be enhanced to include: 1. The Fire Water System aging management program will be enhanced to inspect selected portions of the water based fire protection system piping located aboveground and exposed to the fire water internal environment by non-intrusive volumetric examinations. These inspections shall be performed prior to the period of extended operation and will be performed every 10 years thereafter. 2. The Fire Water System aging management program will be enhanced to replace or perform 50-year sprinkler head inspections and testing using the guidance of NFPA-25 "Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems" (2002 Edition), Section 5-3.1.1. These inspections will be performed prior to the 50-year in-service date and every 10-years thereafter.	A.2.1.18	Program to be enhanced prior to the period of extended operation. Inspection schedule identified in commitment.	Section B.2.1.18

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
19	Aboveground Steel Tanks	Aboveground Steel Tanks is an existing program that will be enhanced to include: 1. The program will be enhanced to include internal UT measurements to measure the wall thickness on the bottom of the tanks supported on a fiber pad on top of the concrete foundation (Fire Water Storage Tanks). Measured wall thickness will be monitored and trended if significant material loss is detected. These thickness measurements of the tank bottom will be taken and evaluated against design thickness and corrosion allowance to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period of operation. 2. The program will be enhanced to provide routine visual inspections of the carbon steel tanks external surfaces (Fire Water Storage Tanks, Fire Diesel Fuel Oil Tank and 17-Ton CO2 Storage Tank), including removal of tank insulation from the Fire Water Storage tank to detect degradation. These inspections will be performed to detect degraded paint and coatings, and any resulting metal degradation, prior to loss of the tank intended function.	A.2.1.19	Program to be enhanced prior to the period of extended operation. Tank bottom UT inspections will also be performed prior to the period of extended operation.	Section B.2.1.19

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
20	Fuel Oil Chemistry	Fuel Oil Chemistry is an existing program that will be enhanced to include: 1. Equivalent requirements for fuel oil purity and fuel oil testing as described by the Standard Technical Specifications. 2. Addition of biocides, stabilizers and corrosion inhibitors as determined by fuel oil sampling or inspection activities. 3. Internal inspection of Diesel Fire Pump Fuel Oil 280-gallon tank (T-565) using visual inspections and ultrasonic thickness examination of tank bottom. 4. Quarterly water and sediment multilevel sampling on the Diesel Fuel Oil Storage Tanks identified in A.2.1.20 5. Internal inspection of the Diesel Fuel Oil Storage Tanks identified in A.2.1.20 using visual inspections and ultrasonic thickness examination of tank bottoms. 6. Quarterly particulate sampling of Diesel Fire Pump Fuel Oil 280-gallon tank (T-565). 7. To confirm the absence of any significant aging effects, a one-time inspection of each of the 550-gallon Diesel Fuel Oil Day Tanks will be performed.	A.2.1.20	Program to be enhanced and one-time inspections to be performed prior to the period of extended operation.	Section B.2.1.20

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
21	Reactor Vessel Surveillance	Reactor Vessel Surveillance is an existing program that will be enhanced to include: 1. Implement the requirements of BWRVIP-116, “BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal,” including the conditions specified by the NRC in its Safety Evaluation dated February 24, 2006. 2. If future plant operations exceed the limitations specified in RG 1.99, the impact of plant operation changes on the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified. Similarly, if future plant operation exceeds the bounds established by surveillance data that are to determine Upper Shelf Energy or P-T limits, then the impact of plant operation changes on the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified. Additionally, when all the surveillance capsules are removed, then operating restrictions will be established to ensure that the plant is operated within the conditions to which the surveillance capsules were exposed. If the reactor vessel exposure conditions (neutron flux, spectrum, irradiation temperature, etc.) are altered, then the basis for the	A.2.1.21	Program to be enhanced prior to the period of extended operation.	Section B.2.1.21

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
		projection to 60 years is reviewed; and, if deemed appropriate, a revised fluence projection is prepared and the effects of the revised fluence analysis on neutron embrittlement calculations will be evaluated. If necessary an active surveillance program will be re-instituted for Hope Creek. The employment of additional surveillance specimens will be coordinated through the BWRVIP Integrated Surveillance Program (ISP). Any changes to the reactor vessel exposure conditions and the potential need to re-institute a vessel surveillance program will be discussed with the NRC staff prior to changing the plant's licensing basis.			
22	One-Time Inspection	One-Time Inspection is a new program and will be used for the following: 1. To confirm the effectiveness of the Water Chemistry program to manage the loss of material, cracking, and the reduction of heat transfer aging effects for aluminum, copper alloy, ductile cast iron, gray cast iron, nickel alloy, steel, stainless steel, and cast austenitic stainless steel in treated water, steam, sodium pentaborate and reactor coolant environments.	A.2.1.22	Program to be implemented prior to the period of extended operation. One-time inspections to be performed within the ten-year period prior to the period of extended operation.	Section B.2.1.22

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
		2. To confirm the effectiveness of the Fuel Oil Chemistry program to manage the loss of material aging effect for copper alloy, steel, galvanized steel and stainless steel in a fuel oil environment. 3. To confirm the effectiveness of the Lubricating Oil Analysis program to manage the loss of material and the reduction of heat transfer aging effects for copper alloy, gray cast iron, steel and stainless steel in a lubricating oil environment. 4. To confirm loss of material in carbon steel piping and fittings is insignificant in an air/gas-wetted (internal) environment.			
23	Selective Leaching of Materials	Selective Leaching of Materials is a new program that will include one-time inspections of a representative sample of susceptible components to determine if loss of material due to selective leaching is occurring.	A.2.1.23	Program to be implemented prior to the period of extended operation. One-time inspections to be performed within the ten-year period prior to the period of extended operation.	Section B.2.1.23
24	Buried Piping Inspection	Buried Piping Inspection is an existing program that will be enhanced to include: 1. At least one opportunistic or focused excavation and inspection of carbon steel, galvanized steel, ductile cast iron and gray cast iron piping and components within ten years prior to entering the period of extended	A.2.1.24	Program to be enhanced prior to the period of extended operation. Inspection schedule identified in commitment.	Section B.2.1.24

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
		operation. Also, upon entering the period of extended operation, a focused excavation and inspection of each of the above materials shall be performed within the first ten years, unless an opportunistic inspection occurs within this ten-year period.			
25	External Surfaces Monitoring	External Surfaces Monitoring is a new program that directs visual inspections of components such as piping, piping components, ducting and other components in the scope of license renewal, exposed to an air environment, to manage aging effects.	A.2.1.25	Program to be implemented prior to the period of extended operation.	Section B.2.1.25
26	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components is a new program that manages the aging of the internal surfaces of piping, piping components and piping elements, tanks and ducting components.	A.2.1.26	Program to be implemented prior to the period of extended operation.	Section B.2.1.26
27	Lubricating Oil Analysis	Existing program is credited.	A.2.1.27	Ongoing	Section B.2.1.27
28	ASME Section XI, Subsection IWE	ASME Section XI, Subsection IWE is an existing program that will be enhanced to include: 1. Install an internal moisture barrier at the junction of the drywell concrete floor and the steel drywell shell prior to the period of extended operation. 2. Require inspection of the moisture barrier for loss of sealing in accordance with IWE 2500 after it is installed.	A.2.1.28	Program to be enhanced prior to the period of extended operation. Inspection schedule identified in commitment.	Section B.2.1.28

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
		3. Verify that the reactor cavity seal rupture drain lines are clear from blockage once prior to the period of extended operation, and one additional time during the first ten years of the period of extended operation. 4. Verify that drains at the bottom of the drywell air gap are clear from blockage once prior to the period of extended operation, and one additional time during the first ten years of the period of extended operation. 5. Investigate the source of any leakage detected by the reactor cavity seal rupture drain line instrumentation and assess its impact on the drywell shell. 6. Monitor the drains at the bottom of the drywell air gap for leakage in the event leakage is detected by the reactor cavity seal rupture drain line instrumentation.			
29	ASME Section XI, Subsection IWF	Existing program is credited.	A.2.1.29	Ongoing	Section B.2.1.29
30	10 CFR Part 50, Appendix J	Existing program is credited.	A.2.1.30	Ongoing	Section B.2.1.30

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
31	Masonry Wall Program	Masonry Wall is an existing program that will be enhanced to include: 1. Additional buildings and masonry walls as described in A.2.1.31. 2. Add an Examination Checklist for masonry wall inspection requirements. 3. Specify an inspection frequency of not greater than 5 years for masonry walls.	A.2.1.31	Program to be enhanced prior to the period of extended operation.	Section B.2.1.31
32	Structures Monitoring Program	Structures Monitoring is an existing program that will be enhanced to include: 1. Additional structures and components as described in A.2.1.32 2. Concrete structures will be observed for a reduction in equipment anchor capacity due to local concrete degradation. This will be accomplished by visual inspection of concrete surfaces around anchors for cracking, and spalling. 3. Clarify inspection criteria for loss of material due to corrosion and pitting of additional steel components, such as embedments, panels and enclosures, doors, siding, metal deck, and anchors. 4. Perform a one-time inspection of the external stainless steel surfaces of the expansion bellows at Condensate Storage Tank Dike for loss of material due to corrosion, within the ten-year	A.2.1.32	Program to be enhanced prior to the period of extended operation. One-time inspection to be performed within the ten-year period prior to the period of extended operation.	Section B.2.1.32

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
		period prior to the period of extended operation. 5. Require inspection of penetration seals, structural seals and elastomers for degradations that will lead to a loss of sealing by visual inspection of the seal for hardening, shrinkage and loss of strength. 6. Require monitoring of vibration isolators, associated with component supports other than those covered by ASME XI, Subsection IWF. 7. Add an Examination Checklist for masonry wall inspection requirements. 8. Parameters monitored for wooden components will be enhanced to include: Change in Material Properties, Loss of Material due to Insect Damage and Moisture Damage. 9. Specify an inspection frequency of not greater than 5 years for structures including submerged portions of the Service Water Intake Structure. 10. Require individuals responsible for inspections and assessments for structures to have a B.S. Engineering degree and/or Professional Engineer license, and a minimum of four years experience working on building structures.			

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
		11. Perform periodic sampling, testing, and analysis of ground water chemistry for pH, chlorides, and sulfates on a frequency of 5 years. 12. Require supplemental inspections of the in scope structures within 30 days following extreme environmental or natural phenomena (large floods, significant earthquakes, hurricanes, and tornadoes). 13. Perform a chemical analysis of ground or surface water in-leakage when there is significant in-leakage or there is reason to believe that the in-leakage may be damaging concrete elements or reinforcing steel. 14. Implementing procedures will be enhanced to include additional acceptance criteria details specified in ACI 349.3R-96.			
33	RG 1.127, Inspection of Water-Control Structures	RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants is an existing program that will be enhanced to include: 1. Shoreline Protection and Dike structures will be added to the program. 2. Parameters monitored for wooden components will be enhanced to	A.2.1.33	Program to be enhanced prior to the period of extended operation.	Section B.2.1.33

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
		include change in material properties and loss of material due to insect damage and moisture damage. 3. The inspection requirement for submerged concrete structural components will be enhanced to require that inspections be performed by dewatering a pump bay or by a diver if the pump bay is not dewatered. 4. Specify an inspection frequency of not greater than 5 years for structures including submerged portions of the Service Water Intake Structure. 5. Require supplemental inspections of the in scope structures within 30 days following extreme environmental or natural phenomena (large floods, significant earthquakes, hurricanes, and tornadoes).			
34	Protective Coating Monitoring and Maintenance Program	Existing program is credited.	A.2.1.34	Ongoing	Section B.2.1.34
35	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements is a new program and will be used to manage aging of non-EQ cables and connections during the period of extended operation.	A.2.1.35	Program and initial inspections to be implemented prior to the period of extended operation.	Section B.2.1.35

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
36	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits is a new program that will be implemented to manage the aging of the cable and connection insulation of the in scope portions of the Leak Detection and Radiation Monitoring System, and the Neutron Monitoring System.	A.2.1.36	Program and initial assessment of testing and calibration results to be implemented prior to the period of extended operation.	Section B.2.1.36
37	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements is a new program that will be used to manage the aging effects and mechanisms of non-EQ, in scope inaccessible medium voltage cables. Manholes and cable vaults associated with the cables included in this aging management program will be inspected as described in A.2.1.37.	A.2.1.37	Program and initial cable tests and manhole inspections to be implemented prior to the period of extended operation.	Section B.2.1.37
38	Metal-Enclosed Bus	Metal Enclosed Bus is a new program that will manage the aging of in-scope metal enclosed busses.	A.2.1.38	Program and initial inspections to be implemented prior to the period of extended operation.	Section B.2.1.38

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
39	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements is a new program that will be used to confirm the absence of an aging effect with respect to electrical cable connection stressors. A representative sample of non-EQ electrical cable connections will be selected, for one-time testing considering application (medium and low voltage), circuit loading (high loading) and location, with respect to connection stressors.	A.2.1.39	Program and one-time testing to be implemented prior to the period of extended operation.	Section B.2.1.39
40	High Voltage Insulators	High Voltage Insulators is a new program that manages the degradation of insulator quality due to the presence of salt deposits or surface contamination.	A.2.2.1	Program to be implemented prior to the period of extended operation.	Section B.2.2.1
41	Periodic Inspection	Periodic Inspection is a new program that manages the aging of piping, piping components, piping elements, ducting components, tanks and heat exchanger components.	A.2.2.2	Program to be implemented prior to the period of extended operation.	Section B.2.2.2
42	Aboveground Non-Steel Tanks	Aboveground Non-Steel Tanks is a new program that will manage loss of material of outdoor non-steel tanks. The Aboveground Non-Steel Tanks program will include a UT wall thickness inspection of the bottom of the only tank in the program, which is the stainless steel condensate storage tank. The UT measurements will be taken to ensure that significant degradation is not occurring and that the component intended function will be maintained during the extended period of operation.	A.2.2.3	Program to be implemented prior to the period of extended operation. Tank bottom UT inspections will also be performed prior to the period of extended operation.	Section B.2.2.3

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
43	Buried Non-Steel Piping Inspection	Buried Non-Steel Piping Inspection is an existing program that will be enhanced to include: 1. At least one opportunistic or focused excavation and inspection of buried reinforced concrete piping and components will be performed within ten years prior to entering the period of extended operation. Upon entering the period of extended operation at least one focused excavation and inspection of buried reinforced concrete piping and components will be performed within the first ten years, unless an opportunistic excavation and inspection occurs within this ten year period. 2. At least one opportunistic or focused excavation and inspection of buried stainless steel piping and components will be performed within ten years prior to entering the period of extended operation. Upon entering the period of extended operation at least one focused excavation and inspection of buried stainless steel piping and components will be performed within the first ten years, unless an opportunistic excavation and inspection occurs within this ten year period. 3. Guidance for inspection of concrete aging effects.	A.2.2.4	Program to be enhanced prior to the period of extended operation. Inspection schedule identified in commitment.	Section B.2.2.4

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
44	Boral Monitoring Program	Existing program is credited.	A.2.2.5	Ongoing	Section B.2.2.5
45	Small-Bore Class 1 Piping Inspection	Small-Bore Class 1 Piping is a new program that will manage the aging effects of cracking in small-bore (greater than or equal to NPS 1 and less than NPS 4) Class 1 piping through the use of a combination of volumetric examinations and visual inspections.	A.2.2.6	Program to be implemented prior to the period of extended operation.	Section B.2.2.6
46	Metal Fatigue of the Reactor Coolant Pressure Boundary	Metal Fatigue of the Reactor Coolant Pressure Boundary is an existing program that will be enhanced to include: 1. Adding transients beyond those defined in the Technical Specifications and the UFSAR, and expanding the fatigue monitoring program to encompass other components identified to have fatigue as an analyzed aging effect, which require monitoring. 2. Using a software program to automatically count transients and calculate cumulative usage on select components. 3. Addressing the effects of the reactor coolant environment on component fatigue life by assessing the impact of the reactor coolant environment on a sample of critical components for the plant identified in NUREG/CR-6260.	A.3.1.1	Program to be enhanced prior to the period of extended operation.	Section B.3.1.1

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
		4. Requiring a review of additional reactor coolant pressure boundary locations if the usage factor for one of the environmental fatigue sample locations approaches its design limit.			
47	Environmental Qualification of Electric Components (EQ)	Existing program is credited.	A.3.1.2	Ongoing	Section B.3.1.2
48	New P-T Curves	Revised Pressure-Temperature (P-T) limits will be submitted to the NRC when necessary to comply with 10 CFR 50 Appendix G.	A.4.2.3	Ongoing	Section 4.2.3
49	RPV Circumferential Weld Examination Relief	PSEG will request relief from the requirement to perform volumetric examinations of the Reactor Pressure Vessel Circumferential Welds, in accordance with 10 CFR 50.55(a)	A.4.2.4	Prior to the period of extended operation.	Section 4.2.4
50	Operating Experience Review	PSEG will perform an evaluation of operating experience at extended power uprate (EPU) levels prior to the period of extended operation to ensure that operating experience at EPU levels is properly addressed by the aging management programs. The evaluation will include Hope Creek and other BWR plants operating at EPU levels.	N/A	Prior to the period of extended operation.	NUREG-1800 Section 3.0.2

NO.	PROGRAM OR TOPIC	COMMITMENT	UFSAR SUPPLEMENT LOCATION (LRA APP. A)	ENHANCEMENT OR IMPLEMENTATION SCHEDULE	SOURCE
51	Reactor Internals Components – Core Plate Rim Hold-Down Bolts	PSEG will perform one of the following: 1. Install core plate wedges, or 2. Perform an analysis that demonstrates the component function is maintained.	A.4.2.7	Prior to the period of extended operation.	Section 4.2.7 and Appendix C
52	Jet Pump Slip Joint Clamp	PSEG will replace the slip joint clamp or perform an analysis that demonstrates the component function is maintained.	A.4.7.3	Prior to the period of extended operation, or prior to reaching the analyzed limit of 35.4 EFPY, whichever comes first.	Section 4.7.3

APPENDIX B AGING MANAGEMENT PROGRAMS
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B.1 INTRODUCTION

B.1.1 OVERVIEW

License renewal Aging Management Program (AMP) descriptions are provided in this appendix for each program credited for managing aging effects based upon the Aging Management Review (AMR) results provided in Sections 3.1 through 3.6 of this application.

In general, there are four (4) types of AMPs:

- Prevention programs preclude aging effects from occurring.
- Mitigation programs slow the effects of aging.
- Condition monitoring programs inspect/examine for the presence and extent of aging.
- Performance monitoring programs test the ability of a structure or component to perform its intended function.

More than one type of AMP may be implemented for a component to ensure that aging effects are managed.

Part of the demonstration that the effects of aging are adequately managed is to evaluate credited programs and activities against certain required attributes. Each of the AMPs described in this section has ten (10) elements which are consistent with the attributes described in Appendix A.1, “Aging Management Review – Generic (Branch Technical Position RLSB-1)” and in Table A.1-1 “Elements of an Aging Management Program for License Renewal” of NUREG-1800. The 10-element detail is not provided when the program is deemed to be consistent with the assumptions made in NUREG-1801. The 10-element detail is only provided when the program is plant specific.

Credit has been taken for existing plant programs whenever possible. As such, all programs and activities associated with a system, structure, component, or commodity grouping were considered. Existing programs and activities that apply to systems, structures, components, or commodity groupings were reviewed to determine whether they include the necessary actions to manage the effects of aging.

Existing plant programs were often based on a regulatory commitment or requirement, rather than aging management. Many of these existing programs included the required license renewal 10-element attributes, and have been demonstrated to adequately manage the identified aging effects. If an existing program did not adequately manage an identified aging effect, the program was enhanced as necessary. Occasionally, the creation of a new program was necessary.

B.1.2 Method of Discussion

For those AMPs that are consistent with the assumptions made in Sections X and XI of NUREG-1801, or are consistent with exceptions, each program discussion is presented in the following format:

- A Program Description abstract of the overall program form and function is provided.
- A NUREG-1801 Consistency statement is made about the program.
- Exceptions to the NUREG-1801 program are outlined and a justification for the exceptions is provided.
- Enhancements or additions to the NUREG-1801 program are provided. A proposed schedule for completion is discussed.
- Operating Experience (OE) information specific to the program is provided.
- A Conclusion section provides a statement of reasonable assurance that the program is effective, or will be effective, once enhanced.

The plant specific AMPs are described in terms of the 10 program elements in NUREG-1800, Section A.1.2.3 “Aging Management Program Elements”.

B.1.3 Quality Assurance Program and Administrative Controls

The Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Appendix A.2, “Quality Assurance For Aging Management Programs (Branch Technical Position IQMB-1)” of NUREG-1800. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls, and is applicable to the safety-related and nonsafety related systems, structures, and components (SSCs) that are subject to AMR. In many cases, existing activities were found adequate for managing aging effects during the period of extended operation. Generically, the three elements are applicable as follows:

Corrective Actions:

A single corrective actions process is applied regardless of the safety classification of the system, structure, or component. Corrective actions are implemented through the initiation of a Notification in accordance with the Corrective Action Program established in response to 10 CFR 50, Appendix B. The Corrective Action Program requires the initiation of a Notification for actual or potential problems, including unexpected plant equipment degradation, damage, failure, malfunction or loss. Site documents that implement aging management programs for license renewal will direct that a Notification be prepared in accordance with those procedures whenever non-conforming conditions are found (i.e., the acceptance criteria are not met). It is noted that previous Corrective Action Programs referred to Condition Reports (CRs) for documenting actual or potential problems and non-conforming conditions. This term is synonymous with the term Notification.

Equipment deficiencies are corrected through the Work Control Program in accordance with plant procedures. Although equipment deficiencies may initially be documented by the Work Control Program, the Corrective Action Program specifies that a Notification also be initiated, if required, for condition identification, assignment of significance level and investigation class, investigation, corrective action determination, investigation report review and approval, action tracking, and trend analysis.

The Corrective Action Program implements the requirements of NO-AA-10, the Salem and Hope Creek Quality Assurance Topical Report (QATR), Chapter 16, "Corrective Action." Specifically, conditions adverse to quality and significant conditions adverse to quality are resolved through direct action, the implementation of corrective actions, and where appropriate, the implementation of corrective actions to prevent recurrence.

Confirmation Process:

The focus of the confirmation process is on the follow-up actions that must be taken to verify effective implementation of corrective actions. The measure of effectiveness is in terms of correcting and precluding repetition of adverse conditions. The Corrective Action Program includes provisions for timely evaluation of adverse conditions and implementation of any corrective actions required, including root cause determinations and prevention of recurrence where appropriate (e.g., significant conditions adverse to quality). The Corrective Action Program provides for tracking, coordinating, monitoring, reviewing, verifying, validating, and approving corrective actions, to ensure effective corrective actions are taken. The Corrective Action Program also monitors for potentially adverse trends. The existence of an adverse trend due to recurring or repetitive adverse conditions will result in the initiation of a Notification. The AMPs required for license renewal would also uncover any unsatisfactory condition due to ineffective corrective action.

Since the same 10 CFR 50, Appendix B corrective actions and confirmation process is applied for nonconforming safety-related and nonsafety-related systems, structures, and components subject to Aging Management Review (AMR) for license renewal, the Corrective Action Program is consistent with the NUREG-1801 elements.

Administrative Controls:

The document control process applies to all generated documents, procedures, and instructions regardless of the safety classification of the associated system, structure, or component. Document control processes are implemented in accordance with the requirements of 10 CFR 50, Appendix B, "Quality Assurance Requirements for Nuclear Power Plants and Fuel Reprocessing Plants." Implementation is further defined in NO-AA-10, the Salem and Hope Creek Quality Assurance Topical Report (QATR), Chapter 6, "Document Control."

Administrative controls procedures provide information on procedures, instructions and other forms of administrative control documents, as well as guidance on classifying these documents into the proper document type and as-building frequency. Revisions will be made to procedures and instructions that implement or administer aging management program requirements for the purposes of managing the associated aging effects for the period of extended operation.

B.1.4 Operating Experience

Operating experience is used in two ways at Hope Creek to enhance plant programs, prevent repeat events, and prevent events that have occurred at other plants from occurring at Hope Creek. The first way in which operating experience is used is through the Hope Creek Operating Experience process (OPEX). The Operating Experience process screens, evaluates, and acts on operating experience documents and information to prevent or mitigate the consequences of similar events. The second way is through the process for managing programs. This process requires the review of program related operating experience by the program owner.

Both of these processes review operating experience from external (also referred to as industry operating experience) and internal (also referred to as in-house) sources. External operating experience may include such things as INPO documents (e.g., SOERs, SERs, SENs, etc.), NRC documents (e.g., GLs, LERs, INs, etc.), and other documents (e.g., 10 CFR Part 21 Reports, etc.). Internal operating experience may include such things as event investigations, trending reports, and lessons learned from in-house events as captured in program notebooks, self-assessments, and in the 10 CFR Part 50, Appendix B corrective action process.

Each AMP summary in this appendix contains a discussion of operating experience relevant to the program. This information was obtained through the review of in-house operating experience captured by the Corrective Action Program, Program Self-Assessments, and Program Health Reports, and through the review of industry operating experience. Additionally, operating experience was obtained through interviews with system and program engineers. New programs utilized plant and or industry operating experience as applicable, and discussed the operating experience and associated corrective actions as they relate to implementation of the new program. The operating experience in each AMP summary identifies past corrective actions that have resulted in program enhancements and provides objective evidence that the effects of aging have been, and will continue to be, adequately managed.

B.1.5 NUREG-1801 Chapter XI Aging Management Programs

The following AMPs are described in the sections listed in this appendix. The programs are either generic in nature as discussed in NUREG-1801, Section XI, or are plant-specific. NUREG-1801 Chapter XI programs are listed in

Section B.2.1. Plant-specific programs are listed in Section B.2.2. All generic programs are fully consistent with or are, with some exceptions, consistent with programs discussed in NUREG-1801. Programs are identified as either existing or new.

1. ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (Section B.2.1.1) [Existing]
2. Water Chemistry (Section B.2.1.2) [Existing]
3. Reactor Head Closure Studs (Section B.2.1.3) [Existing]
4. BWR Vessel ID Attachment Welds (Section B.2.1.4) [Existing]
5. BWR Feedwater Nozzle (Section B.2.1.5) [Existing]
6. BWR Control Rod Drive Return Line Nozzle (Section B.2.1.6) [Existing]
7. BWR Stress Corrosion Cracking (Section B.2.1.7) [Existing]
8. BWR Penetrations (Section B.2.1.8) [Existing]
9. BWR Vessel Internals (Section B.2.1.9) [Existing]
10. Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) (Section B.2.1.10) [New]
11. Flow Accelerated Corrosion (Section B.2.1.11) [Existing]
12. Bolting Integrity (Section B.2.1.12) [Existing]
13. Open-Cycle Cooling Water System (Section B.2.1.13) [Existing]
14. Closed-Cycle Cooling Water System (Section B.2.1.14) [Existing]
15. Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (Section B.2.1.15) [Existing]
16. Compressed Air Monitoring (Section B.2.1.16) [Existing]
17. Fire Protection (Section B.2.1.17) [Existing]
18. Fire Water System (Section B.2.1.18) [Existing]
19. Aboveground Steel Tanks (Section B.2.1.19) [Existing]
20. Fuel Oil Chemistry (Section B.2.1.20) [Existing]
21. Reactor Vessel Surveillance (Section B.2.1.21) [Existing]
22. One-Time Inspection (Section B.2.1.22) [New]
23. Selective Leaching of Materials (Section B.2.1.23) [New]

24. Buried Piping Inspection (Section B.2.1.24) [Existing]

25. External Surfaces Monitoring (Section B.2.1.25) [New]

26. Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (Section B.2.1.26) [New]

27. Lubricating Oil Analysis (Section B.2.1.27) [Existing]

28. ASME Section XI, Subsection IWE (Section B.2.1.28) [Existing]

29. ASME Section XI, Subsection IWF (Section B.2.1.29) [Existing]

30. 10 CFR Part 50, Appendix J (Section B.2.1.30) [Existing]

31. Masonry Wall Program (Section B.2.1.31) [Existing]

32. Structures Monitoring Program (Section B.2.1.32) [Existing]

33. RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants (Section B.2.1.33) [Existing]

34. Protective Coating Monitoring and Maintenance Program (Section B.2.1.34) [Existing]

35. Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (Section B.2.1.35) [New]

36. Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits (Section B.2.1.36) [New]

37. Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (Section B.2.1.37) [New]

38. Metal Enclosed Bus (Section B.2.1.38) [New]

39. Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (Section B.2.1.39) [New]

40. High Voltage Insulators (Section B.2.2.1) [New]

41. Periodic Inspection (Section B.2.2.2) [New]

42. Aboveground Non-Steel Tanks (Section B.2.2.3) [New]

43. Buried Non-Steel Piping Inspection (Section B.2.2.4) [Existing]

44. Boral Monitoring Program (Section B.2.2.5) [Existing]

45. Small-Bore Class 1 Piping Inspection (Section B.2.2.6) [New]

B.1.6 NUREG-1801 Chapter X Aging Management Programs

The following NUREG-1801 Chapter X AMPs are described in Section B.3 of this appendix as indicated. Programs are identified as either existing or new.

1. Metal Fatigue of Reactor Coolant Pressure Boundary (Section B.3.1.1) [Existing]
2. Environmental Qualification (EQ) of Electric Components (Section B.3.1.2) [Existing]

B.2 Aging Management Programs

B.2.0 NUREG-1801 Aging Management Program Correlation

The correlation between the NUREG-1801 (Generic Aging Lessons Learned (GALL)) programs and the Hope Creek Aging Management Programs (AMPs) is shown below. Links to the sections describing the Hope Creek NUREG-1801 programs are provided.

NUREG-1801 NUMBER	NUREG-1801 PROGRAM	HOPE CREEK PROGRAM
XI.M1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (Section B.2.1.1)
XI.M2	Water Chemistry	Water Chemistry (Section B.2.1.2)
XI.M3	Reactor Head Closure Studs	Reactor Head Closure Studs (Section B.2.1.3)
XI.M4	BWR Vessel ID Attachment Welds	BWR Vessel ID Attachment Welds (Section B.2.1.4)
XI.M5	BWR Feedwater Nozzle	BWR Feedwater Nozzle (Section B.2.1.5)
XI.M6	BWR Control Rod Drive Return Line Nozzle	BWR Control Rod Drive Return Line Nozzle (Section B.2.1.6)
XI.M7	BWR Stress Corrosion Cracking	BWR Stress Corrosion Cracking (Section B.2.1.7)
XI.M8	BWR Penetrations	BWR Penetrations (Section B.2.1.8)
XI.M9	BWR Vessel Internals	BWR Vessel Internals (Section B.2.1.9)
XI.M10	Boric Acid Corrosion	Not Applicable (Hope Creek is a BWR)
XI.M11	Nickel-Alloy Nozzles and Penetrations	Not Applicable (Hope Creek is a BWR)
XI.M11A	Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of Pressurized Water Reactors	Not Applicable (Hope Creek is a BWR)

NUREG-1801 NUMBER	NUREG-1801 PROGRAM	HOPE CREEK PROGRAM
XI.M12	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	Not used. See XI.M13. Aging effects managed by Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) (Section B.2.1.10).
XI.M13	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) (Section B.2.1.10)
XI.M14	Loose Part Monitoring	Not used. Not credited for aging management.
XI.M15	Neutron Noise Monitoring	Not Applicable (Hope Creek is a BWR)
XI.M16	PWR Vessel Internals	Not Applicable (Hope Creek is a BWR)
XI.M17	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion (Section B.2.1.11)
XI.M18	Bolting Integrity	Bolting Integrity (Section B.2.1.12)
XI.M19	Steam Generator Tube Integrity	Not Applicable (Hope Creek is a BWR)
XI.M20	Open-Cycle Cooling Water System	Open-Cycle Cooling Water System (Section B.2.1.13)
XI.M21	Closed-Cycle Cooling Water System	Closed-Cycle Cooling Water System (Section B.2.1.14)
XI.M22	Boraflex Monitoring	Not used. Not credited for aging management. This material is not used in the spent fuel pool racks.
XI.M23	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (Section B.2.1.15)
XI.M24	Compressed Air Monitoring	Compressed Air Monitoring (Section B.2.1.16)
XI.M25	BWR Reactor Water Cleanup System	Not used. Not credited for aging management. Hope Creek will not be implementing a BWR Reactor Water Cleanup System program. All three of the screening criteria as specified in XI.M25 BWR Reactor Water Cleanup System have been satisfied at Hope Creek. Refer to relevant discussion in Table 3.3.1, Item 3.3.1-37.
XI.M26	Fire Protection	Fire Protection (Section B.2.1.17)
XI.M27	Fire Water System	Fire Water System (Section B.2.1.18)
XI.M28	Buried Piping and Tanks Surveillance	Not Used. See XI.M34. The aging effects associated with buried piping and tanks are managed by the Buried Piping Inspection program (Section B.2.1.24).
XI.M29	Aboveground Steel Tanks	Aboveground Steel Tanks (Section B.2.1.19)

NUREG-1801 NUMBER	NUREG-1801 PROGRAM	HOPE CREEK PROGRAM
XI.M30	Fuel Oil Chemistry	Fuel Oil Chemistry (Section B.2.1.20)
XI.M31	Reactor Vessel Surveillance	Reactor Vessel Surveillance (Section B.2.1.21)
XI.M32	One-Time Inspection	One-Time Inspection (Section B.2.1.22)
XI.M33	Selective Leaching of Materials	Selective Leaching of Materials (Section B.2.1.23)
XI.M34	Buried Piping and Tanks Inspection	Buried Piping Inspection (Section B.2.1.24)
XI.M35	One-Time Inspection of ASME Code Class 1 Small Bore-Piping	Not used. Plant specific program, Small-Bore Class 1 Piping Inspection, is used (Section B.2.2.6)
XI.M36	External Surfaces Monitoring	External Surfaces Monitoring (Section B.2.1.25)
XI.M37	Flux Thimble Tube Inspection	Not Applicable (Hope Creek is a BWR).
XI.M38	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components (Section B.2.1.26)
XI.M39	Lubricating Oil Analysis	Lubricating Oil Analysis (Section B.2.1.27)
XI.S1	ASME Section XI, Subsection IWE	ASME Section XI, Subsection IWE (Section B.2.1.28)
XI.S2	ASME Section XI, Subsection IWL	Not Applicable. Hope Creek is a BWR with a Mark I steel containment. ASME Section XI, Subsection IWL applies to inspections (or ISI) of reinforced concrete containments, and is therefore not applicable to Hope Creek.
XI.S3	ASME Section XI, Subsection IWF	ASME Section XI, Subsection IWF (Section B.2.1.29)
XI.S4	10 CFR Part 50, Appendix J	10 CFR Part 50, Appendix J (Section B.2.1.30)
XI.S5	Masonry Wall Program	Masonry Wall Program (Section B.2.1.31)
XI.S6	Structures Monitoring Program	Structures Monitoring Program (Section B.2.1.32)
XI.S7	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	RG 1.127. Inspection of Water-Control Structures Associated with Nuclear Power Plants (Section B.2.1.33)
XI.S8	Protective Coating Monitoring and Maintenance Program	Protective Coating Monitoring and Maintenance Program (Section B.2.1.34)
XI.E1	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (Section B.2.1.35)

NUREG-1801 NUMBER	NUREG-1801 PROGRAM	HOPE CREEK PROGRAM
XI.E2	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits (Section B.2.1.36)
XI.E3	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (Section B.2.1.37)
XI.E4	Metal Enclosed Bus	Metal Enclosed Bus (Section B.2.1.38)
XI.E5	Fuse Holders	Not used. The metallic clamp portions of fuse holders have no aging effects requiring management.
XI.E6	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (Section B.2.1.39)
X.M1	Metal Fatigue of Reactor Coolant Pressure Boundary	Metal Fatigue of Reactor Coolant Pressure Boundary (Section B.3.1.1)
X.S1	Concrete Containment Tendon Prestress	Not Applicable (Hope Creek is a BWR with steel containment)
X.E1	Environmental Qualification (EQ) of Electrical Components	Environmental Qualification (EQ) of Electrical Components (Section B.3.1.2)
N/A	Hope Creek plant specific program	High Voltage Insulators (Section B.2.2.1)
N/A	Hope Creek plant specific program	Periodic Inspection (Section B.2.2.2)
N/A	Hope Creek plant specific program	Aboveground Non-Steel Tanks (Section B.2.2.3)
N/A	Hope Creek plant specific program	Buried Non-Steel Piping Inspection (Section B.2.2.4)
N/A	Hope Creek plant specific program	Boral Monitoring Program (Section B.2.2.5)
N/A	Hope Creek plant specific program	Small-Bore Class 1 Piping Inspection (Section B.2.2.6)

B.2.1 NUREG-1801 Chapter XI Aging Management Programs

This section provides summaries of the NUREG-1801 Chapter XI programs credited for managing the effects of aging.

B.2.1.1 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD

Program Description

The Hope Creek ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program is an existing program that is part of the Inservice Inspection (ISI) program. The program includes inspections performed to manage cracking, loss of fracture toughness and loss of material in Class 1, 2, and 3 piping and components exposed to reactor coolant, steam and treated water environments within the scope of license renewal. The program provides for the periodic visual, surface, and volumetric examination and leakage testing of pressure-retaining piping and components including welds, pump casings, valve bodies, integral attachments, and pressure-retaining bolting.

The Hope Creek ASME Section XI program includes the requirements of ASME Code, Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” 2001 edition through 2003 addenda, augmented by Generic Letter 88-01, BWRVIP-75, “Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules,” NUREG-0313, “Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping,” and NUREG-0619, “BWR Feedwater Nozzle and CRD Return Line Nozzle Cracking.” The Hope Creek ASME Section XI program also includes a Risk-Informed Inservice Inspection (RISI) program. The program includes periodic visual, surface, and volumetric examination and leakage test of Class 1, 2, and 3 pressure-retaining components and their integral attachments in the scope of license renewal. Hope Creek programs include, “BWR Feedwater Nozzles”, “BWR Control Rod Drive Return Line Nozzle”, and “BWR Stress Corrosion Cracking.” In accordance with 10 CFR 50.55a(g)(4)(ii), the Hope Creek ISI program is updated each successive 120-month inspection interval to comply with the requirements of the latest edition of the ASME Code specified twelve months before the start of the inspection interval.

Hope Creek has experienced an occurrence of cracking of ASME Code Class 1 small-bore piping resulting from thermal and mechanical cyclic loading. Because of this, a plant-specific program, Small-Bore Class 1 Piping Inspection, is credited with the aging management of ASME Code Class 1 small-bore piping in lieu of the NUREG-1801 program XI.M35, “One Time Inspection of ASME Code Class 1 Small-Bore Piping.”

The Hope Creek ASME inservice inspection program is to be augmented as identified in the GALL Report to manage effects by other programs including, "Water Chemistry."

The Hope Creek ISI program details the requirements for the examination and testing, repair, and replacement of components specified in ASME Section XI Subsections IWB-1100, IWC-1100, and IWD-1100 for Class 1, 2, and 3, respectively, including pressure-retaining components and their integral attachments.

The Hope Creek ASME inservice inspection program includes an alternate method approved in accordance with 10 CFR 50.55a, which is used to determine the inspection locations, inspection frequency, and inspection techniques for Class 1 Category B-F and B-J, and Class 2 Category C-F-1 and C-F-2 welds in accordance with 10 CFR 50.55a(a)(3)(i). This method also addresses volumetric examination of welds less than NPS 4 inches.

The ISI program consists of condition monitoring activities that detect degradation of components before loss of intended function. No preventive or mitigating attributes are associated with these activities.

The Hope Creek ISI program plans provide the ISI 10-Year Program and Schedules, which includes the examination categories and descriptions as identified in ASME Section XI, Tables IWB-2500-1, IWC-2500-1, and IWD-2500-1.

The Hope Creek ISI program plan provides the extent and schedule of inspections, and the plan's inservice inspection tables provide the examination categories, descriptions, and examination requirements, as specified in ASME Section XI, Table IWB-2500-1 for Class 1 components, Table IWC-2500-1 for Class 2 components, and IWD-2500-1 for Class 3 components. Alternative approved methods that meet the requirements of IWA-2240 are also specified in these tables and are identified in the ISI program plans as NRC accepted ASME Code Cases that are implemented as part of the program.

The Hope Creek ISI program uses three types of examination: visual, surface, and volumetric, in accordance with the general requirements of Subsection IWA-2000.

At Hope Creek the in-vessel examination procedures are consistent with the requirements of BWRVIP-03 and other appropriate BWRVIP guidelines, as well as the requirements of Section XI of the ASME Boiler and Pressure Vessel Code. Hope Creek does not currently apply inspection relief for vessel internal components with hydrogen water chemistry in accordance with BWRVIP-62.

The required examinations in each examination category for Class 1, 2, and 3 components subject to examination per Section XI, Subsection IWB, IWC, and IWD, will be completed during the inspection interval in accordance with the schedule and extent of Tables IWB-2412-1, IWC-2412-1, and IWD-2412-1, respectively, or alternatives approved by the NRC, per the Hope Creek plan.

In accordance with the ASME Section XI Code requirements, the Hope Creek implementing procedure requires flaw indications, or relevant conditions of degradation, to be evaluated in accordance with IWB-3132.3 or IWB-3142.4. If the component is qualified as acceptable for continued service, the areas containing such flaw indications or relevant conditions will be reexamined during the next three inspection periods for Class 1 components in accordance with IWB-2420 (b) and (c). If flaw indications, or relevant conditions of degradation are evaluated in accordance with IWC-3122.3 or IWC-3132.3, and the component is qualified as acceptable for continued service, the areas containing such flaw indications or relevant conditions will be reexamined during the next inspection period for Class 2 components in accordance with IWC-2420 (b) and (c). If flaw indications, or relevant conditions are evaluated in accordance with IWB-3100, and the component qualifies as acceptable for continued service, the areas containing such flaw indications or relevant conditions will be reexamined during the next inspection period for Class 3 components in accordance with IWD-2420 (b).

If examinations reveal flaws or indications exceeding the acceptance standards, the initial expansion of examinations will comply with the requirements of IWB-2430 (a), IWC-2430 (a), IWD-2430 (a) for Class 1, 2, or 3 respectively, or alternatives approved by the NRC. If the examinations reveal additional indications exceeding the standards of IWB-3000 and IWC-3000, then a second expansion of scope is required in the current outage. This second expansion will comply with the requirements of IWB-2430 (b), IWC-2430 (b), and IWD-2430 (b) for Class 1, 2, or 3 respectively, or alternatives approved by the NRC.

Indications and relevant conditions detected during examinations are evaluated in accordance with ASME Section XI, Articles IWB-3000 for Class 1, IWC-3000 for Class 2, and IWD-3000 for Class 3, per the Hope Creek ISI program.

In the event that weld repair of nickel alloy or welding of irradiated structural components of the reactor vessel or internals are performed, the guidance of BWRVIP-44 and BWRVIP-45 would be met. All BWR vessel and internal repairs performed meet the applicable BWRVIP guidelines and ASME code requirements.

NUREG-1801 Consistency

The Hope Creek ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program is consistent with the ten elements of aging management program XI.M1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD specified in NUREG 1801**.**

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that cracking due to stress corrosion cracking, cracking due to thermal and mechanical loading, cracking due to cyclic loading, loss of fracture toughness due to thermal aging embrittlement and loss of material due to general, pitting and crevice corrosion are being adequately managed. The following examples of operating experience provide objective evidence that the Hope Creek ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. An unacceptable linear indication was detected on "A" Reactor Recirculation inlet weld RPV1-N2KSE (RPV nozzle to safe end weld) during the 2004 refueling outage. The flaw was axially oriented and located in the RPV nozzle weld. The flaw was detected by an ultrasonic examination, which was being conducted to meet the requirements of Generic Letter 88-01 and NUREG-0313 for IGSCC. The indication was detected using an automated Performance Demonstration Initiative (PDI)-qualified UT detection technique, and an approximate flaw size of 0.75" long by 0.35" deep was obtained using a manual UT sizing technique. The results of the examination was entered into the plant corrective action process. The ISI inspections during this refueling outage was the first-time use of the PDI ultrasonic inspection technique, which was demonstrated to have significantly better flaw detection capabilities than the ultrasonic inspection techniques previously qualified and used for IGSCC inspections. A cause and effect analysis and review of operating experience relative to BWR pipe cracking was used to determine the apparent cause. The N2K weld flaw was attributed to stress corrosion cracking. Corrective actions consisted of a weld overlay for repair of the flaw. Extent of condition review and requirements of GL 88-01 resulted in an expanded inspection scope of two additional recirculation inlet nozzles. No flaws were detected as a result of these expanded inspections. An extent of cause review and additional corrective actions for contributing factors was also performed as part of the evaluation. Follow-up actions as a result of this event and new industry related operating experience from another nuclear plant and a BWR Vessel Internals Project letter during the year 2007 led to a review of past UT data and weld configurations that prompted additional inspections to be performed during the 2007 refueling outage, when another indication was found in a recirculation inlet weld (RPV nozzle to safe end). The characteristics of the flaw found in 2007 were consistent with Intergranular Stress Corrosion Cracking (IGSCC). An approximate flaw size of 13.2-inches long (ID length) by 1.311-inches deep was obtained using a PDI-qualified automated UT sizing technique. The maximum depth of the flaw (89% through wall) was recorded for approximately 1-inch of the flaw length and the remaining length of the flaw the depth was observed to be approximately 40% through wall. This example provides objective evidence that the program provides appropriate guidance for inspection and evaluation, that deficiencies are entered into the corrective action process, and that appropriate actions for extent of condition and cause are taken as

necessary to ensure effective condition monitoring of piping and components within the scope of license renewal.

2. An unacceptable linear indication was detected on Hope Creek Reactor Recirculation inlet weld RPV1-N2ASE (RPV nozzle to safe end weld) during the 2007 refueling outage. The flaw was circumferentially oriented and located in the RPV nozzle side of the weld. The indication was detected using an automated Performance Demonstration Initiative (PDI)-qualified UT detection technique, which has been demonstrated to have significantly better flaw detection capabilities than the ultrasonic inspection techniques previously qualified and used for IGSCC inspections. The inspection was being conducted in response to recent operating experience (OE) from another nuclear plant and a subsequent re-examination analysis of past Hope Creek automated UT data as recommended by the Boiling Water Reactor Vessel and Internals Project (BWRVIP), and as followup inspections resulting from an unacceptable indication discovered during the 2004 refueling outage. The characteristics of the flaw were consistent with Intergranular Stress Corrosion Cracking (IGSCC). An approximate flaw size of 13.2-inches long (ID length) by 1.311-inches deep was obtained using a PDI-qualified automated UT sizing technique. The maximum depth of the flaw (89% through wall) was recorded for approximately 1-inch of the flaw length and for the remaining length of the flaw the depth was observed to be approximately 40% through wall. The condition was entered into the corrective action program where cause and corrective actions were determined. An Apparent Cause Evaluation was performed and determined the inherent susceptibility of Alloy 82 and 182 weld metal to stress corrosion cracking (SCC) in the BWR primary coolant, particularly in the presence of aggravating factors such as previous machining on the ID surface of the weld root, was the apparent cause for this flaw. Corrective actions consisted of a weld overlay for repair of the flaw and an expanded inspection scope to examine two (2) additional nozzle to vessel dissimilar metal (DM) welds during the 2007 outage. The two additional welds examined were the N2D Recirculation inlet nozzle to safe end weld and the N9 CRD return nozzle DM weld. The two welds were screened due to having the highest IGSCC susceptibility ranking. No unacceptable flaws were found. An extent of cause and additional corrective actions for contributing factors was also performed as part of the evaluation. This example provides objective evidence that the program provides appropriate guidance for inspection and evaluation, that deficiencies are entered into the corrective action process, and that appropriate action (expansion of scope due to observed conditions) is taken as necessary to ensure effective condition monitoring of piping and components within the scope of license renewal.

3. During the 2003 refueling outage, a VT-2 in-service leak test was performed on Class 1 systems. During the inspections the following discrepancies were noted and entered into the corrective action process for appropriate corrective action. A packing leak of 26 drops per minute was noted on valve AB-F016B, a packing leak of 3 drops per minute was noted on valve 1FCV-002, a leak of 35 drops per minute was noted on the “B” recirculation pump seal, a small through seat leak was noted on solenoid

valve 1HB-HV-5228, and seven leaks were identified ranging from 5 to 50 drops per minute from control rod drive flange joints. All of the above identified leaks were either repaired or dispositioned utilizing the corrective action process. Although none of the leaks constituted a loss or degradation of the Class 1 pressure boundary, the inspection techniques and sensitivity to reporting these types of leaks demonstrates a high level of assurance that the program provides appropriate guidance for inspection and evaluation, that deficiencies are entered into the corrective action process, and that appropriate action is taken as necessary to ensure effective condition monitoring of piping and components within the scope of license renewal.

A review of approximately five years of inservice inspection results revealed that one thousand and twenty one inspections have been performed with only four unacceptable conditions noted. Two of those conditions have been discussed above, and the other two are related to misalignments of pipe supports. The operating experience of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program did not show any adverse trend in performance. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing Hope Creek ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD aging management program provides reasonable assurance that the identified aging effects are adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.2 Water Chemistry

Program Description

The Hope Creek Water Chemistry aging management program is an existing program whose activities consist of monitoring and controlling the chemical environments of those systems that are exposed to reactor water, steam, condensate and feedwater, control rod drive water, demineralized water storage tank (DWST) water, condensate storage tank (CST) water, torus water, and spent fuel pool water, such that aging effects of system components are minimized. This program manages the aging effects of cracking, loss of material, reduction of neutron-absorbing capacity and reduction of heat transfer. Chemical control of the Hope Creek water systems minimizes contaminant concentration; mitigates loss of material due to general, crevice, and pitting corrosion; and mitigates cracking caused by corrosion and stress corrosion cracking (SCC) in addition to other aging mechanisms. Major component types include the reactor vessel, reactor internals, piping, piping elements and piping components, heat exchangers and tanks. Reactor water, condensate, control rod drive water, feedwater, demineralized water storage tank water, condensate tank water, torus water and spent fuel pool water are classified as treated water for aging management. The water chemistry program is also credited for mitigating loss of material and cracking for components exposed to sodium pentaborate, steam and reactor coolant environments. The Standby Liquid Control system contains a demineralized water and sodium pentaborate solution controlled in accordance with plant procedures and Technical Specifications.

The Hope Creek Water Chemistry aging management program activities are implemented using station procedures and processes. Chemical control strategies for the Hope Creek water chemistry program are defined in the BWR Chemistry Optimization procedure. The Hope Creek water chemistry program follows the guidance set forth in EPRI 1008192 "BWRVIP-130: BWR Vessel and Internals Project; BWR Water Chemistry Guidelines – 2004 Revision", which is a later revision to the guidelines referenced above in NUREG-1801, XI.M2 (BWRVIP-29). However, NUREG-1801, XI.M2 states that later revisions are acceptable.

Hope Creek has chosen a strategy that uses ECP or the measured molar ratio of hydrogen to oxygen as the primary indicator of IGSCC mitigation with proof of sufficient catalyst loading. Hope Creek monitors ECP via a standard GE Mitigation Monitoring System (MMS). It is connected to the common discharge of the RWCU pumps and flow is returned to the common suction of the RWCU pump. If ECP is unavailable, the measured molar ratio of hydrogen to oxygen can be used as an alternate indicator of protection. BWRVIP-118 and BWRVIP-62 both recommend that the hydrogen injection rate should be set to maintain a molar ratio of 3:1 at the location to be protected. The target injection rate for each BWR is a molar ration of 3:1, and Hope Creek achieves this ratio. In addition Hope Creek has a coupon mitigation monitoring system in accordance with BWRVIP-130. The coupons are removed and analyzed approximately twice per cycle to ensure a proper noble metal application. The

EPRI guidelines in BWRVIP-130 for BWR feedwater, condensate, and control rod drive water recommend that conductivity, dissolved oxygen level, and concentrations of iron and copper (feedwater only) are monitored and kept below the recommended levels to mitigate SCC. The EPRI guidelines in BWRVIP-130 also include recommendations for controlling water chemistry in auxiliary systems: torus/pressure suppression chamber, condensate storage tank, and spent fuel pool.

Hope Creek chemistry monitors and controls known detrimental contaminants such as chlorides and sulfates for the Condensate Storage Tank (CST), Demineralized Water Storage Tank (DWST), Spent Fuel Pool, Torus, Condensate & Feedwater in accordance with BWRVIP-130.

Hope Creek chemistry monitors conductivity of the Condensate Storage Tank (CST), Demineralized Water Storage Tank (DWST) and Torus water in accordance with BWRVIP-130.

Control Rod Drive chemistry monitors and controls conductivity and dissolved oxygen in accordance with BWRVIP-130.

The managing of aging effects on Standby Liquid Control (SBLC) system components subject to the sodium pentaborate environment relies on monitoring and control of SBLC poison storage tank makeup water chemistry. The makeup water is monitored in lieu of the sodium pentaborate solution in the storage tank, because the sodium pentaborate would mask most of the chemistry parameters monitored. The effectiveness of the water chemistry program will be verified by a one-time inspection of selected SBLC system components as part of the One-Time Inspection aging management program.

The Hope Creek procedures set goal values that meet values set by EPRI BWRVIP-130. When a monitored parameter exceeds the goal values, the procedure requires that the values be confirmed, corrective action be taken to return the parameter to the desired range. The sampling frequencies are specified in station procedures in accordance with EPRI water chemistry guidelines. Whenever corrective actions are taken to address an abnormal chemistry condition, increased sampling is utilized to verify the effectiveness of these actions.

Industry experience has shown that water chemistry programs may not be effective in low flow or stagnant flow areas of plant systems. The Water Chemistry aging management program does not provide for detection of aging effects. However, components located in such areas at Hope Creek will receive a one-time inspection prior to the period of extended operation. This inspection will be performed as part of the Hope Creek One-Time Inspection aging management program. This program includes provisions specified by NUREG-1801 for the verification of proper chemistry control and aging management; such that the intended functions of plant components will be maintained during the period of extend operation for Hope Creek components.

Site quality assurance procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B.

NUREG-1801 Consistency

The Water Chemistry aging management program is consistent with the ten elements of aging management program XI.M2, "Water Chemistry," specified in NUREG-1801 with the following exceptions:

Exceptions to NUREG-1801

1. NUREG-1801 indicates that hydrogen peroxide is monitored to mitigate degradation of structural materials. The Hope Creek program does not monitor for hydrogen peroxide. **Program Elements Affected: Scope of Program (Element 1) and Parameters Monitored or Inspected (Element 3).**

Justification for Exception

Rapid decomposition of hydrogen peroxide makes reliable data difficult to obtain and BWRVIP-130 Section 6.3.3, "Water Chemistry Guidelines for Power Operation," does not address monitoring for hydrogen peroxide. Noble metal chemical application and hydrogen addition to feedwater has been applied in order to mitigate occurrence of IGSCC of structural materials by suppressing the formation of hydrogen peroxide. The hydrogen addition has accomplished an Electrochemical Corrosion Potential (ECP) value less than -230mV, SHE (Standard Hydrogen Electrode). By maintaining a low ECP less than -230mV, SHE, the reactor water chemistry minimizes the effects from hydrogen peroxide below the threshold that prompted the issue raised in NUREG 1801. Hope Creek uses the ISI program to investigate whether structural degradation in potentially affected locations is ongoing. The Hope Creek ISI program provides for condition monitoring of the reactor vessel, reactor internal components and ASME Class 1 pressure retaining components in accordance with ASME Section XI, Subsection IWB. Indications and relevant conditions detected during examinations are evaluated in accordance with ASME Section XI Articles IWB-3000, for Class 1.

2. NUREG-1801 indicates that dissolved oxygen is monitored. The condensate storage tank water, demineralized water storage tank water, spent fuel pool water and torus water are not sampled for dissolved oxygen. **Program Elements Affected: Scope of Program (Element 1) and Parameters Monitored or Inspected (Element 3).**

Justification for Exception

This is consistent with the guidance provided in BWRVIP-130. The Hope Creek chemistry procedures require monitoring of conductivity, chlorides, sulfates and total organic carbon (TOC) in accordance with limits set by BWRVIP-130 as an alternate method for ensuring component integrity.

3. NUREG-1801 indicates that water quality (pH and conductivity) is maintained in accordance with established guidance. The pH is not monitored for torus water. **Program Elements Affected: Scope of Program (Element 1) and Parameters Monitored or Inspected (Element 3).**

Justification for Exception

BWRVIP-130, "BWR Water Chemistry Guidelines," Section 8.2.1.11, indicates pH measurement accuracy in most BWR streams is unreliable because of the dependence of the instrument reading on ionic strength of the sample solution. In addition, the monitoring of pH is not discussed in BWRVIP-130, Appendix B for condensate storage tank, demineralized water storage tank, or torus water. Hope Creek monitors pH in the Condensate Storage Tank & Demineralized Water Storage Tank. Alternate methods are applied to monitor the water chemistry of the torus in lieu of direct pH measurements. The Hope Creek chemistry procedures require monitoring of conductivity, chlorides and sulfates in accordance with limits set by BWRVIP-130.

4. Aging of Standby Liquid Control system components subject to the sodium pentaborate environment relies on control of SBLC poison storage tank water chemistry. The sodium pentaborate solution is not monitored. The makeup water to the tank is monitored in lieu of the sodium pentaborate solution in the storage tank. **Program Elements Affected: Scope of Program (Element 1) and Detection of Aging Effects (Element 4).**

Justification for Exception

The makeup water to the tank is monitored in lieu of the sodium pentaborate solution in the storage tank because the sodium pentaborate would mask most of the monitored water chemistry parameters. The effectiveness of the water chemistry program will be verified by a one-time inspection of selected Standby Liquid Control system components as part of the One-Time Inspection aging management program.

Enhancements

None.

Operating Experience

The Water Chemistry aging management program is a mitigation program that assures contaminants are maintained below applicable limits to mitigate the aging of plant piping and components. Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that cracking, loss of material, reduction of neutron-absorbing capacity and reduction of heat transfer are being adequately managed. The following examples of operating experience provide objective evidence that the Hope Creek Water Chemistry aging management program will be effective in assuring that intended functions will be maintained consistent with the current licensing bases for the period of extended operation:

1. Hope Creek began service of full flow condensate pre-filters in June 1999 in response to a long-standing plant issue, high feedwater iron concentration. Feedwater iron typically ran 6 to 8 ppb with desired levels at less than 2 ppb. Within a week of going in service, feedwater iron concentration dropped to below 0.1 ppb prompting chemistry personnel to begin iron oxide addition through the active zinc injection system. Prior to pre-filters,

deep bed condensate demineralizers were removed from service at the frequency of one vessel per week. The resin was removed from the vessel and rinsed with 60,000 to 80,000 gallons of water to remove entrained insoluble iron. This cleaning process prevented Hope Creek from using anion underlays for enhanced sulfate removal, a secondary seasonal issue for reactor water. Typical summer sulfate values were above 3 ppb with desired level less than 2 ppb. Following pre-filter service, iron buildup in the condensate polishers was no longer a problem allowing the chemistry staff to implement anion underlays. From that point on, condensate demineralizer beds were no longer cleaned and reactor sulfates dropped to less than 1 ppb year round. Allowing the resins to sit static drastically improved reactor water chemistry and lengthened resin bed life from approximately 2 years to over 4 years. This demonstrates the Water Chemistry program's ability to initiate and implement corrective actions based on elevated chemistry parameters. The installation of the pre-filters not only allowed the Water Chemistry program to bring the feedwater iron concentrations to desired levels, it also enabled the chemistry department to implement other improvements to the program.

2. Condensate demineralizer influent (CDI) conductivity showed a very small increase on 03/28/06 from an average of 0.0555 to an average of 0.0565 uS/cm. The increase remained constant into 03/29/06. CDI chloride was measured on 03/29/06 at 0.46 and 0.49 ppb. Chloride should be at the limit of detection of <0.22 ppb. A review of hotwell and driptray conductivities showed a single increase in the B-North driptray from 0.11933 to 0.21940 uS/cm on 03/28/06, therefore continued trending was performed. CDI conductivity reached 0.058 uS/cm on 04/03/06; this is the Action Level 1 value, which invoked increased monitoring and implementation of long term corrective action planning. Upon isolation of the B-North waterbox in preparation for the April 2006 refueling outage (RF13), CDI conductivity returned to 0.055 uS/cm. During startup from RF13, chemistry personnel utilized leak check dimple plugs in the B-North inlet waterbox. Two leaking tubes were identified and plugged. No further leak indications were seen in the B-North waterbox. This example illustrates that the Hope Creek water chemistry program is effective in monitoring and detecting unexpected parameters as well as investigating and resolving the reason for the unanticipated chemistry value.

3. During the October 2004 refueling outage (RF12) Hope Creek replaced the low-pressure turbine rotors and shells, and moisture separator internals. During startup from the outage chemistry identified an increase in condensate conductivity when the turbine was synchronized with the grid. Samples showed the presence of both inorganic and organic chloride species. Reactor water was sampled within 15 minutes and showed an increasing chloride concentration. Reactor vessel increased to a maximum of 3.44 ppb chloride (Action Level 1 is 5ppb). As a result of the increase, the chemistry department performed increased sampling. The chlorides remained elevated for approximately 10 days while it was determined that the intrusion had poisoned the two condensate demineralizers that were in service at the time. When these two beds were finally removed from service, reactor water chlorides returned to normal levels of <0.22 ppb. The

cause of the increase chloride levels was theorized to be remnants of an organic lubricant / solvent used during the manufacturing process of the replaced low-pressure turbine and moisture separator. When steam flow increased it "flushed out" the remains of the lubricant on the replaced components, which resulted in the increased chloride levels. Chemistry detected the increased levels immediately and was able to monitor the changing parameters. This monitoring was useful in determining the source of the contaminants and later determining that the condensate demineralizers in service at the time of the event were exhausted because the condensate demineralizers were poisoned by the organic lubricant /solvent. This is another illustration that the Hope Creek water chemistry program is effective in monitoring and detecting unexpected parameters as well as aiding in the investigation and resolution of the unanticipated chemistry value.

The operating experiences discussed above are examples of abnormal transients that were identified by routine monitoring activities and corrective actions that were put in place to correct or prevent reoccurrence of such transients in the future. Over the past five years Hope Creek has not exceeded an Action Level 1 limit, except for reactor water conductivity. However, each time the limit was exceeded it was caused by a non-deleterious condition, specifically a loss of hydrogen water chemistry. Currently there are no indications of intergranular stress corrosion cracking (IGSCC) at Hope Creek. Additionally, there have been three indications of IGSCC identified and repaired from 1997 thru 2007.

Additionally, assessments of the Water Chemistry program are performed to identify the areas that need improvement to maintain the quality performance of the program. The information above provides objective evidence that the current Water Chemistry aging management program is effective in mitigating the aging effect of cracking at Hope Creek.

Conclusion

The existing Water Chemistry aging management program, supplemented by the One-Time Inspection Program, provides reasonable assurance that cracking, loss of material reduction of neutron-absorbing capacity and reduction of heat transfer aging effects will be managed such that the systems and components with the scope of the program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.2.1.3 Reactor Head Closure Studs

Program Description

The Reactor Head Closure Studs Aging Management Program is an existing program that provides for ASME Section XI inspections of reactor head closure studs, nuts and washers for cracking due to stress corrosion cracking (SCC) or intergranular stress corrosion cracking (IGSCC), loss of material due to wear, and coolant leakage from reactor vessel closure stud bolting. The Reactor Head Closure Studs program is a condition based monitoring program that effectively monitors and detects the applicable aging effects. The frequency of monitoring is adequate to prevent significant degradation. The program is based on the examination and inspection requirements specified in the 1998 ASME Section XI B&PV Code, Subsection IWB, including 2000 addenda, Table 2500-1, and preventive measures described in NRC Regulatory Guide 1.65, “Materials and Inspection for Reactor Vessel Closure Studs.”

The Reactor Closure Head Studs program implements ASME Section XI inspection requirements through the ISI program plan. The inspections monitor for size of cracking, loss of material due to wear, and coolant leakage from reactor vessel closure stud bolting.

The program uses visual and volumetric examinations in accordance with the general requirements of Section XI Subsection IWA-2000. The Reactor Head Closure Studs program was developed in accordance with the requirements detailed in the ASME Boiler and Pressure Vessel Code, Section XI, Division 1, Subsections IWA, IWB, Mandatory Appendices, and Inspection Program B of IWA-2432.

ASME Section XI allows for a number of examinations methods to be used for volumetric and visual inspections. The applicable editions of the ASME Codes do not require surface examinations; thus, surface examinations of the head studs are not performed. This is acceptable in accordance with the approved code year requirements under 10 CFR 50.55a. The flange threads receive a volumetric examination and the surfaces of nuts and washers are inspected using a VT-1 examination. Bushing examinations are not required since no bushings exist on the reactor studs. All pressure-retaining boundary components in Examination Category B-P receive a visual VT-2 examination during the system leakage test and the system hydrostatic test.

The extent and schedule for examining and testing the reactor head closure studs, nuts, and washers are as specified in Table IWB-2500-1 for B-G-1 components, “Pressure Retaining Bolting Greater than 2 Inches in Diameter”.

Indications and relevant degraded conditions detected during examinations are evaluated in accordance with ASME Section XI Subsection IWB-3100, for Class 1 components by comparing ISI results with the acceptance standards of IWB-3400 and IWB-3500. Specifically, flaw indications or relevant degraded conditions are evaluated in accordance with IWB-3515 or IWB-3517 as indicated in Table IWB-2500-1 and Table 3410-1 of ASME Section XI.

The Hope Creek Reactor Head Closure Studs program includes the preventive measures to mitigate cracking described in NRC Regulatory Guide 1.65, which includes the use of approved corrosion inhibitors and lubricants. The reactor head closure studs, nuts, and washers are not metal-plated and are surface treated with an acceptable phosphate coating to inhibit corrosion and reduce SCC and IGSCC. In addition, approved lubricants are applied to the nuts and threads and all bearing surfaces of the nuts and washers prior to reactor vessel head re-installation.

The reactor head closure studs are constructed of ASME A540 Grade B23, Class 3 material, which has a maximum tensile strength of less than 170 ksi, which complies with NRC Regulatory Guide 1.65.

NUREG-1801 Consistency

The Reactor Head Closure Studs aging management program is consistent with the ten elements of aging management program XI.M3, Reactor Head Closure Studs, specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

The Reactor Head Closure Studs aging management program has provisions regarding inspection techniques and evaluation, material specifications, corrosion prevention, and other aspects of reactor pressure vessel head stud cracking. Implementation of the program provides reasonable assurance that the effects of cracking due to SCC or IGSCC and loss of material due to wear are adequately managed.

The following examples of operating experience provide objective evidence that the Reactor Head Closure Studs program is effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. All reactor head closure studs were examined by the UT method during the spring, 2006 outage (RFO13). All reactor head closure studs, nuts washers were examined by the VT-1 method during the spring, 2006 outage (RFO13). Note: Closure nut number 66 exhibited gouge marks on the outside of the top surface of the nut. This was previously identified, documented, and evaluated as acceptable in the corrective action program. No other recordable indications were identified.

2. All reactor head closure studs were examined by the UT method during the 1995 extended outage (RFO6). All reactor head closure studs and nuts were examined by the fluorescent magnetic particle method, and all closure washers were examined by the VT-1 method during the 1994 refueling outage (RFO5). The results of these examinations were all acceptable.

The operating experience of the Reactor Head Closure Studs program shows there are no signs of age related degradation. This has been demonstrated by past satisfactory test and inspection results. Since no age related degraded conditions have existed, no investigations and corrective actions have been required. Historically, inspections have found the reactor studs, nuts, and washers to be in satisfactory condition and no studs, nuts or washers have ever been replaced or repaired as a result of age related degradation. This provides objective evidence that the current Reactor Head Closure Studs program effectively monitors for stress corrosion cracking.

The operating experience of the Reactor Head Closure Studs program did not show any adverse trend in performance. The problem identified above which was not age related would not cause a significant impact to the safe operation of the plant. There is sufficient confidence that the continued implementation of the Reactor Head Closure Studs program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Reactor Head Closure Studs program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing Reactor Head Closure Studs program provides reasonable assurance that aging effects are adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.4 BWR Vessel ID Attachment Welds

Program Description

The BWR Vessel ID Attachment Welds aging management program is an existing program that manages the effects of cracking of reactor vessel internal attachment welds exposed to reactor coolant through water chemistry and ASME Section XI Inservice Inspections (ISI). The program incorporates the inspection and evaluation recommendations of BWRVIP-48-A, as well as the water chemistry recommendations of BWRVIP-130. The program is implemented through station procedures that provide for mitigation of cracking through water chemistry and condition monitoring through in-vessel examinations of the reactor vessel internal attachment welds. The scope of the programs includes the steam dryer support and hold down brackets, guide rod wall bracket, feedwater sparger bracket, jet pump riser braces, core spray piping brackets, and surveillance sample holder brackets.

Hope Creek station mitigates the potential for SCC and IGSCC by maintaining high water purity through the water chemistry program. The reactor water chemistry program monitors and controls known detrimental contaminants in accordance with the recommendations of BWRVIP-130 (EPRI TR-1008192). The program description and the evaluation and technical basis of monitoring and maintaining reactor water chemistry are presented in the B.2.1.2, Water Chemistry Program. As is described in the Water Chemistry program, BWRVIP-130 replaced BWRVIP-29 as the BWR water chemistry standard. A revision later than BWRVIP-29 is permitted by NUREG-1801, Program XI.M1.

The program monitors the effects of SCC and IGSCC on the intended function of vessel attachment welds by the detection and sizing of cracks by ISI in accordance with the guidelines of NRC approved BWRVIP-48-A and the requirements of the American Society of Mechanical Engineers (ASME) Code, Section XI, Table IWB-2500-1. The jet pump riser brace and core spray piping bracket attachment welds are inspected in accordance with the frequency and methods described in BWRVIP-48-A. The dryer support bracket and feedwater sparger bracket attachment welds are inspected using EVT-1 techniques while maintaining the inspection frequency per ASME Section XI Examination Category for B-N-2 components. The remaining attachment welds are inspected in accordance with ASME Section XI, Table IWB 2500-1.

Evaluation of indications is conducted consistent with IWB-3500 and IWB-3600 of Section XI of the ASME Code and the additional guidance provided in BWRVIP-48-A.

Flaw evaluations for the vessel ID attachment welds, if needed, utilize the guidance of BWRVIP-14, BWRVIP-59, and BWRVIP-60 guidelines for evaluation of crack growth in stainless steels, nickel alloys, and low-alloy steels, respectively as applicable.

If flaws are found, the scope of the inspection is expanded in accordance with ASME Section XI and guidance provided in BWRVIP-48-A. The initial expansion of examinations will comply with the requirements of IWB-2430(a) or alternatives approved by the NRC. If the examinations reveal additional indications exceeding the standards of IWB-3500, then a second expansion of scope is required during the outage. This second expansion will comply with the requirements of IWB-2430(b) or alternatives approved by the NRC.

Repair and replacement procedures comply with the requirements of the ASME Section XI. If the flaw exceeds the requirements of IWB-3600, repair and replacement is performed consistent with the requirements of ASME Section XI Subsection IWA-4000. In the 1995 edition of ASME Section XI, Sections IWB-4000 and IWB-7000 have been deleted and their requirements placed in IWA-4000.

NUREG-1801 Consistency

The BWR Vessel ID Attachment Welds aging management program is consistent with the ten elements of aging management program XI.M4, "BWR Vessel ID Attachment Welds," specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Cracking due to SCC or IGSCC has occurred in BWR components made of austenitic stainless steel and nickel alloy, which is documented in industry documents, such as Generic Letter 88-01 and NUREG-0313. The Hope Creek BWR Vessel ID Attachment Welds program is based on the guidelines provided by BWRVIP-48-A. This BWRVIP guideline has evaluated available operating experience to determine which welds are susceptible to cracking from SCC and IGSCC and provide recommendations for inspection and evaluation of results for these welds. Implementation of the Hope Creek program provides reasonable assurance that cracking will be adequately managed so the intended functions of the vessel attachment welds will be maintained consistent with the current licensing basis CLB for the period of extended operation.

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that cracking due to SCC and IGSCC are being adequately managed. The following examples of operating experience provide objective evidence that the BWR Vessel ID Attachment Welds program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. The inspection requirements for BWR Vessel ID Attachment Welds are implemented through the station BWR Vessel Internals Program, which incorporate the requirements of Section XI of the ASME Code as well as those from BWRVIP-48-A. Visual inspections (EVT-1, VT-1, VT-3, as applicable) of these welds have been performed since the plant has been in operation. To date, the Hope Creek inspections have not detected cracks in the vessel ID attachment welds.

   This example illustrates how condition monitoring in accordance with BWRVIP and ASME Section XI inspection guidelines is used to manage the effects of cracking in the vessel internal attachment welds. The lack of indications can be attributed in part to effective water chemistry, suitable design, and effective installation practices.

   The inspection of the vessel ID attachment welds is performed as part of the in-vessel internals inspection activities. The results of reactor internals component inspections discussed below provide meaningful examples of operating experience that are applicable to the Hope Creek BWR Vessel Internals program.

2. During a scheduled core shroud examination in 2007 (refueling outage RF14), small indications were found in a number of the horizontal welds. Inspection of the horizontal weld (H4) near the core midplane revealed five indications, all of which were less than 2 inches in length and with a depth less than 15% through wall. These indications represent a small fraction of the total weld length. The core shroud had been previously inspected in 1997 and no indications were found. The inspections results were entered into the corrective action program and evaluated to determine what further actions needed to be taken. The evaluations used the guidelines provided in BWRVIP-76, "BWR Core Shroud Inspection and Flaw Evaluation Guidelines". The BWRVIP-76 guidelines consider several factors in determining the plant specific inspection requirements, including the amount of cracking observed, the water quality to which the shroud has been exposed, years of operation, materials of construction, and whether repairs have been made to the shroud. The Hope Creek shroud is made from 304L stainless steel, had been in operation for more than eight years, was exposed to good water chemistry since the previous inspection in 1997, and was un-repaired. Considering these factors and the relatively small amount of cracking compared to the criteria specified in BWRVIP-76 led to the determination that no further inspection of the shroud was necessary in refueling outage RF14. It was also determined that the 10-year inspection interval for the next inspection was still appropriate.

3. An inspection of the jet pumps setscrew tack welds was performed in 2007 (refueling outage RF14). Cracks were found on the shroud setscrew tack welds of Jet pump 9. Additionally, a small gap of 0.009 inch was found on the vessel side setscrew.

The setscrew tack weld cracks were evaluated by the NSSS vendor (General Electric) as part of the station’s corrective action program. The cause of the tack weld cracking was determined to be high cycle fatigue from jet pump vibration. Vibratory loads from the inlet-mixer can be transmitted to the restrainer bracket through the setscrews threads, if the setscrews are not properly seated and a gap exists. The screws were mechanically staked to prevent the existing setscrew gap from increasing and creating new gaps. During the 2009 refueling outage, an auxiliary spring wedge was installed to replace the function of the setscrew to prevent the creation of a gap.

The above examples illustrate how the Hope Creek vessel inspection programs monitor for cracking in accordance with BWRVIP guidelines. The examples also demonstrate that, when deficiencies are found, appropriate corrective actions are taken through the corrective action program, including actions to determine the cause and extent of the condition.

The reactor vessel internal attachment welds have been inspected for cracking due to SCC or IGSCC since the plant has been in operation. Inspections were conducted in accordance with the guidelines of NRC approved BWRVIP-48-A and the requirements of the ASME Code, Section XI Table IWB-2500-1, as required by Hope Creek BWR Vessel ID Attachment Welds aging management program. The inspections have not detected cracks in the reactor vessel attachment welds.

As demonstrated in examples 2 and 3 the inspections, conducted in accordance with approved BWRVIP documents and the requirements of the ASME Code, Section XI Table IWB-2500-1, were able to detect cracks that exist in other reactor vessel internal components. This provides reasonable assurance that implementation of the BWR Vessel ID Attachment Welds aging management program, which uses these inspection techniques, will effectively identify cracking of the attachment welds prior to a loss of an intended function. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the BWR Vessel ID Attachment Welds program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing BWR Vessel ID Attachment Welds aging management program provides reasonable assurance that the aging effects of cracking are adequately managed so that the intended functions of vessel ID attachment welds will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.5 BWR Feedwater Nozzle

Program Description

The BWR Feedwater Nozzle aging management program is an existing program that manages the effects of cracking in the reactor vessel feedwater nozzles exposed to reactor coolant. The program provides for monitoring of feedwater nozzles for cracking through station procedures in accordance with the requirements of the American Society of Mechanical Engineers (ASME) Code, Section XI, Subsection IWB, Table IWB-2500-1 and recommendations of the BWR Owners Group Licensing Topical Report General Electric (GE) NE-523-A71-0594-A, Revision 1. The program is implemented through the plant ISI program and specifies periodic ultrasonic (UT) inspections of critical regions of the feedwater nozzle. The inspections are performed at intervals not exceeding ten years.

In response to NUREG-0619, design changes were made to the feedwater nozzles prior to initial plant operation to mitigate or prevent thermally induced fatigue cracking. Design changes included eliminating the cladding on nozzle inner diameter and the use of a triple sleeve feedwater sparger design.

Mitigation of cracking in the feedwater nozzle is also accomplished through the use of a feedwater level control system that utilizes a startup level control valve for low power operation to decrease flow fluctuations. As recommended in NUREG-0619, the RWCU return flow is injected in both feedwater loops. Both of these measures help to decrease the frequency and magnitude of temperature fluctuations at the feedwater nozzle during low power operation. Hope Creek does not have a thermal sleeve bypass leakage detection system and the inspection interval has not been modified based on leakage data.

The aging management program monitors the effects of cracking on the intended function of the component by detection and sizing of cracks by enhanced ISI in accordance with ASME Section XI, Subsection IWB and the recommendation of GE NE-523-A71-0594. Inspection results that do not satisfy the acceptance standards of IWB-3500 are documented in a corrective action report in accordance with plant corrective action program.

NUREG-1801 Consistency

The BWR Feedwater Nozzle aging management program is consistent with the ten elements of aging management program XI.M5, BWR Feedwater Nozzle, specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the BWR Feedwater Nozzle program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. A review of the industry operating experience, as summarized in NUREG-0619, reveals that several BWR plants have experienced cracking in the feedwater nozzles and connecting feedwater spargers. Plants designed before 1980 were particularly susceptible. NUREG-0619 provided several recommendations for inspections and design improvements. Hope Creek started operation in 1986 with the important design features recommendations in NUREG-0619 incorporated into the plant's design, including eliminating the cladding on nozzle inner diameter and the use of a low leakage triple sleeve feedwater sparger. These design features significantly reduce thermal fatigue and the likelihood of cracking in the feedwater nozzles.

   The feedwater nozzles have been inspected for cracking as part of the Augmented Inspections of the Hope Creek ISI Program in accordance with NUREG-0619 in 1987, 1992, 1997, and 2004 using UT techniques. No flaws (indication of cracking) in the feedwater nozzles have been detected. In 2001 the program performed fracture mechanics analysis in accordance with GE-NE-523-A71-0594-A, Rev. 1 to demonstrate that a 10-year interval is sufficient to provide timely indication of detection of cracking.

This example provides objective evidence that condition monitoring is used to manage the effects of cracking in the vessel feedwater nozzles using the guidance of approved industry standards. The example also illustrates that industry experience has been incorporated to improve the program. The lack of indications to date can be attributed in part to implementing the design recommendations defined in NUREG-0619.

The Hope Creek ISI inspections of other reactor vessel nozzles discussed below provide additional examples of operating experience that are applicable to the Hope Creek BWR Feedwater Nozzle program. The examples illustrate how ISI inspection activities, conducted by qualified personnel, are able to detect flaws. The examples also illustrate that appropriate and timely disposition is provided through the corrective action program. The BWR Feedwater Nozzle program uses similar processes to effectively manage the effects of cracking in the feedwater nozzles.

2. In 2004, during refueling outage RF12, an unacceptable flaw, that is, a crack indication, was detected on "A" Reactor Recirculation inlet weld RPV1-N2KSE (RPV nozzle to safe end weld). The flaw was detected by ultrasonic examination, which was being conducted to meet the requirements of Generic Letter 88-01 and NUREG 0313 for IGSCC. The flaw was detected using an automated Performance Demonstration Initiative (PDI)-qualified UT detection technique.

As part of the corrective action process a technical evaluation was performed to determine the root cause of the crack indication. Using industry-operating experience relative to cracking in BWR piping welds the cause of the N2K weld flaw was determined to be IGSCC. The corrective action consisted of performing a weld overlay to repair the flaw. Additionally, the inspection scope was expanded to examine two additional recirculation inlet nozzles. No additional flaws were detected as a result of these added inspections. The corrective actions also specified a follow up inspection in the next refueling outage. The follow up inspection in 2007 (refueling outage RF14) did not detect any flaws in the overlay.

This example illustrates that ISI inspections by qualified personnel are capable of detecting crack indications in reactor pressure vessel components. The example also demonstrates that deficiencies are entered into the corrective action process and appropriate actions are taken to determine the cause and extent of the condition, and to correct deficiencies in an appropriate and timely manner.

3. In response to industry operating experience from another nuclear power station where a flaw was found in a recirculation nozzle weld, Hope Creek performed an ultrasonic inspection of the recirculation (N2A) nozzle-to-safe end weld in 2007 refueling outage (RF14). The N2A nozzle was selected based on an evaluation of past inspection results and a comparison of the N2A nozzle inspection results to that of the repaired nozzle at another nuclear power station. Following surface preparation, the ultrasonic inspection of the N2A nozzle weld indicated a flaw in the nozzle-to-safe end weld, which was repaired by a weld overlay repair similar to that performed previously on Hope Creek's N2K nozzle.

   As part of the corrective action process, an evaluation recommended that the Hope Creek N9 and the N2D vessel nozzles also be examined. The recommendation was based on conservative engineering judgment and not on a regulatory or other industry requirement to perform inspections of these two nozzles. The N9 and N2D nozzles were inspected by the same ultrasonic techniques that were used on the N2A nozzle and no indication of cracking was found.

These examples provide objective evidence that the inservice inspection activities, of which the BWR Feedwater Nozzle program is part, perform appropriate inspections to detect indication of cracking in RPV nozzles. The examples illustrate that industry operating experience is utilized to improve the effectiveness of the inspection process. The examples also demonstrate that, when deficiencies are found, appropriate corrective actions are taken through the corrective action program, including actions to determine the cause and extent of condition.

The Hope Creek feedwater nozzles have been inspected in 1987, 1992, 1997, and 2004 for cracking in accordance with the BWR Feedwater Nozzle aging management program. The inspections identified no cracking of the feedwater nozzles.

As demonstrated in examples 2 and 3 inspection of other reactor vessel nozzles conducted using examination methods specified by the BWR Feedwater Nozzle aging management program were able to detect cracking. This provides sufficient confidence that the implementation of the BWR Feedwater Nozzle program will effectively identify cracking of the feedwater nozzles prior to a loss of an intended function. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where cracking is found. Assessments of the BWR Feedwater Nozzle program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing BWR Feedwater Nozzle aging management program provides reasonable assurance that the aging effects of cracking are adequately managed so that the intended functions of the feedwater nozzles will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.6 BWR Control Rod Drive Return Line Nozzle

Program Description

The BWR Control Rod Drive Return Line Nozzle aging management program is an existing program that provides for condition monitoring of the N9 nozzle (originally intended to be used as the CRD Return Line Nozzle) for cracking through station ISI procedures based on the ASME Section XI requirements. To mitigate cracking in the N9 nozzle Hope Creek completed the requirements of NUREG-0619 by capping the designated CRD return line nozzle (N9) and deleting the return line as part of the original plant design. The program performs in-service inspections to monitor the effects of cracking on the N9 nozzle. Augmented inspections of the nozzle-to-cap weld are included in the Hope Creek ISI program. The N9 nozzle is exposed to the environment of reactor coolant.

The program performs inspections of the capped N9 nozzle in accordance with requirements of the American Society of Mechanical Engineers (ASME) Code, Section XI, Subsection IWB, Table IWB 2500-1. ISI examinations include ultrasonic inspection of the nozzle inside radius section and nozzle-to-vessel weld. Future inspections of the Inside radius of the N9 nozzle will be performed using EVT-1 in accordance with NRC accepted Code case N648-1, subject to the conditions specified in Regulatory Guide 1.147.

Hope Creek also conducts UT examinations of the CRD return line nozzle-to-cap weld in accordance with the guidelines of staff-approved boiling water reactor vessel and internals project (BWRVIP) document BWRVIP-75-A as part of the BWR Stress Corrosion Cracking Program. The inspection methods used in the program have been proven effective in detecting cracking in RPV nozzles.

The extent and schedule of inspection of the N9 nozzle are determined by the approved Hope Creek ISI program. The Hope Creek ISI Program assures detection of cracks before the loss of intended function of the N9 nozzle.

As noted above, Hope Creek completed the requirements of NUREG-0619 by capping the N9 nozzle prior to plant operation. As a result, continued inspection of the nozzle as required by NUREG-0619 is not applicable to Hope Creek

Hope Creek procedures require use of ASME Section XI for evaluating flaw indications. Flaw indications are evaluated in accordance with the guidelines of ASME Section XI IWB-3100, using the acceptance standards of IWB-3512 as directed by IWB-3410.

Removing cracks by mechanical means such as grinding is acceptable per ASME Section XI. However, current industry practice is to repair detected cracks by weld overlay, using NRC approved methods. Hope Creek does not anticipate cracks to develop in the N9 nozzle welds; however, should a flaw be detected and a repair be required, all available repair techniques would be evaluated. If Hope Creek should decide to a repair method not previously approved by the NRC, a relief request would be submitted for NRC review and approval.

If the flaw exceeds the requirements of IWB-3600, repair and replacement is performed consistent with the requirements of ASME Section XI Subsection IWA-4000. In the 1995 edition of ASME Section XI Sections IWB-4000 and IWB-7000 have been deleted and their requirements placed in IWA-4000.

NUREG-1801 Consistency

The BWR Control Rod Drive Return Line Nozzle aging management program described below is consistent with the ten elements of aging management program XI.M6, BWR CRD Return Line Nozzle, specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the BWR Control Rod Drive Return Line Nozzle program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. A review of the operating experience reveals that cracking in the CRD Return Line nozzle has occurred in several BWR plants as delineated in NUREG-0619 and Information Notice 2004-08. Plants placed in operation before 1980 were especially susceptible. In response to the concerns described in NUREG-0619 the Hope Creek design eliminated the use of a CRD return line. Additionally the N9 nozzle, originally intended to be used for the CRD Return Line, is capped. These design features significantly reduce thermal fatigue and the likelihood of cracking in the nozzle.

   The N9 nozzle has been examined several times since the plant started operation in 1986 with no flaws detected. The UT inspections of the inside radius and nozzle-to-vessel weld of the N9 nozzle were conducted in 1992 and 2000 in accordance with ASME Section XI, Table IWB 2500-1. In addition in response to the IGSCC concerns delineated in GL 88-01 the nozzle-to-cap weld was UT inspected in 1989, 1992, 1995, 1997, 1999, and

2007 with no indications detected. This last inspection was performed using a Performance Demonstration Initiative (PDI)-qualified UT detection technique.

This example illustrates how BWR CRD Return Line Nozzle program inspects the N9 nozzle in accordance with the requirements of ASME Section XI. The lack of indications can be attributed in part to implementing the design recommendations defined in NUREG-0619.

2. The Hope Creek ISI inspections of other vessel nozzles provide additional meaningful examples of operating experience that are applicable to the BWR CRD Return Line Nozzle program. The following examples demonstrate how ISI inspection activities, conducted by qualified personnel, are able to detect flaws. The examples also illustrate that appropriate and timely disposition of discrepancies is provided through the corrective action program. Similar processes would be used by the BWR CRD Return Line Nozzle program to effectively manage the effects of cracking in the N9 nozzle.

   In 2004 during refueling outage RF12 an unacceptable flaw or crack indication was detected in the N2K nozzle weld (RPV recirculation inlet nozzle-to-safe end weld). The flaw was detected by ultrasonic examination, which was conducted to meet the requirements of Generic Letter 88-01 and NUREG 0313 for IGSCC. The indication was detected using an automated Performance Demonstration Initiative (PDI)-qualified UT detection technique.

   As part of the corrective action process a technical evaluation was performed to determine the cause of the flaw. Using industry operating experience relative to BWR piping, the apparent cause of the N2K weld flaw was attributed to stress corrosion cracking. The corrective action consisted of performing a weld overlay to repair the flaw. Additionally, the inspection scope was expanded to examine two additional recirculation inlet nozzles. No additional flaws were detected as a result of these added inspections. The weld overlay was inspected again in the next refueling outage and no flaw indications were detected.

3. In response to operating experience from another nuclear power station where a flaw was found in a recirculation nozzle weld, Hope Creek performed an inspection of the N2A recirculation nozzle-to-safe end weld in the 2007 refueling outage (RF14). The N2A nozzle was selected based on an evaluation of past inspection results and a comparison of the N2A nozzle inspection results to that of the repaired nozzle at another nuclear power station. In both cases past inspections had shown similar irregular UT readings that were not classified as flaws. Following surface preparation, the UT inspection of the Hope Creek N2A nozzle weld in 2007 indicated a flaw in the nozzle-to-safe end weld. The flaw was repaired by a weld overlay similar to that performed previously on the Hope Creek N2K nozzle.

As part of the corrective action process, an evaluation recommended that the Hope Creek N9 and the N2D vessel nozzles also be examined. The recommendation was based on conservative engineering judgment and not on a regulatory or other industry requirement to perform inspections of these two nozzles. The N9 and N2D nozzles were inspected by the same ultrasonic techniques used on the N2A nozzle and no flaw indications were found. No further action during RF14 refueling outage was required for the N9 or N2D nozzles.

These examples provide objective evidence that the inservice inspection activities, which is used by the BWR CRD return Line Nozzle program, perform appropriate inspections to detect flaws in RPV nozzles. The examples also demonstrate that through the corrective action process appropriate actions are taken to determine the cause and extent of condition, if deficiencies are found. The example also illustrates that industry operating experience is utilized to improve the effectiveness of the inspection process.

The CRD return line nozzle has never been in service because it was capped prior to startup. The nozzle has been inspected seven (7) times between 1989 and 2007 and no indications have been identified. The inspections used non-destructive examination (NDE) techniques that have detected indications in other reactor vessel nozzles. There is sufficient confidence that the implementation of the BWR CRD return Line Nozzle program will effectively identify cracking prior to a loss of an intended function. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the BWR CRD return Line Nozzle program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing BWR Control Rod Drive Return Line Nozzle aging management program provides reasonable assurance that the cracking aging effects are adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.7 BWR Stress Corrosion Cracking

Program Description

The program is an existing program that manages intergranular stress corrosion cracking (IGSCC) in reactor coolant pressure boundary piping and piping components made of stainless steel (SS) and nickel based alloy components as delineated in NUREG-0313, Rev. 2, and Generic Letter (GL) 88-01 and its Supplement 1. The program includes preventive measures to mitigate IGSCC, inspection, and flaw evaluation to monitor IGSCC and its effects.

The program includes preventive measures to mitigate the effects of IGSCC. Reactor coolant water chemistry is monitored in accordance with the guidelines in BWRVIP-130 to maintain high water purity to reduce susceptibility to SCC or IGSCC. Hope Creek implemented Hydrogen Water Chemistry and Noble Metals Chemical Addition to further reduce susceptibility of the piping systems exposed to reactor coolant to SCC or IGSCC. Additionally, Hope Creek has applied Mechanical Stress Improvement (MSIP) to several reactor vessel nozzle welds to reduce the susceptibility of these welds to IGSCC.

The program addresses the management of crack initiation and growth due to IGSCC in the reactor coolant pressure boundary (RCPB) piping, welds and components through the implementation of the ISI program in accordance with ASME Section XI. Inservice inspections, which are performed as an augmentation of the Section XI ISI program, are designed to maintain structural integrity and ensure that aging effects will be discovered and repaired before the loss of intended function of the components. The inspection scope identified in GL 88-01 has been modified for the Hope Creek IGSCC inspection program to reflect the guidance defined in the staff-approved BWRVIP-75-A, “BWR Vessel and Internals Project Technical Basis for Revisions to Generic Letter 88-01 Inspection Schedules.”

Inspection and flaw evaluation is conducted in accordance with the Hope Creek ISI Program Plan. When a flaw exceeds the applicable acceptance standards of IWB-3500 an analytical evaluation is performed in accordance with IWB-3600 to determine its acceptability for continued service without repair or replacement. Evaluations are performed using the applicable crack growth rate given in ASME Section XI. BWRVIP-14-A, BWRVIP-59-A, BWRVIP-60-A, and BWRVIP-62 also provide approved guidelines that could be used for evaluating crack growth in stainless, nickel alloys, and low-alloy steels. In accordance with GL 88-01, an evaluation performed to accept an IGSCC flaw must be approved by the NRC before resumption of operation.

The guidance for weld overlay repair and stress improvement or replacement is provided in several industry documents, including Generic Letter 88-01, ASME Section XI, Subsection IWA-4000 and specific code cases. (Note: In the 1995 edition of ASME Section XI, Sections IWB-4000 and IWB-7000 were deleted and their requirements placed in IWA-4000.) Hope Creek has performed stress improvement and weld overlay repairs. These actions were in accordance with ASME Section XI, IWA-4000, consistent with the guidelines provided in GL 88-01. For repair of stainless steel piping the Hope Creek program recognizes ASME Section XI code Case N-504-3 as an NRC-approved repair alternative methodology.

The program will be enhanced, as noted below, to provide reasonable assurance that the BWR Stress Corrosion Cracking program aging effects will be adequately managed during the period of extended operation.

NUREG-1801 Consistency

The BWR Stress Corrosion Cracking aging management program is consistent with the ten elements of aging management program XI.M7, BWR Stress Corrosion Cracking, specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

Prior to the period of extended operation the following enhancement will be implemented in the following program element(s).

1. The program will be enhanced to clarify that, for the components within the scope of the BWR Stress Corrosion Cracking program, resistant materials will be used for new and replacement components. This includes low carbon stainless piping and stainless steel weld material limited to a maximum carbon content 0.035 wt. % and a minimum ferrite content of 7.5%. **Program Element affected: Preventive Actions (Element 2)**

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the BWR Stress Corrosion Cracking program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation.

Intergranular stress corrosion cracking has occurred in BWR piping made of austenitic stainless steel and nickel-base alloys. Cracking has occurred in recirculation, core spray, residual heat removal (RHR), control rod drive (CRD) return line penetrations, and reactor water cleanup (RWCU) system piping welds. Some of the history is recorded in NUREG-0313, Generic Letter 88-01 and BWRVIP-75-A. NRC Information Notices 82-39, 84-41, and 04-08 provide additional information. NUREG-0313, first issued in 1977 and revised in 1980, provided guidelines for mitigating the effects of IGSCC.

From the time of initial plant design and construction Hope Creek has aggressively pursued actions to reduce the effect of IGSCC within the reactor coolant pressure boundary. The Hope Creek plant design incorporated the recommendations of NUREG-0313, Rev 1 at the time of construction. For example, corrosion resistant materials were used for the RPV safe ends and extensions. The vessel design eliminates thermal sleeves that were part of the pressure boundary and formed cervices. Corrosion resistant cladding was applied to field welds for 304 stainless steel piping connections and all of the shop welds were furnace solution heat treated before installation. These measures are described in Chapter 5 of the Hope Creek UFSAR. Hope Creek has also applied mechanical stress improvement process (MSIP) to several reactor pressure vessel nozzle welds to reduce the effects of IGSCC. Similarly, Hope Creek has implemented Hydrogen Water Chemistry (HWC) and Noble Metals Chemical Addition (NMCA) to mitigate the environment that promotes IGSCC. To continue to improve the management of IGSCC, Hope Creek actively participates in industry forums that are combating IGSCC, such as the BWR Vessel and Internals Project (BWRVIP) and the ASME Section XI Performance Demonstration Initiative (PDI) working group.

Hope Creek has performed inspections of the IGSCC susceptible components and welds as delineated in NUREG-0313, and latter modified by Generic Letter 88-01 and more recently by BWRVIP-75-A as part of the ASME Section XI ISI program. The Hope Creek ISI program identifies 386 augmented components that are inspected in accordance with GL 88-01. These inspections have not detected flaws, except for the three instances described below.

1. In 1997 during refueling outage RF07, personnel performing a routine tour of the drywell observed water dripping down from the area near the N5B nozzle of the reactor pressure vessel (RPV). Analysis of the water revealed the fluid was reactor coolant water. Further investigation revealed the presence of a through wall leak from three pinholes at the top of the core spray nozzle-to-safe end weld. The N5B nozzle is associated with the A loop of Core Spray.

   The observations were immediately entered in the correction action process and a thorough investigation was conducted to determine the cause, extent, impact, and the appropriate corrective actions. Because the leak involved an emergency core cooling system the condition was reported to the NRC in LER 97-023. Additionally, the finding was disseminated to the nuclear industry via Nuclear Network.

The N5B nozzle-to-safe-end weld was examined using UT technology to characterize the defect in accordance with ASME Section XI requirements. A review of the UT data by several expert organizations, including General Electrical, PSEG personnel, and EPRI experts determined that the cracking was a result of IGSCC in the Alloy 182 weld metal.

As part of the corrective action process the extent of the condition was investigated by inspecting other similar welds. Following the guidance of NUREG-0313 and GL 88-01 two other welds were inspected, the other core spray nozzle (N5A) and recirculation outlet nozzle N2D. In each case the nozzle-to-safe-end was examined using UT. No flaws were detected in these welds. An NRC-approved weld overlay repair was performed during the 1997 refueling outage. Subsequent inspections of the weld overlay in 1999, 2000, and 2003 have not detected flaws. The through-wall leak found in N5B in 1997 and other incidences of IGSCC through the BWR fleet prompted Hope Creek to apply Mechanical Stress Improvement Process (MSIP) for nineteen (19) RPV nozzle welds. The majority of this work was performed in 1999 and the remainder completed in 2003.

This example demonstrates that deficiencies are entered into the corrective action process and appropriate actions are taken to correct deficiencies in an appropriate and timely manner. This example also demonstrates that the corrective action process is effective in determining the cause and extent of the condition for defects that are found. The example illustrates that corrective actions are performed using established and approved industry guidelines and that Hope Creek aggressively pursues means to mitigate the effects of IGSCC. These actions are utilized in the BWR Stress Corrosion Cracking program to assure that the intended function(s) will be maintained consistent with the CLB for the period of extended operation.

2. In 2004 during refueling outage RF12 an unacceptable flaw or crack indication was detected in the N2K nozzle weld (RPV recirculation inlet nozzle-to-safe end weld). The flaw was detected by ultrasonic examination, which was conducted to meet the requirements of Generic Letter 88-01 and NUREG 0313 for IGSCC. The indication was detected using an automated Performance Demonstration Initiative (PDI)-qualified UT detection technique.

   As part of the corrective action process a technical evaluation was performed to determine the cause of the flaw. Using industry operating experience relative to BWR piping, the apparent cause of the N2K weld flaw was attributed to intergranular stress corrosion cracking. The corrective action consisted of performing a weld overlay to repair the flaw. Additionally the inspection scope was expanded to examine two additional recirculation inlet nozzles. No additional flaws were detected as a result of these added inspections. The weld overlay was inspected again in the next refueling outage and no flaw indications were detected.

3. In response to operating experience from another nuclear plant where a flaw was found in a recirculation nozzle weld, Hope Creek performed an inspection of the N2A recirculation nozzle-to-safe end weld in the 2007 refueling outage (RF14). The N2A nozzle was selected based on an evaluation of past inspection results and a comparison of the N2A nozzle inspection results to that of the repaired nozzle at another nuclear power station. In both cases past inspections had shown similar irregular UT readings that were not classified as flaws. Following surface preparation, the UT inspection of the Hope Creek N2A nozzle weld in 2007 indicated a flaw in the nozzle-to-safe end weld. The flaw was repaired by a weld overlay similar to that performed previously on the Hope Creek N2K nozzle.

   As part of the corrective action process, an engineering evaluation recommended that the Hope Creek capped CRD return line nozzle (N9) and the N2D vessel nozzles also be examined. The recommendation was based on conservative engineering judgment and not on a regulatory or other industry requirement to perform inspections of these two nozzles. The N9 and N2D nozzles were inspected by the same ultrasonic techniques used on the N2A nozzle and no flaw indications were found. No further action during RF14 refueling outage was required for the N9 or N2D nozzles.

These examples provide objective evidence that the inservice inspection (ISI) activities are used in the Stress Corrosion Cracking program perform appropriate inspections to detect flaws in RPV nozzles. The examples also demonstrate that, through the corrective action process, appropriate actions are taken to determine the cause and extent of condition if deficiencies are found. The examples also illustrate that industry operating experience is utilized to improve the effectiveness of the inspection process.

Conclusion

The existing BWR Stress Corrosion Cracking aging management program provides reasonable assurance that the cracking aging effects are adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.8 BWR Penetrations

The BWR Penetrations aging management program is an existing program that manages the effects of cracking of the reactor vessel instrumentation penetrations (nozzles) exposed to reactor coolant through water chemistry and inservice inspections. The scope of the program includes beltline instrumentation nozzles and other instrumentation nozzles; except for the Standby Liquid Control/core plate differential pressure (dP) nozzle and the jet pumps instrumentation nozzles, which are in the scope of program B.2.1.1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD. The BWR Penetrations aging management program incorporates the inspection and evaluation recommendations of BWRVIP-49-A, "Instrument Penetration Inspection and Flaw Evaluation Guidelines", as well as the water chemistry recommendations of BWRVIP-130, "BWR Vessel and Internals Project BWR Water Chemistry Guidelines". The program is implemented through station procedures that provide for mitigation of cracking through water chemistry and condition monitoring through examinations of reactor vessel instrument penetrations welds.

Hope Creek mitigates the potential for SCC and IGSCC by maintaining high water purity through the water chemistry program. The reactor water chemistry program monitors and controls known detrimental contaminants in accordance with the recommendations of BWRVIP-130 (EPRI TR-1008192). The program description and the evaluation and technical basis of monitoring and maintaining reactor water chemistry are presented in the B.2.1.2, Water Chemistry Program. As is described in the Water Chemistry program, BWRVIP-130 replaced BWRVIP-29 as the BWR water chemistry standard. A revision later than BWRVIP-29 is permitted by NUREG-1801, Program XI.M1.

The Hope Creek program monitors the effects of SCC and IGSCC by the detection of cracks by performing inspections as part of the ISI program, in accordance with the guidelines of BWRVIP-49-A, as well as the requirements of American Society of Mechanical Engineers (ASME) Code, Section XI, Table IWB-2500-1. Description of the Hope Creek ISI program, including the controlling edition of ASME Section XI, is provided in B.2.1.1, ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD. During each refueling outage a VT-2 inspection of the penetration weld is performed during the reactor coolant pressure boundary leak test. The guidelines of BWRVIP-49-A provide information on the type of instrument penetration, evaluate their susceptibility and consequences of failure, and define the inspection strategy to assure safe operation.

The nondestructive examination (NDE) techniques used for inspection of the Hope Creek vessel instrument penetrations, including the uncertainties inherent and executing NDE techniques in a BWR, are defined in BWRVIP-03.

The Hope Creek BWR Penetrations aging management program allows for inspection relief based on BWRVIP-62; however, no relief request has been made for Hope Creek. Any relief request from the requirement of ASME XI will be submitted to the NRC for approval in accordance 10 CFR 50.55a.BWRVIP-27-A addresses the Standby Liquid Control (SLC) system nozzle. The guidelines of BWRVIP-27-A are applicable to plants in which the SLC system injects sodium pentaborate into the bottom head region of the vessel. The SLC system at Hope Creek injects pentaborate into the vessel through the core spray system, not through a bottom head penetration. As stated in the BWRVIP document the guidelines of BWRVIP-27-A do not apply to plants such as Hope Creek where SLC injects via the Core Spray piping. Plants that inject SLC through a bottom head penetration also use this penetration for the core plate differential pressure (dP) instrumentation. At Hope Creek the penetration for the core plate dP instrumentation penetration (N10) is inspected in accordance with ASME Section XI, Table IWB-2500-1 requirements.

Since the inspections are performed using VT-2 during a system pressure test, defects in the penetration are discovered only if leakage is detected. The leakage would be documented and processed through the corrective action program to determine the need for any expansion of examinations and reinspection. Repairs would be completed in accordance with ASME Section XI requirements, and a subsequent pressure test conducted.

Flaw evaluations are not applicable to the Hope Creek Vessel Penetrations program because cracking is detected by leakage, which must be repaired before returning the component to service.

NUREG-1801 Consistency

The BWR Penetrations aging management program is consistent with the ten elements of aging management program XI.M8, "BWR Penetrations," specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Cracking due to SCC or IGSCC has occurred in BWR components made of austenitic stainless steel and nickel alloy, as is documented in Generic Letter 88-01 and NUREG-0313. The Hope Creek BWR Penetrations program factors in this industry experience, because it is based on the guidelines provided by BWRVIP-27-A and BWRVIP-49-A. These BWRVIP guidelines have evaluated available operating experience to determine which welds are susceptible to cracking from SCC and IGSCC and provide recommendations to inspection and evaluation of results for these welds. Implementation of the Hope Creek program provides reasonable assurance that cracking will be adequately managed so the intended functions of the instrument penetrations will be maintained consistent with the current licensing basis CLB for the period of extended operation.

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the Hope Creek BWR Penetrations program will be effective in assuring that intended function(s) are maintained consistent with the CLB for the period of extended operation:

1. The inspection requirements for reactor vessel instrumentation penetrations are implemented as part of the vessel ASME Section XI ISI activities, which is consistent with the recommendations of BWRVIP-49-A. As required by ASME Section XI, at each refueling a reactor coolant boundary leakage is performed as part of the Hope Creek ISI Program. A VT-2 test by qualified personnel is performed for all reactor coolant pressure retaining components, including the reactor vessel instrument penetrations, within the scope of this program. Throughout the operating life of the plant no leaks have been found in the penetrations managed by this program. This example illustrates how BWR Penetrations program implements the inspection requirements using the methods and inspection frequency recommended in the appropriate BWRVIP guidelines. The lack of indications can be attributed in part to effective water chemistry, suitable design, and appropriate installation practices.

2. During each refueling outage VT-2 inspections are performed during the pressure boundary leakage test. A review of the inspection results for Hope Creek did not reveal a case in which a VT-2 inspection found cracking in a Class 1 component. However, VT-2 inspections have detected leaks at mechanical interfaces such as flanges and valve packing. In each case the discrepancy is entered in to the corrective action program and appropriate action, such as repair, is taken. Although none of the leaks constituted a loss or degradation of the Class 1 pressure boundary, this example demonstrates the inspection techniques and qualified personnel are capable of detecting small leaks in Class 1 components. This provides reasonable assurance that the inspection techniques used in the BWR Penetrations aging management program is capable of detecting leaks before a loss of intended function.

Hope Creek has conducted VT-2 inspections of the reactor vessel instrument penetrations during each past refueling outage in accordance with the BWR Penetrations aging management program. The VT-2 inspections were conducted during the reactor coolant pressure boundary hydrostatic test to detect leakage that could be attributed to potential SCC and ISGCC of instrument penetrations. To date, no leakage of the reactor vessel instrument penetrations has been identified. The VT-2 inspections have detected leaks at mechanical interfaces such as flanges and valve packing. In each case the leakage did not result in a loss of the pressure boundary intended function. The leaks were entered in the corrective action process and appropriate action, such as repair, was taken. This provides reasonable assurance that inspection techniques used in the BWR Penetrations aging management program are capable of detecting leaks before a loss of an intended function. There is sufficient confidence that the implementation of the Hope Creek BWR Penetrations aging management program will effectively identify degradation prior to failure. Appropriate guidance for repair, or replacement is provided for locations where degradation is found. Assessments of the Hope Creek BWR Penetrations aging management program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing BWR Penetrations aging management program provides reasonable assurance that the aging effects of cracking are adequately managed so that the intended functions of instrument penetrations will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.9 BWR Vessel Internals

Program Description

The Hope Creek BWR Vessel Internals aging management program is an existing program that manages the effects of cracking and loss of material of reactor pressure vessel internals exposed to reactor coolant through water chemistry and inservice inspection. The program incorporates the inspection and evaluation recommendations of the applicable and approved BWRVIP guidelines and ASME Section XI, as well as the water chemistry recommendations of BWRVIP-130, "BWR Vessel and Internals Project BWR Water Chemistry Guidelines." The program is implemented through station procedures that provide for mitigation of cracking through water chemistry and condition monitoring through examinations of reactor internal components.

Hope Creek station mitigates the potential for stress corrosion cracking (SCC), intergranular stress corrosion cracking (IGSCC) and irradiation assisted stress corrosion cracking (IASCC) by maintaining high water purity through the water chemistry program. The reactor water chemistry program monitors and controls known detrimental contaminants in accordance with the recommendations of BWRVIP-130 (EPRI TR-1008192). The program description and the evaluation and technical basis of monitoring and maintaining reactor water chemistry are presented in the B.2.1.2, Water Chemistry Program. As is described in the Water Chemistry program, BWRVIP-130 replaced BWRVIP-29 as the BWR water chemistry standard. A revision later than BWRVIP-29 is permitted by NUREG-1801, Program XI.M1.

Hope Creek is committed to following the BWRVIP guidelines for managing reactor internal components. The Hope Creek Vessel Internals program includes the following BWRVIP guidelines for inspection, evaluation, and repair recommendations for the components listed.

Core Shroud: Inspections and flaw evaluations are performed in accordance with BWRVIP-76. BWRVIP-07 and BWRVIP-63 have been superceded by BWRVIP-76. The repair design criteria in BWRVIP-02-A would be utilized in preparing a repair plan for the core shroud.

Core Plate: Inspections and flaw evaluations are performed in accordance with BWRVIP-25. The repair design criteria in BWRVIP-50-A would be utilized in preparing a repair plan for the core plate.

Shroud Support: Inspections and evaluations are performed in accordance with BWRVIP-38. The repair design criteria in BWRVIP-52-A would be utilized in preparing a repair plan for the core shroud support.

LPCI Coupling: Inspections and flaw evaluations are performed in accordance with BWRVIP-42-A. The repair design criteria in BWRVIP-56-A would be utilized in preparing a repair plan.

Top Guide: Inspections and evaluations are performed in accordance with BWRVIP-26-A. The repair design criteria in BWRVIP-50-A would be utilized in preparing a repair plan. The current fluence at the Hope Creek grid beams exceeds the IASCC threshold of 5×10^{20} n/cm^2. The inspections and evaluations are performed in accordance with BWRVIP-183. The current Hope Creek BWR Vessel Internals Program specifies that 10% of the grids beam cells containing control rod blades are inspected every 12 years, with at least 5% inspected within 6 years. Inspections are performed using EVT-1 methods. The program also allows for inspections to be performed using UT once it becomes available. These inspections will be conducted prior to the period of extended operation and will continue through the period of extended operation.

Core Spray: Inspections and evaluations are performed in accordance with BWRVIP-18-A. The program utilizes the guidelines for replacement and repair contained in BWRVIP-16-A and BWRVIP-19-A.

Jet Pumps: Inspections and evaluations are performed in accordance with BWRVIP-41. The program utilizes the repair design criteria contained in BWRVIP-51-A.

Control Rod Drive Housings: Inspections and evaluations are performed in accordance with BWRVIP-47-A. The program utilizes the repair design criteria contained in BWRVIP-55-A and BWRVIP-58-A.

Lower Plenum: Inspections and evaluations are performed in accordance with BWRVIP-47-A. The program utilizes the repair design criteria contained in BWRVIP-55-A. For repair of instrumentation penetrations, BWRVIP-57-A provides repair design criteria for those penetrations not within the lower plenum.

Steam Dryer: Inspections and evaluations are performed in accordance with BWRVIP-139. The program utilizes the repair design criteria contained in BWRVIP-181.

Access Hole Covers: Inspections and evaluations are performed in accordance with BWRVIP-180.

Hope Creek has or will complete each of the license renewal applicant action items described in the NRC safety evaluations for the above BWRVIP reports prior to the period of extended operation. Refer to Appendix C for a listing of the action items described in the NRC safety evaluations for the above BWRVIP reports.

The program provides for monitoring the effects of cracking on the intended function of internals components through detection and sizing of cracks by inspections performed in accordance with the guidelines of applicable and BWRVIP documents, as well as the requirements of ASME Section XI. The inspections are performed consistent with the recommendations of applicable and approved BWRVIP guidelines, as well as the requirements of ASME Section XI, Table IWB-2500-1. Description of the Hope Creek ISI program, including the controlling edition is provided in B.2.1.1, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program.

ASME Section XI specifies VT-1 examinations to detect surface discontinuities and imperfections, cracks, corrosion, wear, or erosion. VT-3 examinations are specified to determine the general condition of component supports by verifying parameters, such as clearances and displacements, and by detecting discontinuities and imperfections, such as loss of integrity of bolted or welded connections, or loose or missing parts, debris, corrosion, wear, or erosion. For each outage the Hope Creek BWR Vessel Internals Program determines the necessary inspections based on the BWRVIP guidelines and the ASME Code. The examination procedures also identify the type and location of examination (VT-1, EVT-1, VT-3) required for each component as well as the basis for the inspection (for example: BWRVIP, ASME Code or design requirement).

The BWRVIP guidelines often recommend more stringent inspections than those specified by ASME Section XI, such as the use of enhanced VT-1 or UT, in place of VT-1 or VT-3 for select components and locations. The Hope Creek BWR Vessel Program implements the more stringent inspections recommended in the BWRVIP guidelines. The nondestructive examination (NDE) techniques used for inspection of the Hope Creek vessel internals, including the uncertainties inherent in delivering and executing NDE techniques in a BWR, are defined in BWRVIP-03.

The Hope Creek BWR Vessel Internals aging management program implements the appropriate nondestructive examination (NDE) standards for inspection of BWR vessel internals that are specified in BWRVIP-03, including the uncertainties inherent in delivering and executing NDE techniques in a BWR.

The Hope Creek BWR Vessel Internals program allows for inspection relief based on BWRVIP-62. However, no relief has been taken for Hope Creek. Any relief request from the requirement of ASME Section XI will be submitted to the NRC for approval in accordance with 10 CFR 50.55a.

Evaluation of indications is conducted consistent with the applicable and approved BWRVIP guideline or ASME Section XI, as appropriate.

Flaws are evaluated in accordance with the guidance provided in the associated BWRVIP guidelines or ASME Section XI, as appropriate for a particular component. Additional general guidelines for flaw evaluation of crack growth in stainless steels (SS), nickel alloys, and low-alloy steels is found in BWRVIP-14-A, BWRVIP-59-A, and BWRVIP-60-A.

Repair and replacement activities, if needed, are performed in accordance with ASME Section XI requirements, consistent with the recommendations of the appropriate BWRVIP repair/replacement guidelines. For nickel alloy repairs, BWRVIP-44 would be used; for weld repairs of irradiated structural components, BWRVIP-45 would be utilized in developing a repair plan.

NUREG-1801 Consistency

The BWR Vessel Internals aging management program is consistent with the ten elements of aging management program XI.M9, "BWR Vessel Internals," specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Cracking due to SCC, including IGSCC, has occurred in BWR reactor vessel internal components as reported in NRC generic documents (Generic Letters, Bulletins, Information Notices) and General Electric Service Information Letters (SIL). The review of the documents for applicability to Hope Creek and the actions taken by Hope Creek are discussed below. .

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that cracking due to stress corrosion cracking (SCC) and intergranular stress corrosion cracking (IGSCC) are being adequately managed. The following examples of operating experience provide objective evidence that the Hope Creek BWR Vessel Internals aging management program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. Cracking has been observed in core shrouds at both horizontal and vertical welds. It has affected shrouds fabricated from both Type 304 and Type 304L SS. Type 304L SS is generally considered to be more resistant to SCC. Weld regions are most susceptible to SCC. This industry experience is documented in NRC Generic Letter 94-03, Information Notices 97-17, and 94-42.

   In response to the industry experience cited in GL 94-03 and IN 97-17, and 94-42, Hope Creek has inspected the core shroud at regular intervals, once in 1997 and again in 2007. The inspection performed in 1997 did not detect flaw indications. A second shroud inspection was performed in 2007 during refueling outage RF14. The inspection was performed by qualified NDE using UT techniques following the guidelines of BWRVIP-76. Small indications were found in a number of the horizontal welds. Inspection of the horizontal weld near the core midplane (H4) revealed five indications, all less than 2 inches in length, with a depth less than 15% through wall.

   As part of corrective action program these indications were evaluated using the guidelines provided in BWRVIP-76, BWR Core Shroud Inspection and Flaw Evaluation Guidelines. Because of the small amount of cracking observed and the good reactor water chemistry maintained during the operating life of the plant it was determined that no additional inspections were required in RF14. It also determined that no change to the current ten-year inspection interval was necessary. The shroud welds are planned to be inspected again in 2016.

This example provides objective evidence that the BWR Vessel Internals program implements inspection requirements using the methods and inspection frequency recommended in the appropriate BWRVIP guidelines. This example also illustrates that ISI inspections by qualified personnel, are capable of detecting flaws in reactor vessel internal components. The example also demonstrates that deficiencies are entered into the corrective action process and appropriate actions are taken to correct any the deficiencies.

2. Cracking in shroud support plate access hole covers has been reported in other BWRs, as documented in NRC Information Notice IN 83-03 and IN 92-57. The original equipment manufacturer, General Electric, issued guidance for this issue in SIL 462. Hope Creek has performed inspection of the access hole covers in 1997, 2003, and 2006 following the guidance of SIL 462. The inspections identified no flaws.

   Starting in 2009 Hope Creek began to inspect the plate access hole covers in accordance with BWRVIP-180. For Hope Creek there is little difference between the requirements of SIL 462 and BWRVIP-180. The most significant difference is that BWRVIP-180 requires the use of EVT-1 instead of VT-1, if visual examinations are performed. The 2009 inspections identified no flaws. The next inspection of the shroud support plate access hole covers is planned for 2015.

3. Cracking in core spray spargers has occurred in some BWRs as discussed in NRC Bulletin 80-13. Hope Creek inspected the core spray sparger during refueling outages in 1997, 1999, 2001, 2004 and 2007. No indications have been detected to date. The core spray sparger is inspected in accordance with BWRVIP-18-A. The last three inspections were performed with NDE personnel using a combination VT-1 and EVT-1 exam methods. The next inspection of the spargers is planned for 2010.

4. Cracking of the core plate rim hold down bolts has not been reported in any BWR. A thorough inspection of the core plate is difficult. A technique has not been developed yet to access the underneath regions of the core plate needed to inspect the hold down bolts. Hope Creek inspected all 34 of the hold down bolts in1997 and 26 of the 34 hold down bolts in 1999. These inspections were of the portion of the hold down above the core plate using VT-3. No indication of cracking was observed. Hope Creek's inspection strategy for the core plate hold down rim bolts is in accordance with BWRVIP-25. However an inspection technique for performing UT inspections recommended in BWRVIP-25 is not currently available. Hope Creek will continue to inspect the core plate hold down rim bolts as described in Appendix C.

5. Cracking in the top guides grid beams has occurred in some BWRs as reported NRC IN 95-17. Hope Creek has performed several inspections since the started operation in 1986, namely in 1992, 1994, 1996, 1997, and 1999. No indications have been detected in any of these inspections using VT-1 and VT-3 examination techniques.

   Starting in 2009 Hope Creek began to inspect the top guides grid beams in accordance with the guidance of BWRVIP-183. The 2009 inspections identified no flaws.

6. Instances of cracking have occurred in the jet pump assembly, hold-down beam, and jet pump riser pipe elbows in BWRs. These have been reported in NRC Information Notices 80-07, 93-101, and 97-02, respectively. Hope Creek performs jet pump assembly inspections in every refueling outage. Starting in 1999, with Refueling Outage RF-08, the Vessel Internals Program performs the inspection of jet pumps has been in accordance with BWRVIP-41. No cracking has been observed in the jet pump assembly, hold down beams and jet pump elbows. Cracking was observed in jet pump setscrew tack welds and in jet pump sensing line brackets as discussed below.

   Jet Pump Setscrew Tack Welds

   During a scheduled inspection of the jet pumps in 2007 (RF14), all three setscrew tack welds on the shroud side of Jet Pump 9 (JP9) were found cracked. Both tack welds on the vessel side setscrew were inspected and no evidence of cracking was found. Also a small gap was found on the vessel side of the setscrew.

   As part of the corrective action process the condition was evaluated by the NSSS vendor (General Electric). The cause of the tack weld failures was determined to be high cycle fatigue from jet pump vibration. Vibratory loads from the inlet-mixer to restrainer bracket through the setscrews threads occurs, if the screws are not seated and a gap exists. Corrective actions included mechanically staking the setscrews to prevent the setscrew gap from increasing and creating new gaps at the screws. During the 2009 refueling outage, an auxiliary spring wedge was installed to replace the function of the setscrew to prevent the creation of a gap.

   Jet Pump Sensing Line Brackets

   During the 1997 refueling outage (RF-07), indications were found on three jet pump sensing line lower brackets welds. No cracks were observed on the sensing lines. The safety evaluation associated with this deficiency report justified operation with a repair to the brackets. The repair consisted of clamping the sensing lines to the lower support brackets in the original welded position, essentially restoring the lines to their original structural configuration. Subsequent inspections of the jet pump sensing lines have not revealed further cracking in the brackets.

7. Cracking of nuclear instrumentation dry tubes has been observed at several BWRs. The cracking is intergranular and has been observed in dry tubes without apparent sensitization, suggesting that IASCC may also play a role in the cracking. This is discussed in General Electric Service Information Letter (SIL) 409. In response to SIL 409 Hope Creek inspected the nuclear instrumentation dry tubes in 1999. Circumferential cracks were found in all 12 dry tubes. In the 2000 refueling outage (RF-09) all 12 dry tubes were replaced with a new dry tube design made of IASCC-resistant material. The next inspection of the nuclear instrumentation dry tubes is planned for 2015.

8. Failure of BWR/3 steam dryer cover plate during operation following extended power uprate (EPU) has been reported in the industry as documented in NRC Information Notices, IN 2002-26, IN 2002-26, Supplement 1, and IN 2002-26, Supplement 2. Failure of the cover plate was attributed to high cycle fatigue failure, due to flow induced vibration. Hope Creek performed a baseline inspection of the steam dryer, prior to EPU operating conditions, using guidance provided in BWRVIP-139, "Steam Dryer Inspection & Evaluation Guidelines." The inspections identified IGSCC type cracking and no fatigue cracking. The cracks were evaluated and found acceptable for continued operation.

   Following implementation of EPU, during 2009 refueling outage, Hope Creek conducted a re-baseline inspection of the steam dryer using the guidance in BWRVIP-139. The inspections identified no fatigue related cracking. The inspections identified additional stress corrosion cracking and a weld quality related crack. The cracks were entered in the corrective action process and evaluated and found acceptable for continued service.

   The lack of cracking may be a result of the following modifications made to the steam dryer prior to its initial operation to improve its structural integrity.

   - The 0.125-inch (in) thick outer hoods were replaced with 0.5-in hood, and outer hood welds were strengthened.

   - The 0.1875-in thick central steam outlet end plates were replaced with 0.5-in plates.

   - The 0.5 x 1-in tie bars were replaced with 2 x 2-in tie bars and the number of tie bars was increased.

   - The 0.187-in reinforcing strips were added to extend the effective weld lengths between the middle and inner hoods and end plates. The inside corners of these hoods to the end plates were back-welded to a minimum height of 50-in above the support ring

   Also the lack of cracking may be due to main steam line SRV piping configuration.

   This example demonstrates that industry operating experience (OE) information is reviewed for applicability to Hope Creek and incorporated in

BWR Vessel Internals aging management program to improve its effectiveness.

The operating experience of the Hope Creek BWR Vessel Internals aging management program has not identified cracking of vessel internal components to the extent reported in other BWR's. That is, inspections conducted in accordance with ASME Section XI and approved BWRVIP guidelines have not detected cracking in the shroud support plate access hole covers, core spray spargers, top guides grid beams, jet pumps assembly, jet pumps hold down beams, jet pumps riser pipe elbows, and no fatigue related cracking of the steam dryer. The inspections identified limited number of small cracks in the core shrouds welds, cracking in the nuclear instrumentation dry tubes, non-fatigue related cracks in the steam dryer, and cracks in the jet pump 9 setscrews tack welds and the jet pumps sensing line support brackets. The cracks were entered in the corrective action process and evaluated for acceptance or repair and replacement in accordance with associated BWRVIP guidelines or ASME Section XI as appropriate for the particular component. Cracks in the core shroud welds and those identified in the steam dryer were found acceptable for continued service. The nuclear instrumentation dry tubes were replaced with new design made of IASCC resistant material. The jet pump 9 setscrews tack welds and sensing lines support bracket welds were repaired.

Based on the above, there is sufficient confidence that the implementation of the Hope Creek BWR Vessel Internals program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Hope Creek BWR Vessel Internals program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing BWR Vessel Internals aging management program provides reasonable assurance that cracking and the loss of material aging effects are adequately managed so that the intended functions of BWR vessel internals within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.10 Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)

Program Description

The aging management program for Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless steel (CASS) is a new program that will provide for aging management of CASS reactor internal components exposed to reactor coolant and neutron flux within the scope of license renewal. The program will be implemented prior to the period of extended operation.

The Hope Creek reactor vessel internals receive a visual inspection in accordance with the American Society of Mechanical Engineers (ASME) Code Section XI, Subsection IWB, Category B-N-1 and B-N-2 and the BWR Vessel Internals program. The BWR Vessel Internals program inspections will be supplemented to detect the effects of loss of fracture toughness due to thermal aging and neutron irradiation embrittlement of cast austenitic stainless steel (CASS) reactor vessel internals determined to be susceptible to loss of fracture toughness.

The Hope Creek Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel aging management program will include a component specific evaluation to (a) identify the “susceptible components” determined to be limiting from the standpoint of thermal aging susceptibility (i.e., ferrite and molybdenum contents, casting process, and operating temperature) and/or neutron irradiation embrittlement (neutron fluence), and (b) for each “potentially susceptible” component, aging management will be accomplished through either a supplemental examination of the affected component based on the neutron fluence to which the component has been exposed as part of the BWR Vessel Internals program during the license renewal term, or a component-specific evaluation to determine its susceptibility to loss of fracture toughness.

The following CASS material components susceptible to thermal aging and neutron irradiation embrittlement and subject to loss of fracture toughness include:

- Control Rod Assemblies; guide tubes
- Core Spray Lines and Spargers; spray nozzles and elbows
- Fuel Supports
- Jet Pump Assemblies; transition piece, inlet, throat, and diffuser collar
- Steam Dryers; drain line fittings

The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel aging management program will be a monitoring program that will effectively detect the applicable aging effects and the frequency of monitoring will be adequate to prevent significant degradation.

NUREG-1801 Consistency

The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) aging management program is consistent with the ten elements of aging management program XI.M13, Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS), specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of Hope Creek operating experience provides objective evidence that existing BWR Reactor Internal program inspections including CASS components effectively assure the intended functions are maintained consistent with the CLB for the period of extended operation. The new thermal aging and neutron irradiation embrittlement of CASS program will augment existing internal vessel inspection techniques.

1. In April 2006, during Hope Creek RF13 planned in-vessel internal inspections, wedge wear was observed on Jet Pump #2 (JP-2). The wear was reported at the interface between the inlet-mixer and the restrainer bracket pad. The inspection specifically found a 0.009” gap between the restrainer bracket set screw and the inlet-mixer on JP-2. As part of the corrective action program, an engineering evaluation was performed and the cause of the indications was found to be slip joint leakage induced vibration. A Slip Joint Clamp was installed to suppress the slip joint leakage vibration mechanism and a follow-up inspection was performed in the subsequent refuel outage (RF14) to ensure that no further wedge wear had occurred. In addition, the scope of the inspection was expanded to verify no additional indications were found in accordance with the requirements found in BWRVIP-41. The follow-up inspection verified the slip joint clamp effectively addressed the condition. The slip joint clamp was added to the vessel internals program for future re-inspections. This OE item shows existing in-vessel internal inspections are effective in identifying degradation and the corrective action and evaluation programs assure intended functions are maintained and follow-up actions are identified and planned.

2. During RF13 planned internal visual vessels inspections (IVVI) work in October 2006, three crack indications were identified in the JP 6 wedge stellite face below the restrainer bracket. The cracks were on the surface and had no impact on the function of the wedge. No further action was required since no significant degradation was occurring at the wedge. Further inspections have been scheduled at the next required ISI Long-Term Inspection Plan, as directed by BWRVIP-41 requirements. This OE item shows the current vessel inspection programs effectively identify cracked components and ensure intended functions are maintained.

3. During a planned RF14 inspection in October 2007, the jet pump set screw tack welds at jet pump 9, shroud side, were inspected for cracking and the original tack welds were found to have cracked. No movement of the setscrews was found during this inspection. The corrective action included mechanically staking the setscrews and installing an auxiliary spring wedge. The auxiliary spring wedge was not able to be installed; therefore a follow-up action item was initiated for RF15 to complete the installation of the auxiliary spring wedge. The condition was evaluated in accordance with BWRVIP-06 and found to be acceptable for the continued operation and did not constitute a safety concern. This OE item shows the current vessel inspection programs effectively identify degraded components and evaluate corrective action items required to ensure intended functions are maintained.

The operating experience of existing BWR Vessel Internals program found no adverse trends in performance. Problems identified would not cause a significant impact to the safe operation of the plant and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Thermal Aging and Neutron Irradiation Embrittlement of CASS aging management program which will augment the existing BWR Vessel Internals program will effectively identify degradation of the CASS components found in the control rod assemblies, core spray lines and spargers, fuel supports, jet pump assemblies, and in the steam dryer prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Thermal Aging and Neutron Irradiation Embrittlement of CASS aging management program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The new Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless steel (CASS) aging management program will provide reasonable assurance that the effects of loss of fracture toughness will be adequately managed so that the intended functions of cast austenitic stainless steel (CASS) components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.11 Flow-Accelerated Corrosion

Program Description

The Flow-Accelerated Corrosion (FAC) aging management program at Hope Creek is an existing program that is based on EPRI guidelines in NSAC-202L-R3, “Recommendations for an Effective Flow Accelerated Corrosion Program.” The program provides for predicting, detecting, and monitoring wall thinning in piping and fittings, valve bodies, and heat exchangers due to FAC.

Analytical evaluations and periodic examinations of locations that are most susceptible to wall thinning due to FAC are used to predict the amount of wall thinning in pipes, fittings, and feedwater heater shells. Program activities include analyses to determine critical locations, baseline inspections to determine the extent of thinning at these critical locations, and follow-up inspections to confirm the predictions. Inspections are performed using ultrasonic, visual or other approved testing techniques capable of detecting wall thinning. Repairs and replacements are performed as necessary.

Where applicable, analyses to determine critical locations in piping and other components susceptible to FAC is performed utilizing CHECWORKS, a predictive code that uses the implementation guidance of NSAC-202L-R3 to satisfy the criteria specified in 10 CFR Part 50, Appendix B for development of procedures and control of special processes. For each examined component, a verified and validated PC-based computer program, called FAC Manager, is utilized in conjunction with CHECWORKS to calculate component wear, wear rate, projected thickness, and remaining life. If a component’s remaining life cannot be demonstrated to be more than one operating cycle, then corrective action is required, such as repair, replacement, or reevaluation.

No preventive or mitigative attributes are directly associated with the FAC program. However, it is recognized that monitoring of water chemistry to control pH and dissolved oxygen content is effective in reducing FAC. The program considers water treatment changes that may affect the FAC rates (e.g., water treatment amines, hydrogen water chemistry, hydrazine addition, or any other change that affects the pH or dissolved oxygen concentration).

The FAC program, which was originally outlined in NUREG-1344, is implemented as required by NRC Generic Letter 89-08, “Erosion/Corrosion-Induced Pipe Wall Thinning”. NUREG-1801 specifies in XI.M17 that the program relies on implementation of the Electric Power Research Institute (EPRI) guidelines in the Nuclear Safety Analysis Center (NSAC)-202L-R2 for an effective FAC program. As noted above, the FAC program is based on the EPRI guidelines in NSAC-202L, R3, “Recommendations for an Effective Flow-Accelerated Corrosion program.”

NUREG-1801 Consistency

The Flow-Accelerated Corrosion aging management program is consistent with the ten elements of aging program XI.M17, “Flow-Accelerated Corrosion,” specified in NUREG-1801 with the following exception:

Exceptions to NUREG-1801

1. NUREG-1801 specifies in XI.M17 that the program relies on implementation of the Electric Power Research Institute (EPRI) guidelines in the Nuclear Safety Analysis Center (NSAC)-202L-R2 (EPRI 1011838) for an effective FAC program. The Hope Creek FAC Program is based on the EPRI guidelines found in NSAC-202L-R3. **Program Elements Affected: Scope of Program (Element 1) and Detection of Aging Effect (Element 4).**

Justification for Exception

The sections of NSAC-202L associated with the program elements were reviewed to show that Revision 2 and 3 of the guidelines are equivalent with one main difference: Revision 3 allows an additional method for determining the wear of piping components from UT inspection. This method is called the Averaged Band Method. This method is a derivation of the Band Method and builds upon the years of experience with the Band Method, which remains an option in NSAC-202L-R3 for determining the wear of piping components from UT inspection. As explained in NSAC-202L-R3, overly conservative methods, such as the Band Method, can lead to unnecessary inspections or re-inspections. The Averaged Band Method provides a more realistic estimate of piping wear than the Band Method.

Enhancements

None.

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that wall thinning due to flow-accelerated corrosion is being adequately managed. The following examples of operating experience provide objective evidence that the Flow-Accelerated Corrosion program will be effective in assuring that intended function(s) would be maintained consistent with the CLB for the period of extended operation:

1. The Hope Creek FAC Program implemented a proactive replacement plan in September 2006, to mitigate wall thinning by upgrading to FAC resistant materials. Upgrading piping to a FAC resistant material is an industry best practice. EPRI's NSAC-202L-R3 (TR 1011838) "Recommendations for an Effective Flow-Accelerated Corrosion Program" states that upgrading the carbon steel piping to material containing chrome should alleviate FAC damage. Hope Creek has experienced FAC induced through-wall leaks with carbon steel piping. As a result of these piping leaks, Hope Creek has taken on a proactive replacement plan to upgrade the susceptible carbon

steel components with FAC resistant materials. Using plant and industry experience the FAC program manager determines what plant systems should be upgraded with FAC resistant materials.

The following plant systems have had portions of their piping upgraded: main steam drains, reactor water feed pump turbine steam supply drains, extraction steam lines, seal steam lines, feedwater heater vent lines, RCIC and HPCI steam supply drain lines, and plant heating system. Most of the upgrades have been with Chromium-Molybdenum alloy steel. None of the replaced piping has experienced any through-wall leakage due to FAC. This proactive material upgrading will continue to be evaluated by the FAC program manager and upgrades are considered for the remainder of the operating vent lines for all of the Feedwater Heaters, the main steam turbine control valve before seat drains and leak-off lines, the main steam lead drains, portions of reactor feed pump turbine steam drains, the steam jet air ejector runoff drain, portions of plant heating piping inside the turbine building steam tunnel, and the turbine bypass seal leak-off lines.

This example provides objective evidence that the FAC aging management program effectively monitors the aging effects of FAC on piping and components. In addition the program has taken corrective action to have a proactive replacement plan to upgrade the susceptible carbon steel components with FAC resistant material.

2. As result of feedwater heater shell failures at other nuclear plants (OE-9941), as well as Salem Unit 1 plant experience with feedwater heaters (OE11020), feedwater heater shell inspections were instituted at Hope Creek. In 2000, the #5A, B & C feedwater heater shell area was replaced in the vicinity of the extraction steam inlet nozzles. A shell area was cut out of the heaters, and was replaced with carbon steel plate roll-bonded with 0.125" stainless steel cladding on the inside diameter. The extraction steam inlet nozzle was also replaced with the same configuration. All feedwater heaters (except the #1 heaters) have been inspected at least once. The shell area around two of the four #1C feedwater heater extraction steam inlet nozzles were inspected in 2007, and no problem was identified. Inspection of the remaining two extraction steam inlet nozzles for the #1C, and all the #1A and #1B feedwater heaters extraction steam inlet nozzles are planned for 2010.

   As a part of the feedwater heater shell FAC inspection program, stress evaluations are performed to obtain the allowable minimum wall thickness. This minimum allowable thickness is the basis for trending wall thinning and tracking when the next inspection is scheduled. The scope of the feedwater heater shell inspection project is to inspect every feedwater heater shell at least once in the vicinity of the extraction steam inlet nozzle. Wear rates are determined and wall thinning on the feedwater heaters are trended, and analyses are performed to determine appropriate inspections, which are scheduled prior to the shell reaching its minimum allowable wall thickness.

This example provides objective evidence that the FAC aging management program effectively monitors and trends the aging effects of FAC on piping and components. In addition this program takes corrective actions prior to loss of intended function, and the program uses industry operating experience to improve program implementation.

3. In 2004, the Hope Creek FAC program prompted a wall thickness inspection of feedwater heater nozzles in response to OE17919, “Inspection Identifies Holes in #2 Heater Extraction at LaSalle Unit 1". Based on ultrasonic testing (UT) and visual inspection, significant wall thinning downstream of the piping/nozzle weld for the #2A feedwater heater nozzles was discovered. Extent of condition evaluation determined that #2B and #2C feedwater heaters had experienced the same kind of wall thinning.

   During internal weld repairs in April 2006, it was discovered that the nozzle had a stainless steel liner, which started at about 1/4" downstream of the pipe/ nozzle weld, rather than being fully extended. The wall thinning was found to be caused by steam cutting of the nozzle between the inner liner and the outer diameter, indicating the degradation to the nozzle would have been less severe had the liner been fully extended to the top of the nozzle. So far eleven out of the twelve nozzles for the #2 feedwater heaters (FWHs) have been repaired by internal weld build-up. A re-evaluation of the twelfth nozzle's wall thickness concluded that repairs were not required until RF16 outage (October 2010). Replacement of all three #2 FWHs is planned for RF16 outage. The new FWHs will have extraction steam inlet nozzles fabricated with alloy steel, which is resistant to FAC. To correct the root cause of this problem, the Hope Creek FAC Program will continue to monitor FAC-susceptible feedwater heater nozzles and make repairs or replacements as warranted.

   This example provides objective evidence that the FAC aging management program uses industry operating experience to investigate FAC related concerns and the program takes corrective actions prior to loss of intended function.

4. Extended Power uprate (EPU) at Hope Creek was implemented in 2008. In advance of this power uprate, in 2002, Hope Creek performed a FAC evaluation on CHECWORKS at 20% power uprate. Comparing the predicted CHECWORKS wear rates at EPU with wear rates at normal power, this evaluation revealed that the power uprate operating conditions would have a minimal impact on FAC wear rates. Also, results showed that the average predicted wear rate would not cause an increased need for physical modifications or replacements of the systems that are vulnerable to FAC. In 2008, the CHECWORKS model at Hope Creek was revised to reflect the power uprate conditions, in compliance with the EPRI NSAC 202L-R3 Guidelines.

Hope Creek has benefited from FAC related experience of other nuclear plants that have gone through EPU. Hope Creek actively participates in the CHECWORKS User Group (CHUG) and stays informed of the industry experience on FAC. So far, no industry experience has indicated any FAC related issues because of EPU, that would have any impact on risk ranking by CHECWORKS. Hope Creek will enter its period of extended operation in 2026. This provides at least 18 years of additional plant experience at EPU conditions. In addition, it allows for monitoring experiences at other nuclear plants that have gone through EPU conditions.

This example provides objective evidence that operating experience is being used effectively to improve the program and lessons learned are implemented to make the FAC program effective at Hope Creek.

The operating experience of the Flow-Accelerated Corrosion program shows that the program effectively monitors and trends the aging effects of FAC on piping and components and takes appropriate corrective action prior to loss of intended function. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken. There is sufficient confidence that the implementation of the Flow-Accelerated Corrosion program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Flow-Accelerated Corrosion program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing Flow-Accelerated Corrosion aging management program provides reasonable assurance that wall thinning aging effects are adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.12 Bolting Integrity

Program Description

The Bolting Integrity aging management program is an existing program that provides for condition monitoring of pressure retaining bolted joints within the scope of license renewal. The Bolting Integrity program incorporates NRC and industry recommendations delineated in NUREG-1339, “Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants”, EPRI TR-104213, “Bolted Joint Maintenance & Applications Guide,” and EPRI NP 5769, “Degradation and Failure of Bolting in Nuclear Power Plants,” as part of the comprehensive corporate component pressure retaining bolting program. The program provides for managing cracking, loss of material and loss of preload by performing visual inspections for pressure retaining bolted joint leakage in the following environments: air indoor and outdoor, raw water, soil and treated water.

The Hope Creek ISI program plan tables provide the examination category and description as identified in ASME Section XI, Table IWB-2500-1 for Class 1 components, Table IWC-2500-1 for Class 2 components, and Table IWD-2500-1 for Class 3 components.

Examinations at Hope Creek are currently performed in accordance with the ASME Section XI, 2001 Edition through the 2003 addenda, per the Hope Creek ISI program plans. Examinations for the period of extended operation will be in accordance with the appropriate code edition and addenda for the Hope Creek ISI Program Plan. In accordance with 10 CFR 50.55a(g)(4)(ii), the program is updated each successive 120-month inspection interval to comply with the requirements of the latest edition of the ASME Code specified twelve months before the start of the inspection interval. The extent and schedule of the inspections is in accordance with IWB-2500-1, IWC-2500-1 and IWD-2500-1 and assures that detection of leakage or fastener degradation will occur prior to loss of system or component intended functions. Bolting associated with Class 1 vessel, valve and pump flanged joints receive VT-1 inspection. For other pressure retaining bolting, routine observations will document any leakage before the leakage becomes excessive.

The integrity of non-ASME Class 1, 2, and 3 system and component pressure retaining bolted joints are evaluated by detection of visible leakage during maintenance or routine observation such as system walkdowns. MC component pressure retaining bolting is monitored in accordance with ASME Section XI, Subsection IWE, B.2.1.28, aging management program.

High strength bolts (actual yield strength ≥150 ksi) are not used on structural connections. The structural bolting and fasteners (actual yield strength <150 ksi) both inside and outside containment are inspected by visual inspection by the Structures Monitoring Program, B.2.1.32.

ASTM A490 bolts are used for NSSS Class 1 reactor pressure vessel supports. The bolts are installed with a preload that yields approximately 105 ksi tensile stress, which is less than the minimum yield strength of the bolt. Stress corrosion cracking (SCC) is not an applicable aging effect for these bolts since they are not subject to high sustained tensile stress. These bolts are inspected by the ASME Section XI, Subsection IWF, B.2.1.29, aging management program.

Procurement controls and installation practices, defined in plant procedures, ensure that only approved lubricants, sealants, and proper torque are applied. The activities are implemented through station procedures.

Other aging management programs also manage inspection of bolting and supplement this bolting integrity program. The ASME Section XI Inservice Inspection (ISI) Subsections IWB, IWC, and IWD, B.2.1.1, aging management program manages the inspection of safety-related bolting and supplements this bolting integrity program. The ASME Section XI, Subsection IWF, B.2.1.29, aging management program addresses aging management of ASME Section Class 1, 2, 3 and MC piping and component support bolting. The ASME Section XI, Subsection IWE, B.2.1.28, aging management program addresses aging management of containment pressure retaining bolting. Other structural bolting is managed as part of the Structures Monitoring Program, B.2.1.32. The aging management of crane and hoist bolting is addressed by the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems, B.2.1.15, aging management program. Aging Management of heating and ventilation bolted joints is addressed by the External Surfaces Monitoring, B.2.1.25, aging management program. These monitoring methods are effective in detecting the applicable aging effects and the frequency of monitoring has been adequate to prevent significant degradation. Inspection activities for bolting in a buried environment are performed in conjunction with buried piping and component inspections as part of the Buried Piping Inspection, B.2.1.24, aging mangement program or the plant specific Buried Non-Steel Piping Inspection, B.2.2.4, aging management program.

Class 1, 2 and 3 bolted joint repair falls within the scope of the ASME Section XI Repair and Replacement Program. Flanged joint welding repairs are implemented in accordance with IWA-4000. Pressure bolting replacements are implemented in accordance with IWA-7000. Other pressure retaining bolting maintenance evaluations and repairs follow the EPRI bolting guidelines for the evaluation and repair of the flanges and replacement bolts. The ASME Section XI, Subsection IWF, B.2.1.29, aging management program addresses replacement of NSSS component support bolting. Corrective actions are addressed in accordance with 10 CFR Part 50, Appendix B.

The program will be enhanced, as noted below, to provide reasonable assurance that the Bolting Integrity program aging effects will be managed during the period of extended operation.

NUREG-1801 Consistency

The Bolting Integrity aging management program is consistent with the ten elements of aging management program XI.M18, Bolting Integrity, specified in NUREG-1801 with the following exception:

Exceptions to NUREG-1801

1. NUREG-1801 indicates that if bolting connection for pressure retaining components (not covered by ASME Section XI) is reported to be leaking, then it may be inspected daily. If the leak rate does not increase, the inspection frequency may be decreased to biweekly or weekly. Hope Creek uses the Corrective Action Program to determine an appropriate inspection frequency for identified leaks in bolting connections. **Program Elements Affected: Monitoring and Trending (Element 5)**

Justification for Exception

For periodic inspection of bolting, other than ASME Class 1, 2 or 3 bolting, Hope Creek uses the Corrective Action Program to document and manage those locations where leakage was identified during routine observations including engineering walkdowns and equipment maintenance activities. Based on the severity of the leak and the potential to impact plant operations, nuclear or industrial safety, a leak will be repaired immediately, scheduled for repair, or monitored for change. If the leak rate changes (increases, decreases or stops), the monitoring frequency is re-evaluated and may be revised. Hope Creek operating experience has not indicated a need for a set frequency (e.g., daily) of leakage inspections involving bolting.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program element:

1. The existing program will be enhanced to state that the following bolting material should not be reused:

   a. Galvanized bolts and nuts

   b. ASTM A490 bolts

   c. Any bolt and nut tightened by the turn of nut method.

   Program Elements Affected: Corrective Actions (Element 7)

Operating Experience

Hope Creek has experienced isolated cases of bolt corrosion, loss of bolt preload and bolt torquing issues. In all cases, the existing inspection and testing methodologies have discovered the deficiencies and corrective actions were implemented prior to loss of system or component intended functions.

1. In 2004, an inspection of the torus lateral seismic restraint bolting washers showed scaling. After removal of scale, pitting was observed on the washers. The corrective action taken was to remove scaling from all washers and apply coating to protect the washers from future degradation issues. Follow up inspections of this area did not find rust or scaling. This example provides objective evidence that visual inspections identified scaling of washers prior to loss of intended function, and provided corrective action to resolve the degradation and preclude future degradation of similar components.

2. In 2004, during a system walkdown it was identified that a bolt was missing on a nonsafety-related pipe support base plate in the Safety Auxiliaries Cooling System (SACS) system. Further investigation determined that the bolt was in place but rusted. Engineering evaluation determined that operability of the SACS system was not affected. The hanger was repositioned, and new bolts were installed and properly torqued. This example provides objective evidence that system walkdown inspections identified a missing bolt and provided corrective action to resolve the degraded condition prior to loss of system intended function.

The operating experience of the Bolting Integrity program demonstrates that the problems identified do not impact intended function, and adequate corrective actions are taken to prevent recurrence. There is sufficient confidence that the implementation of the Bolting Integrity program will effectively identify degradation prior to loss of intended function. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Bolting Integrity program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The enhanced Bolting Integrity aging management program provides reasonable assurance that the identified aging effects will be managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.13 Open-Cycle Cooling Water System

Program Description

The Hope Creek Open-Cycle Cooling Water System aging management program is an existing program that includes mitigative, performance-monitoring, and condition-monitoring activities to manage the internal corrosion of piping to minimize susceptibility of corrosion and to verify that corrosion has not exceeded acceptance limits. More than one type of aging management program is necessary to ultimately ensure that the aging effects are adequately managed and the intended function(s) are maintained for the extended period of operation. These activities provide assurance that cracking, loss of material, increase in porosity and permeability, loss of strength, hardening and heat transfer reduction aging effects are maintained at acceptable levels for systems and components within the scope of license renewal.

The GL 89-13 activities provide for management of aging effects in raw water cooling systems through tests and inspections per the guidelines of NRC Generic Letter 89-13. System and component testing, visual inspections, other non-destructive examination (e.g., RT-Radiographic Testing, UT-Ultrasonic Testing, and/or ECT-Eddy Current Testing), and sodium hypochlorite injection are conducted to ensure that aging effects are managed such that system and component intended functions and integrity are maintained. Major component types include pumps, piping, piping elements, piping components, heat exchangers and tanks.

The Hope Creek Open-Cycle Cooling Water System (OCCWS) aging management program primarily consists of station GL 89-13 activities that include sodium hypochlorite injection, system testing, periodic inspections and NDE. The program includes surveillance and control techniques to manage aging effects caused by bio-fouling, corrosion, erosion, protective coating failures, and silting in the OCCW system or structures and components serviced by the OCCW system. Other activities include station maintenance inspections, component preventive maintenance (PM), plant surveillance testing, ISI, and inspections. These activities provide for management of cracking, loss of material (without credit for protective coatings) and reduction of heat transfer (including fouling from biological, corrosion product, and external sources) aging effects where applicable in system components exposed to a raw water environment.

Corporate and station procedures provide instructions and controls for mitigative actions through raw water chemistry control (sodium hypochlorite injection), performance-monitoring through station testing, and condition-monitoring through inspection and testing of Hope Creek raw water systems in the scope of license renewal. These methods and associated frequencies are effective in detecting the applicable aging effects and adequate to prevent significant degradation.

OCCWS aging management program testing and inspections at Hope Creek have detected cracking, material loss, and heat transfer reduction aging effects in raw water system components prior to loss of system intended functions. GL 89-13 program assessments have been performed and corrective actions have been implemented.

For heat exchangers, an aging management program that uses multiple attributes is considered necessary to effectively address all aging effects. These aging management program activities provide input into a total program that includes primary and secondary operating fluid chemistry controls, performance monitoring and inspections of all heat exchangers in the scope of license renewal at Hope Creek to manage cracking, material loss, and heat transfer reduction aging effects where applicable.

Inspection scope, method (e.g., visual or nondestructive examination [NDE]), and testing frequencies are in accordance with the commitments under NRC GL 89-13.

Evaluations are performed for test or inspection results that do not satisfy established criteria and a corrective action report is initiated in accordance with the corrective action process to document the concern in accordance with the 10 CFR Part 50, Appendix B Corrective Action Program. The corrective action program ensures that conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the problem is determined and an action plan is developed to prevent recurrence.

NUREG-1801 Consistency

The Open-Cycle Cooling Water System aging management program is consistent with the ten elements of aging management program XI.M20, Open-Cycle Cooling Water System, specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Some microbiologically-influenced corrosion, failure of protective coatings, and fouling has been observed in several heat exchangers since the beginning of unit operation. The guidance of NRC GL 89-13 has been implemented for approximately twenty years and has been effective in managing aging effects due to bio-fouling, corrosion, erosion, protective coating failures, and silting in structures and components serviced by OCCW systems. Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling, reduction of heat transfer due to fouling, cracking and expansion due to reaction with aggregates, cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel, increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack, increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide are being adequately managed. The following examples of operating experience provide objective evidence that the Open-Cycle Cooling Water System program will be effective in assuring that intended function(s) are maintained consistent with the current licensing basis for the period of extended operation:

1. During the Hope Creek refueling outage in November 2004, technicians found excessive corrosion at the bell and spigot joints at several points on the “A” Station Service Water loop buried piping. There are approximately sixty joints on this service water loop between the intake structure and the Reactor Building. All the joints were examined using broadband scanning, which can detect degradation of the carbon steel piping enclosed in the reinforced concrete. Eight joints out of the sixty joints had some indication of corrosion. The original “A” loop joint had localized thinning of the carbon steel. The thickness was below the minimum acceptance criterion. The thickness of the other seven joints was less than nominal, but above the minimum acceptance criterion.

   Based on the operating experience at the Salem Generating Station with similar Service Water System piping, the decision was made to install a WEKO seal to correct the problem on the worst joint. Seven other joints received similar WEKO seal installations, and the remaining joints received a combination of cleaning and coating restorations to restore the joints to the original configuration. The corrosion of the carbon steel bell rings has been attributed to the blistering of the original epoxy coatings and subsequent attack on the metal surfaces by the brackish estuary water. Hope Creek considers different industry practices for monitoring the reinforced concrete joints, e.g., using broadband scanning. The remaining joints that were not modified with the WEKO seals are inspected every other outage.

This operating experience example provides objective evidence that the monitoring program for the Service Water System piping at the Hope Creek is effective in detecting the degradation of the system and then taking effective corrective action to ensure the long-term operability and reliability of the system.

2. In April 2006 during the refueling outage, three locations in the “B” Station Service Water piping header near the Reactor Building were found below the nominal piping thickness where the epoxy coating was worn away from the carbon steel piping. The technicians initially thought that two of the three areas were below the minimum wall thickness acceptance criterion (≥87.5% of nominal). These problems were discovered during the routine inspection of the Service Water header piping during the refueling outage. Subsequent evaluation of the three locations determined that the areas were not below the calculated design minimum wall thickness, and the areas were cleaned and recoated with epoxy. Subsequent inspection of the “A” loop during the following refueling outage found that one small area was corroded below the minimum wall requirements. The affected area was repaired with weld buildup and reapplication of the epoxy coating. These transition pipe sections are inspected every other outage as part of the GL 89-13 inspection program. This frequency was determined to be adequate to manage the aging effects and to identify degraded conditions prior to failure of intended function based on historical performance.

   This operating experience example provides objective evidence that the inspections are able to detect the degradation of the piping at various locations in the system prior to the actual failure of the equipment. Corrective actions are effective in returning the system to the proper condition for ensuring the long-term reliability of the system.

3. In February 2007, a through-wall leak was found on the “B” Station Service water lube water head tank by station mechanics. This tank provides bearing cooling water during certain design basis accidents until the Service Water pumps are sequenced onto the diesel generator. The investigation of the leak determined that several areas of the tank welds had experienced microbiologically-influenced corrosion attack. These tanks had initially been constructed of 304 stainless steel, but were upgraded to 316L stainless steel in order to lessen the impact of the microbiologically-influenced corrosion attack. However, subsequent inspections of these tanks found that the microbiologically-influenced corrosion was causing pitting in the tank weld areas. The tank welds were repaired using an epoxy coating until a final evaluation was conducted to abandon the tanks, and replace the piping with AL6X material to match the remainder of the service water intake structure piping.

   This operating experience example provides objective evidence that the OCCWS aging management program is effectively monitoring the equipment and taking appropriate corrective action to change the materials and configuration to ensure the long-term safe, reliable operation of the system.

Modifications to the Open-Cycle Cooling Water System as part of the Service Water Improvement project, completed in the 1990s, included replacement of most of the safety-related carbon steel piping with 6% molybdenum stainless steel. Similarly, the safety-related aluminum bronze and carbon steel valves are being replaced on a programmatic basis with the 6% molybdenum stainless steel valves. A review of the operating experience of the Open-Cycle Cooling Water program since the completion of the Service Water Improvement project and the implementation of the NRC Regulatory Guide 89-13 guidance shows that the Open-Cycle Cooling Water System has performed well. While individual problems, such as, those discussed above, have been identified, the problems identified would not cause significant impact on the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Open-Cycle Cooling Water System program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Open-Cycle Cooling Water System program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing Open-Cycle Cooling Water System program provides reasonable assurance that the identified aging effects are adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.14 Closed-Cycle Cooling Water System

Program Description

The Closed-Cycle Cooling Water System aging management program is an existing program that provides for managing aging of piping, piping components, piping elements and heat exchangers that are included in the scope of license renewal for stress corrosion cracking, loss of material and reduction of heat transfer and are exposed to a closed cooling water environment.

The program provides for mitigation, performance monitoring, and condition monitoring activities that are implemented through station procedures. Mitigation activities include measures to maintain water purity and the addition of corrosion inhibitors to minimize corrosion based on EPRI 1007820. Performance monitoring provides indications of degradation in closed-cycle cooling water systems, with plant operating conditions providing indications of degradation in normally operating systems. In addition, station maintenance inspections and nondestructive examination provide condition monitoring of heat exchangers exposed to closed-cycle cooling water environments.

System managers perform monitoring and trending activities in accordance with the plant engineering procedures. For pumps, the parameters monitored include flow, discharge pressures, and suction pressures. For heat exchangers the parameters monitored include flow, temperatures and differential pressures. System and component performance test results are evaluated in accordance with system and component design basis requirements. System monitoring, trending, and walk down results, inspection results, and test results are evaluated by engineering to determine if any corrective actions are required.

A one-time inspection of selected components in stagnant flow areas will be conducted to confirm the absence of aging effects resulting from exposure to closed-cycle cooling water.

Performance monitoring provides indications of degradation in Closed-Cycle Cooling Water systems, with plant operating conditions providing indications of degradation in normally operating systems. In addition, station maintenance inspections and nondestructive examination provide condition monitoring of heat exchangers exposed to closed-cycle cooling water environments.

The program will be enhanced, as noted below, to provide reasonable assurance that the Closed-Cycle Cooling Water System program aging effects will be managed during the period of extended operation.

NUREG-1801 Consistency

The Closed Cycle Cooling Water System aging management program is consistent with the ten elements of aging management program XI.M21, Closed Cycle Cooling Water System, specified in NUREG-1801 with the following exceptions:

Exceptions to NUREG-1801

1. NUREG-1801 refers to EPRI TR-107396 1997 Revision. Hope Creek implements the guidance provided in EPRI 1007820, which is the 2004 Revision to TR-107396. **Program Elements Affected: Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), and Monitoring and Trending (Element 5)**

Justification for Exception

EPRI periodically updates industry water chemistry guidelines, as new information becomes available. Hope Creek has reviewed EPRI 1007820 and have determined that the most significant difference is that the new revision provides more prescriptive guidance and has a more conservative monitoring approach. EPRI 1007820 meets the same requirements of EPRI TR-107396 for maintaining conditions to minimize corrosion and microbiological growth in closed cooling water systems for effectively managing loss of material, cracking, and reduction of heat transfer.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

1. New recurring tasks will be established for enhancing the performance monitoring of the Closed Cycle Cooling Water System. **Program Elements Affected: Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), and Monitoring and Trending (Element 5)**

2. New recurring tasks will be established for enhancing the performance monitoring of the Chilled Water System. **Program Elements Affected: Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), and Monitoring and Trending (Element 5)**

3. A one-time inspection of selected Closed-Cycle Cooling Water program components in stagnant flow areas will be conducted to confirm the effectiveness of the Closed-Cycle Cooling Water program. These inspections will be performed prior to the period of extended operation. **Program Elements Affected: Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), and Acceptance Criteria (Element 6)**

4. A one-time inspection of selected Closed-Cycle Cooling Water program chemical mixing tanks and associated piping will be conducted to confirm the effectiveness of the Closed-Cycle Cooling Water program on the interior surfaces of the tanks and associated piping. These inspections will be performed prior to the period of extended operation. **Program Elements Affected: Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), and Acceptance Criteria (Element 6)**

5. The program will be enhanced such that the plant auxiliary building chilled water system, which is part of the Control Area Chilled Water System, will comply with the pure water control program in accordance with EPRI 1007820 prior to the period of extended operation. **Program Elements Affected: Preventive Actions (Element 2), Detection of Aging Effects (Element 4), and Monitoring and Trending (Element 5)**

6. A one-time inspection of selected Control Area Chilled Water System components, including the plant auxiliary building chilled water system, will be conducted to confirm the effectiveness of the Closed-Cycle Cooling Water program. These inspections will be performed prior to the period of extended operation. **Program Elements Affected: Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), and Monitoring and Trending (Element 5)**

These enhancements will be implemented prior to the period of extended operation. In addition, the one-time inspections will be performed prior to the period of extended operation.

Operating Experience

Degradation of Closed-Cycle Cooling Water systems due to corrosion product buildup or through-wall cracks in supply lines has been observed in operating plants. Accordingly, operating experience demonstrates the need for this program. Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that cracking, loss of material, and reduction of heat transfer are being adequately managed. The following examples of operating experience provide objective evidence that the Closed-Cycle Cooling Water System program will be effective in assuring that intended function(s) are maintained consistent with the CLB for the period of extended operation:

1. On July 31, 2006, during performance of the monthly surveillance tests, the equipment operators observed higher than normal lube oil temperatures on the ‘B’ Emergency Diesel Generator. An investigation was performed and it was concluded that the cause of the increased temperature trends was due to the mis-positioning of the associated throttle valve during a recent Safety Auxiliaries Cooling System flow balancing on the ‘B’ Emergency Diesel Generator. Additionally, during the investigation into the ‘B’ Emergency Diesel Generator increased lube oil temperatures, it was determined that the ‘C’ Emergency Diesel Generator was also having higher than expected SACS delta temperature trends. This too resulted from a mis-positioned throttle valve. The temperature trends on the other two diesel generators were within the expected temperature limits. Although the increased temperature trends did not result from a degraded material condition, this is an example of the effectiveness of the monthly surveillance tests and the use of temperature trending to identify unexpected conditions.

2. Several corrective action reports were generated at Hope Creek during 2001 and 2002 concerning the elevated metal contaminants in the jacket water of the diesel generators. In February of 2003 an evaluation determined that the reuse of the jacket water after draining for maintenance was contributing to the problem. The vendor of the corrosion inhibitor confirmed the long-term reuse of the jacket water could lead to the elevated metal contaminants in the jacket water. As a result the Closed Cycle Cooling Water program determined that the replacement of the current solution with demineralized water and new corrosion inhibitor would rectify this problem. By the end of 2003, all of the diesel generators had the new jacket water in service. Since then, there have been significantly fewer incidents of elevated metal contaminants in the jacket water of the diesel generators. This operating experience is an example of how the Closed Cycle Cooling Water program assesses their current program, and successfully implements corrective actions to remove elevated contaminants to restore the parameters within specifications.

Over the past five years Hope Creek has exceeded an Action Level 1 limit on the nitrite-control programs one time. In November of 2007 the emergency diesel generator exceeded Action Level 1 for NO_2. Levels were brought back into specification in accordance with the EPRI guidelines and station procedures. Additionally, Hope Creek has exceeded an Action Level 1 limit on the pure water systems six times in the past five years. In October of 2008 the safety auxiliary cooling system A loop exceeded Action Level 1 for dissolved oxygen, in September of 2008 the safety auxiliary cooling system B loop exceeded Action Level 1 for conductivity, in August of 2007 the turbine building chilled water exceeded Action Level 1 for dissolved oxygen, in July of 2005 the turbine building chilled water exceeded Action Level 1 for conductivity, in July of 2007 the auxiliary building chilled water exceeded Action Level 1 for dissolved oxygen and in July of 2008 the auxiliary building chilled water exceeded Action Level 1 for conductivity. In all six instances, the parameters were brought back into specification in accordance with the EPRI guidelines and station procedures. There have been no age-related failures identified in the corrective action program on the piping or components of these systems. The operating experiences discussed above are examples of abnormal transients that were identified by routine monitoring activities and corrective actions were implemented. Additionally, the parameters that exceeded Action Level 1 values were isolated events, on independent systems or trains and different parameters. Therefore, no adverse trend can be concluded as a result of these excursions for the Closed-Cycle Cooling Water chemical control programs. This provides objective evidence that the current Closed-Cycle Cooling Water aging management program is effective in mitigating the aging effects at Hope Creek. The Chilled Water System is being enhanced to ensure the long-term reliability of the systems supplied by chilled water.

There is sufficient confidence that the implementation of the Closed-Cycle Cooling Water System program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Closed-Cycle Cooling Water System program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The enhanced Closed-Cycle Cooling Water System program will provide reasonable assurance that the identified aging effects will be managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.15 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

Program Description

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems aging management program is an existing program that provides for periodic visual inspections of cranes and hoists in the scope of 10 CFR 54.4. The program includes structural components, including structural bolting, that make up the bridge, the trolley, lifting devices, and rails in the rail system and includes cranes and hoists that meet the provisions of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems aging management program is a condition monitoring program.

The aging management program is implemented through station procedures that are based on ASME/ANSI B30.2, B30.10, B30.11, and B30.16 and rely upon visual inspection to manage loss of material in an indoor air and outdoor air environment. Structural bolting is monitored for loss of preload by inspecting for loose or missing bolts, or nuts in an indoor air and outdoor air environment. Cranes and hoists accessible during normal plant operation are inspected on a frequency specified in accordance with station procedures and prior to use. Cranes and hoists are inspected approximately every 12 months. The inspection methods are effective in detecting the applicable aging effects and the frequency of monitoring is adequate to prevent significant degradation.

The program evaluates the effectiveness of the maintenance monitoring activities to ensure the structural reliability of cranes and hoists. The program activities verify structural integrity of crane and hoist elements required to maintain their intended function and comply with ASME/ANSI B30.2 and B30.16.

The program will be enhanced to include visual inspection of rails in the rail system for loss of material due to wear. The program will be enhanced to include visual inspection of structural components and structural bolts for loss of material due to general corrosion, pitting, and crevice corrosion and structural bolting for loss of preload due to self-loosening. The acceptance criteria will be enhanced to require evaluation of significant loss of material due to corrosion for structural components and structural bolts, and significant loss of material due to wear of rail in the rail system. The enhancements will be implemented prior to entering the period of extended operation.

NUREG-1801 Consistency

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems aging management program is consistent with the ten elements of aging management program XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems," specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

1. The program will include visual inspection of structural components and structural bolts for loss of material due to general corrosion, pitting, and crevice corrosion and structural bolting for loss of preload due to self-loosening. **Program Elements Affected: Scope of Program (Element 1) and Parameters Monitored or Inspected (Element 3)**

2. The program will be enhanced to require visual inspection of the rails in the rail system for loss of material due to wear. **Program Elements Affected: Scope of Program (Element 1) and Parameters Monitored or Inspected (Element 3)**

3. The acceptance criteria will be enhanced to require evaluation of significant loss of material due to corrosion for structural components and structural bolts, and significant loss of material due to wear of rail in the rail system. **Program Element Affected: Acceptance Criteria (Element 6)**

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging affects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. In 2002, there were five industry events or operating experience (OE) dealing with cranes and hoists reviewed by the Hope Creek operating experience (OE) group over a six-month period. The specific events reviewed were OE13701, OE13702, OE14001, OE14762 and OE14920. For these five events, a common theme involving inadequate upkeep, inadequate preventative maintenance (PM), and inadequate storage of cranes and hoists had been presented in each of these events. Due to the increase in the number of events seen within the nuclear industry at the time, including events where a load was dropped, the operating experience (OE) group prompted a generic implication review at Hope Creek. The operating experience (OE) group initiated a corrective action report to look at programs, policies and procedures for the upkeep, preventative maintenance (PM) and storage of hoists and other lifting devices at Hope Creek.

The site Maintenance organization performed a review of existing programs and procedures to determine the effectiveness of the station's preventative maintenance and storage procedures of lifting devices relative to the review of the operating experiences noted in the events. Existing procedures for the various station hoists and lifting devices were reviewed and it was concluded they provide sufficient guidance for performing inspections and preventative maintenance activities. Hope Creek procedures require that any lifting device that has major maintenance must be load tested prior to being returned to service, and this step reduces the potential of a load drop incidence. Based on the review of OE events and station procedures, it was determined that the existing program and procedures were adequate and no enhancements were warranted. This example provides objective evidence that industry operating experience is reviewed for applicability to the station and consideration is given for process enhancements to the program or procedures for inspection of cranes and hoists.

2. A review of approximately 290 Hope Creek Corrective action reports did not identify any history of loss of material due to corrosion in cranes and hoists structural members or loss of material due to wear in the rail system. In all cases, the existing Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems aging management program has identified only event-driven (not age related) conditions, discussed further below.

   In 2000, a corrective action report was issued to document, evaluate and repair a degraded condition with the refueling bridge trolley rail. During movement of the refueling bridge trolley from the east to west, there was a noticeable bump from trolley movement. Upon further inspection of the rail system, an indentation was identified in the rail. The indentation in the rail was repaired with a weld repair to restore the rail profile configuration. This example provides objective evidence that the station's program is effective in detecting and correcting structural conditions adverse to quality that could affect an intended function.

   In 2006, a corrective action report was issued to document, evaluate and repair a degraded condition with the Hope Creek polar crane. The HC polar crane rail was experiencing premature wheel bearing wear on the crane. An engineering investigation into the cause of the condition concluded that the existing rail configuration was slightly egg shaped and was not reported to be age related due to corrosion or wear. The rails were re-configured from the as found installed condition to remove existing gaps and align the rails to the correct span width. This example provides objective evidence that the station's program is effective in detecting and correcting structural conditions adverse to quality that could affect an intended function.

As discussed in the example 2 above, the operating experience of the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program did not show any adverse trend in performance. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The enhanced Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems aging management program will provide reasonable assurance that the loss of material and loss of preload aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.16 Compressed Air Monitoring

Program Description

The Compressed Air Monitoring aging management program is an existing program that manages piping, piping components, and piping elements, compressor housings, and tanks for loss of material due to general, pitting and crevice corrosion in the compressed air systems. The Hope Creek aging management activities consist of preventive maintenance and condition monitoring measures to manage the effects of aging.

The Compressed Air Monitoring program is based on the Hope Creek response to NRC Generic Letter 88-14, “Instrument Air Supply Problems” and utilizes guidance and standards provided by INPO SOER 88-01. The Compressed Air Monitoring program activities implement the criteria in EPRI TR-108147 (revised guide to EPRI NP-7079) and ASME OM-S/G-1998, Part 17 regarding periodic air quality sampling and sampling locations.

Program activities include air quality checks at various locations in the system to ensure that dew point, particulates, lubricant content, and contaminants are kept within the specified limits in accordance with ANSI/ISA 7.0.01-1996, paragraph 5.

Hope Creek performs testing and inspection of the air system within the scope of license renewal. Pressure decay tests and subsequent stroke tests require inspections for leakage if acceptance criteria are not met.

The effects of corrosion and the presence of contaminants are detected during system manager walk downs, leak rate tests, and preventive maintenance inspections of air filters, accumulators, receiver tanks and air traps. The procedures and work orders for these inspections include specific performance limits.

These periodic tests in conjunction with post maintenance testing, emergency operating procedures and the operator training associated with these operating procedures provide assurance that the air system within the scope of license renewal will fulfill its intended function.

Results from the above inspections and tests are compared with established acceptance criteria to provide for timely detection of aging effects. Evaluations are performed for test or inspection results that do not satisfy established criteria and a corrective action report (SAP Notification) is initiated in accordance with the corrective action process to document the concern in accordance with the 10 CFR Part 50, Appendix B Corrective Action Program. The corrective action program ensures that conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the problem is determined and an action plan is developed to prevent recurrence.

NUREG-1801 Consistency

The Compressed Air Monitoring aging management program is consistent with the ten elements of aging management program XI.M24, Compressed Air Monitoring, specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Industry operating experience indicates that internal degradation can cause significant degradation to susceptible plant components. The following examples of operating experience provide objective evidence that the Compressed Air Monitoring program is effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation

1. During a drain trap inspection at Hope Creek in 1999, rust particles were found in the aftercooler drain line and drain trap. The rust particles were clogging the drain trap, thereby causing it to fail. The drain piping and drain trap were replaced. As part of an extent of condition, a UT test was conducted on the upstream aftercooler shell with satisfactory results. This example provides objective evidence that Compressed Air Monitoring deficiencies are entered into the corrective action process to correct items discovered and to maintain intended functions.

2. During operator rounds at Hope Creek in 2003, an instrument airline was found worn due to vibration at a mounting point. A second worn line was found in the same vicinity. Both worn sections of copper piping were replaced. This example provides objective evidence that Compressed Air Monitoring deficiencies are found and entered into the corrective action process, and that appropriate actions are taken as necessary to ensure continued effective compressed air operation is ensured.

3. In 2007, a leak in the instrument airline was identified on an elbow joint at the exit of an air dryer. The leak was temporarily repaired and placed in the work management system. The repair requires an instrument air header outage and is scheduled for the fall 2009 refueling outage. This operating experience example provides objective evidence that compressed air deficiencies are found, evaluated and corrective actions are placed in the work management system to maintain system intended functions.

As demonstrated in the operating experience examples above, the Compressed Air Monitoring aging management program is effectively managing the aging effects. Based on these examples, station procedures are utilized to identify and document conditions adverse to quality in accordance with the corrective action program. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken. There is sufficient confidence that the implementation of the Compressed Air Monitoring program is effectively identifying degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Compressed Air Monitoring program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing Compressed Air Monitoring aging management program provides reasonable assurance that the loss of material aging effects are adequately managed so that the intended functions of components within the scope license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.17 Fire Protection

Program Description

The Hope Creek Fire Protection program is an existing program that will manage the identified aging effects for the fire barriers, diesel fire pumps fuel oil supply lines, and the Halon and carbon dioxide systems and associated components, through the use of periodic inspections and functional testing to detect aging effects prior to loss of intended functions. System functional tests and inspections are performed in accordance with guidance from NFPA Codes and Standards. The program applies to piping, piping elements, piping components, doors, dampers and fire barriers. The environments that the fire protection components are being managed are air/gas wetted, air-outdoor, and air-indoor.

The Fire Protection program is a condition and performance monitoring program whose monitoring methods are effective in detecting the applicable aging effects and the frequency of monitoring is adequate to prevent significant degradation. The Fire Protection program provides for visual inspections of fire barrier penetration seals for signs of degradation such as change in material properties, loss of materials, cracking, and hardening, through periodic inspection and functional testing. The program requires performance of visual inspections of at least 10% of each type of penetration seals at least once per refueling cycle (18-months). The program specifies visual examinations of the fire barrier walls, ceilings and floors in structures within the scope of license renewal at a frequency of once each refueling outage (18-months). Periodic visual and functional tests are used to manage the aging effects of fire doors and dampers. The inspection frequency for fire doors is 6-months. All fire dampers shall be verified to be functional by visual inspection at least once every refueling cycle (18-months). In addition, 10% of the readily accessible fire dampers shall be functionally tested every refueling cycle (18-months).

Operational tests of the diesel-driven fire pump are performed at least once every refueling cycle (18-months) to record flow and discharge pressures, sequential starting capability and controller and alarm functional tests. The performance tests will be used to detect degradation (corrosion) of the fuel supply lines before the loss of the component intended function, and provide data for trending purposes.

The program also provides for aging management of external surfaces of the Halon and carbon dioxide fire suppression system components through periodic functional tests and visual inspections for any loss of material.

These inspections and tests are implemented through station procedures and recurring task work orders. Personnel performing inspections are qualified and trained to perform the inspection activities. Unacceptable conditions are entered into the Corrective Action Program for proper disposition.

The program will be enhanced, as noted below, to provide reasonable assurance that the Fire Protection program aging effects will be adequately managed during the period of extended operation.

NUREG-1801 Consistency

The Fire Protection aging management program is consistent with the ten elements of aging management program XI.M26, "Fire Protection," specified in NUREG- 1801 with the following exception:

Exception to NUREG-1801

1. NUREG-1801 recommends visual inspection and functional testing of the Halon and Carbon Dioxide fire suppression systems at least once every six months. The Halon and Carbon Dioxide fire suppression systems currently undergo functional testing every refueling cycle (18-months). **Program Elements Affected: Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4).**

Justification for Exception

In addition to the 18-month functional testing, the Halon fire suppression system undergoes more frequent visual inspections for system charge (storage tank weight at least every 6-months), and the low-pressure Carbon Dioxide fire suppression system undergoes a weekly visual storage tank level and pressure check. These test and inspection frequencies are considered sufficient to ensure system availability and operability based on the station operating history (corrective actions, completed surveillance test results) that shows no aging related events have been found that have adversely affected system operation.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

1. The Fire Protection aging management program will be enhanced to provide additional inspection guidance to identify degradation of fire barrier walls, ceilings, and floors for aging effects, such as cracking, spalling and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates. **Program Elements Affected: Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), Monitoring and Trending (Element 5), Acceptance Criteria (Element 6).**

2. The program will be enhanced to provide specific guidance for examining exposed external surfaces of the fire pump diesel fuel oil supply line for corrosion during pump tests. **Program Elements Affected: Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), Monitoring and Trending (Element 5), Acceptance Criteria (Element 6).**

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the fire protection program will be effective in assuring that intended function(s) and will be maintained consistent with the CLB for the period of extended operation:

1. In October 2004, corrosion was found on the external surface of a fire door (1112A) and its door frame. During routine fire door inspections, using the existing surveillance procedures, rust and corrosion were found on the exterior door surface and lower door frame located in the condenser bay. This condition was entered into the corrective action program. The corrosion was attributed to the bottom of the door being in contact with moisture in the condenser bay. The door and frame were repaired and painted. This example provides objective evidence that this program effectively manages the aging effects of the fire doors and deficient conditions are entered into the corrective action program for evaluation and resolution of fire door deficiency. The Fire Protection program surveillance procedures in place for fire door inspection and testing along with the corrective action program will continue to be satisfactory through the period of extended operation.

2. In September 2006, Carbon Dioxide system fire dampers failed to reposition as required during a simulated functional test. The associated surveillance test was performed to ensure that the Carbon Dioxide flooding system would meet its intended design function to maintain Carbon Dioxide levels during an actual fire event. Troubleshooting of the system determined that an electronic signal was not being received preventing the electronic relay to latch, which would have allowed the fire dampers to reposition during this simulated actuation. The defective electronic control board was replaced. The system vendor was brought on site, and observed the retest that was satisfactory performed. This example provides objective evidence that the functional tests performed for the Carbon Dioxide flooding system are sufficient to identify conditions adverse to quality. It also demonstrates the effectiveness of the corrective action program in resolving equipment deficiencies.

3. In January 2006, a fire barrier was found degraded. The identified condition was similar to the conditions found at another nuclear station in 1998. Approximately 12 to 18 inches of structural steel fire proofing was found to be chipped off and was allowing the wire mesh on the steel beam to be visible and exposed. Additional areas in the vicinity where the damage was found were inspected to verify if any additional areas may be affected, none were found. The fireproofing material was repaired to acceptable conditions. The cause of the degraded fire barrier was not determined. This example demonstrates the Fire Protection program that visually inspects fire barriers for damage is capable in identifying deficient conditions. It also demonstrates that the corrective action program will be effective to correct deficient conditions when identified.

Hope Creek complies with NFPA codes, which require comprehensive fire barrier inspections, testing of fire pumps, and inspections and functional testing of fire protection systems (CO2, Halon) system components. NFPA code requirements are followed to ensure that the design features of the Fire Protection system equipment are properly inspected, maintained and functionally tested to ensure that these design features will be maintained. Deficiencies found during these inspections and functional tests are entered into the corrective action program, which return the equipment back to their intended design requirements. The examples above demonstrate that deficiencies are identified and are entered into the corrective action program for disposition. These problems identified do not indicate any adverse trend in performance. There is sufficient confidence that the implementation of the Fire Protection program will effectively identify degradation prior to failure.

Conclusion

The enhanced Fire Protection program will provide reasonable assurance that the identified aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.18 Fire Water System

Program Description

The Fire Water System program is an existing program that will manage identified aging effects for the water-based fire protection system and associated components, through the use of periodic inspections, monitoring, and performance testing. The program provides for preventive measures and inspection activities to detect aging effects prior to loss of intended functions. System functional tests, flow tests, flushes and inspections are performed in accordance with the applicable guidance from NFPA codes and standards. The program applies to water-based fire protection systems that consist of sprinklers, nozzles, fittings, valves, hydrants, hose stations, standpipes, water storage tanks, and aboveground and underground piping and components. The environments that the fire components are being managed are, raw water, air/gas wetted, air-outdoor, and air-indoor. Fire system main header flow tests, sprinkler system inspections, visual yard hydrant inspections, fire hydrant hose inspections, hydrostatic tests, gasket inspections, volumetric inspections, and fire hydrant flow tests and pump capacity tests are performed periodically assure that the aging effect of loss of material due to corrosion, microbiologically influenced corrosion (MIC), or biofouling are managed such that the system intended functions are maintained. Fifty-year sprinkler head inspections will be conducted using the guidance provided in NFPA-25. The initial 50-year inspections will be determined based on the date of the sprinkler system installation. Subsequent inspections will be performed every 10 years after the initial 50-year inspections.

Selected portions of the fire protection system piping located aboveground and exposed to water, will be inspected by non-intrusive volumetric examinations, to ensure that aging effects are managed and that wall thickness is within acceptable limits. The initial wall thickness inspections will be performed before the end of the current operating term and thereafter at a frequency of at least once every 10 years during the period of extended operation. These inspections will be capable of evaluating (1) wall thickness to ensure against catastrophic failure and (2) the inner diameter of the piping as it applies to the flow requirements of the fire protection system.

The fire water storage tank is internally inspected in accordance with NEIL requirements.

The Aboveground Steel Tanks aging management program addresses aging management of the Fire Water Storage Tanks external surfaces. The Buried Piping Inspection aging management program addresses the buried fire main piping external surfaces.

The fire water system is maintained at the required normal operating pressure and monitored such that a loss of system pressure is immediately detected and corrective actions initiated. The fire protection program ensures that testing and inspection activities have been performed and the results have been documented and reviewed by the Fire System Engineer for analysis and trending.

The system flow testing, visual inspections and volumetric inspections assure that the aging effect of loss of material due to corrosion, microbiologically influenced corrosion (MIC), or biofouling are managed such that the system intended functions are maintained.

The program will be enhanced, as noted below, to provide reasonable assurance that the Fire Water System program aging effects will be adequately managed during the period of extended operation.

NUREG-1801 Consistency

The Fire Water System aging management program is consistent with the ten elements of aging management program XI.M27, "Fire Water System," specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

1. The Fire Water System aging management program will be enhanced to inspect selected portions of the water based fire protection system piping located aboveground and exposed to the fire water internal environment by non-intrusive volumetric examinations. These inspections shall be performed prior to the period of extended operation and will be performed every 10 years thereafter. **Program Elements Affected: Preventative Actions (Element 2), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), Monitoring and Trending (Element 5), Acceptance Criteria (Element 6).**

2. The Fire Water System aging management program will be enhanced to replace or perform 50-year sprinkler head inspections and testing using the guidance of NFPA-25 “Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems” (2002 Edition), Section 5-3.1.1. These inspections will be performed by the 50-year in-service date and every 10-years thereafter. **Program Elements Affected: Detection of Aging Effects (Element 4)**

Enhancements will be implemented prior to the period of extended operation, with the inspections and testing performed in accordance with the schedule described above.

Operating Experience

The Fire Water System tests and procedures that are performed at the plant are based on NFPA standards to ensure that the system and fire components will have reliable performance when required to function.

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that the loss of material aging effect is being adequately managed. The following examples of operating experience provide objective evidence that the Fire Water System program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. In August 2001, during routine monthly fire hydrant inspection, water was found in the barrel of the hydrant and could not be drained. Attempts to clear the water were unsuccessful. The hydrant was replace with a new unit. It was thought that the underground drain was blocked not allowing the hydrant to drain. No other hydrants were found to have a leaking barrel. This example provides objective evidence that condition monitoring and routine, inspections of fire protection equipment effectively identifies deficient conditions. The hydrant inspections that are routinely performed are sufficient to identify conditions that could adversely affect hydrant operation. This condition was entered into the corrective action process and the hydrant was subsequently replaced with a new unit. These inspections currently performed provide objective evidence that the program in place routinely verifies hydrant operation and will ensure degradation is discovered prior to loss of flow during the period of extended operation.

2. In May 2002, during routine capacity testing of the motor driven fire pump, discharge flows started to become unstable and degrade. The testing was terminated. Troubleshooting revealed that the temporary startup strainer was still installed in the suction line leading to the pump and had become fouled. Based on finding the startup strainer installed in the suction to the fire pump, all other fire pumps on site were inspected with no other startup strainers found installed. The strainer was removed from the pump suction and the pump performance test was successfully completed and placed back into service. This example provides objective evidence that condition monitoring currently in place to confirm pump performance, is satisfactory to monitor equipment conditions prior to loss of design function. The flow capacity testing currently performed will be continued during the period of extended operation. The performance monitoring methods being used will be capable of identifying satisfactory to identify deficient flow conditions due to aging effects during the period of extended operation.

3. In April 2004, during routine testing of the diesel driven fire pump, the capacity of the pump was met, but the diesel engine speed which is measured as part of the diesel driven fire pump test, did not meet the required speed specification. The diesel engine is required to perform within specific design parameters to ensure design flow from the pump is maintained. An engine overhaul was performed. Upon completion of this maintenance, the retest was performed and the capacity test with the required diesel speed condition was met. Review of the operating experience for pump performance has been found satisfactory. This example provides objective evidence that current performance and capacity testing will detect deficient conditions associated with the diesel driven fire pump. This testing currently performed will continue to be performed during the period of extended operation.

4. The fire protection system manager has performed visual inspections of piping internal conditions when exposed during maintenance activities. The piping internals have been observed to be in good condition with no significant internal fouling or corrosion buildup. This provides objective evidence that system flushing procedures are effective in preventing fouling or corrosion product buildup. The external piping condition is also routinely inspected and maintained by station procedures. Plant operating experience did not reveal any age related events associated with corrosion on the internal or external piping surfaces which could have prevented the Fire Protection system from performing its intended function.

Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Fire Water System program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Fire Water System program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The enhanced Fire Water System program will provide reasonable assurance that the loss of material aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.19 Aboveground Steel Tanks

Program Description

The Aboveground Steel Tanks aging management program is an existing program, which will be enhanced to provide for management of loss of material aging effects for outdoor carbon steel tanks. The Aboveground Steel Tanks program is comprised of outdoor steel tanks (Fire Water Storage Tanks, Fire Diesel Fuel Oil Tank and 17-Ton CO2 Storage Tank) that are subject to an outdoor air or soil environment. The Fire Water Storage Tanks are in contact with both air and soil environments (through their foundations), and are covered by this program. This program is a condition monitoring program and credits the application of paint as a corrosion preventive measure. The program also performs periodic visual inspections to monitor degradation of the paint and any resulting metal degradation for the carbon steel tanks. The program also credits the internal UT inspections that will be performed on the bottom of the Fire Water Storage Tanks, which are supported by concrete foundations. The Fire Diesel Fuel Oil Tank and 17-Ton CO2 Storage Tanks are not directly supported by an earthen or concrete foundation and will undergo external visual inspections without the necessity of bottom surface UT inspections.

The Fire Water Storage Tanks have external surface insulation. Removal of insulation will permit visual inspection of insulated tank surfaces. These tanks are supported on a cement foundation by a ½ inch thick seal pad around the perimeter of the tank.

The Fire Diesel Fuel Oil Tank and 17-Ton CO2 Storage Tank are raised tanks not directly supported by earthen or concrete foundations. The Fire Diesel Fuel Oil Tank has no insulation on the tank. The 17-Ton CO2 Storage Tank has permanently installed fiberglass on the exterior of the tank and it will be treated as a surface coating and not removed for steel tank surface inspections. The exterior painted surfaces of the tanks are inspected for signs degradation such as flaking, cracking and peeling to manage the effects of corrosion and prevent conditions similar to those documented in GL 98-04 from occurring.

These enhancements will be implemented prior to the period of extended operation. Tank bottom UT inspections will also be performed prior to the period of extended operation.

NUREG-1801 Consistency

The Aboveground Steel Tank aging management program is consistent with the ten elements of aging management program XI.M29, specified in NUREG-1801.

Exceptions To NUREG-1801

None.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented:

1. The program will be enhanced to include internal UT measurements to measure the wall thickness on the bottom of the tanks supported on a fiber pad on top of the concrete foundation (Fire Water Storage Tanks). Measured wall thickness will be monitored and trended if significant material loss is detected. These thickness measurements of the tank bottom will be taken and evaluated against design thickness and corrosion allowance to ensure that significant degradation is not occurring and the component intended function will be maintained during the extended period of operation. **Program Elements Affected: Detection of Aging Effects (Element 4), Monitoring and Trending (Element 5)**, **Acceptance Criteria (Element 6).**

2. The program will be enhanced to provide routine visual inspections of the carbon steel tanks external surfaces (Fire Water Storage Tanks, Fire Diesel Fuel Oil Tank and 17-Ton CO2 Storage Tank), including removal of tank insulation from the Fire Water Storage Tank to detect degradation. These inspections will be performed to detect degraded paint and coatings, and any resulting metal degradation, prior to loss of the tank intended function. **Program Elements Affected: Preventive Actions (Element 2), Detection of Aging Effects (Element 4), Monitoring and Trending (Element 5), Acceptance Criteria (Element 6).**

A review of operating experience for the last 5-years identified few problems with tanks within the scope of the Aboveground Steel Tanks program. Of the operating experience reviewed only the two identified issues were determined to be age related degradation. The two issues identified would not have caused failure of the tanks intended functions. There was not any adverse trend in performance. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Aboveground Steel Tanks program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Aboveground Steel Tanks program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that loss of material due to general, pitting, crevice and microbiological influenced corrosion are being adequately managed. The following examples of operating experience provide objective evidence that the Aboveground Steel Tanks program will be effective in assuring that intended function(s) would be maintained consistent with the CLB for the period of extended operation:

1. In 2006, during semi-annual fire protection equipment inspections station personnel along with a NEIL inspector identified minor corrosion located at the bottom of the Fire Water Storage tank 0B-T565. There was no leakage associated with the rusting that was found. Flakes of metal could be removed by hand from the tank flange. The exposed base of the tank had some areas that were missing metal along the bottom edge of the base plate, but this loss did not impact the integrity of the tank. An engineering evaluation was performed of the tank and the foundation. Both of the Fire Water Storage Tank (0A-T508/0B-T508) lower protective insulation sheet metal bands were removed, the insulation was removed and the lower surface of the tanks along with the flanges were inspected and cleaned using wire brush/wheel, and repainted. This work order demonstrates that when deficient conditions are found, they are entered into the corrective action program for evaluation and resolution. This particular deficient condition was placed into the corrective action program, evaluated, and corrective actions taken to prevent the failure of the tank's intended function. The existing program monitors the condition of the tanks, ensuring that the intended function of the components is maintained.

2. In 2001, during routine equipment walkdowns, the diesel fire pump fuel oil day tank was noted to need exterior surface coating. There was no leakage found, but the surface coating was found to be degraded. This condition was entered into the corrective action program. The corrective actions performed were prepping the exterior surface of the storage tank, prime and re-paint of the exterior of the tank. As of this date, no material condition deficiencies on the exterior surfaces of the diesel fire pump fuel oil day tank have been noted. This example demonstrates that when deficient conditions associated with exterior tank coatings are found, corrective actions are taken to prevent surface degradation . This example also provides objective evidence that the Aboveground Steel Tanks program is effective in detecting loss of material/general corrosion, pitting and crevice corrosion, and implementing preventive measures to ensure protective paint and coating is intact on the exterior surface of the diesel fire pump fuel oil day tank.

The operating experience of the Aboveground Steel Tanks program did not show any adverse trend in performance. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Aboveground Steel Tanks program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Aboveground Steel Tanks program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The enhanced Aboveground Steel Tanks program will provide reasonable assurance that the loss of material aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.20 Fuel Oil Chemistry

Program Description

The Fuel Oil Chemistry aging management program is an existing program that includes preventive activities to provide assurance that contaminants are maintained at acceptable levels in fuel oil for systems and components within the scope of Licensing Renewal, to prevent loss of material. The fuel oil tanks within the scope of the program are maintained by monitoring and controlling fuel oil contaminants in accordance with the guidelines of the American Society for Testing and Materials (ASTM). Fuel oil sampling activities meet the requirements of ASTM D 4057 or provide a more conservative sample for the detection of contaminants and water and sediment. Fuel oil will be periodically sampled and analyzed for particulate in accordance with modified ASTM Standard D 2276-00 Method A and for the presence of water and sediment in accordance with ASTM Standard D 2709. Fuel oil sampling and analysis is performed in accordance with approved procedures for new fuel and stored fuel. Protective coatings are not credited for mitigating the loss of material due to general pitting, crevice and microbiologically influenced corrosion (MIC), and biological fouling in fuel oil tanks. Fuel oil tanks are periodically drained of accumulated water and sediment and periodically drained, cleaned, and internally inspected. These activities effectively manage the effects of aging by providing reasonable assurance that potentially harmful contaminants are maintained at low concentrations.

The program will be enhanced, as noted below, to provide reasonable assurance that the Fuel Oil Chemistry program aging effects will be adequately managed during the period of extended operation.

NUREG-1801 Consistency

The Fuel Oil Chemistry aging management program is consistent with the ten elements of aging management program XI.M30, "Fuel Oil Chemistry," specified in NUREG-1801 with the following exceptions:

Exceptions to NUREG-1801

1. NUREG-1801 requires periodic sampling of tanks in accordance with the manual sampling standards of ASTM D 4057-95 (2000). The 280-gallon Diesel Fire Pump Fuel Oil Tank (T-565) samples are single point samples obtained from the tank drain line located off of the bottom of the tank. This sample is not in accordance with the manual sampling standards as described in ASTM D 4057. **Program Elements Affected: Scope of Program (Element 1), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), Acceptance Criteria (Element 6)**

Justification for Exception

For fuel oil storage tanks of less than 159 cubic meters spot sampling recommendations in ASTM D 4057-95 (2000) include a single sample from the middle (a distance of one-half of the depth of liquid below the liquid's surface). The 280-gallon Fire Pump Day Tanks are 1.06 cubic meters so the spot sampling recommendations in ASTM D 4057 are applicable. Although the actual sample location for tanks is lower than prescribed by the ASTM D 4057 standard, the sample results are more likely to capture contaminants, water, and sediment, thus making this a conservative sample location for fuel oil containments. Additionally, the diesel is run weekly, taking suction from the bottom therefore significant stratification is unlikely in such a small tank that is mixed weekly.

2. NUREG-1801 states that the program serves to reduce the potential of exposure of the tank internal surface to fuel oil contaminated with water and biological organisms. This is accomplished by analyzing multilevel samples for water and sediment, biological activity, and particulate on a periodic basis (at least quarterly). Fuel oil tanks should also be periodically drained of accumulated water and sediment, and, periodically drained, cleaned, and internally inspected. The following is an exception to these requirements:

   Multilevel sampling, tank bottom draining, cleaning, and internal inspection of the 550-gallon diesel fuel oil day tanks (1A-T-404, 1B-T-404, 1C-T-404 and 1D-T-404) is not periodically performed at Hope Creek. To confirm the absence of any significant aging effects, a one-time inspection of each of the 550-gallon diesel fuel oil day tanks will be performed as part of the Hope Creek Fuel Oil Chemistry aging management program. Should the one-time inspection reveal evidence of aging effects, this condition will be entered into the corrective action process for resolution. **Program Elements Affected: Scope of Program (Element 1), Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), Monitoring and Trending (Element 5), Acceptance Criteria (Element 6)**

Justification for Exception

These tanks are integral to the routine operation of the Emergency Diesels and are filled with fuel oil that has been previously analyzed within its managed source tanks, the diesel fuel oil storage 26,500-gallon tanks (1A-T-403, 1B-T-403, 1C-T-403, 1D-T-403, 1E-T-403, 1F-T-403, 1G-T-403, 1H-T-403). The fuel oil within the 550-gallon diesel fuel oil day tanks is recirculated to the 26,500-gallon fuel oil storage tanks quarterly to prevent the accumulation of contaminants and water and sediment. Additionally, the diesel fuel oil day tanks are enclosed within the Auxiliary Building, which is maintained at a constant temperature during cold periods. Maintaining a constant temperature during cold periods minimizes diesel fuel oil day tanks thermal cycling and reduces the potential for condensation formation within the day tanks. Therefore, the periodic draining of water and sediment from the bottom of the 550-gallon diesel fuel oil day tanks, and, the periodic draining, cleaning, and internal inspections are not necessary.

3. NUREG-1801 states that the quality of fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion. The Hope Creek fuel oil chemistry program does not currently include the addition of biocides, stabilizers or corrosion inhibitors. **Program Elements Affected: Scope of Program (Element 1), Preventative Actions (Element 2), Parameters Monitored or Inspected (Element 3), Monitoring and Trending (Element 5), Acceptance Criteria (Element 6)**

Justification for Exception

NUREG-1801 directs addition of biocides, stabilizers and inhibitors as a preventative measure. However, Hope Creek Fuel Oil Chemistry program will be enhanced to require addition of these biocides, stabilizers and inhibitors if sampling or inspection activities detect biological activity, biological breakdown of the fuel or corrosion products. Additionally, the Hope Creek fuel oil chemistry program is being enhanced to include the analysis for particulate contamination in new and stored fuel oil. The analysis for particulate contamination will be in accordance with modified ASTM D2276-00, Method A and analysis using this method is sufficient for the detection of corrosion products at an early stage. Fuel contaminants and degradation products will normally settle to the tank bottom where they will be detected by routine analysis or by periodic draining of water and sediment from the storage tank bottoms.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented:

1. The Fuel Oil Chemistry program will be enhanced to invoke equivalent requirements for fuel oil purity and fuel oil testing as described by the Standard Technical Specifications. NUREG-1801 states in XI.M30 that the fuel oil aging management program is in part based on the fuel oil purity and testing requirements of the plant’s Technical Specifications that are based on the Standard Technical Specifications of NUREG-1430 through NUREG-1433. **Program Elements Affected: Scope of Program (Element 1), Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4)**

2. The Fuel Oil Chemistry program will be enhanced to require addition of biocides, stabilizers and inhibitors if sampling or inspection activities detect biological activity, biological breakdown of the fuel or corrosion products. **Program Elements Affected: Scope of Program (Element 1), Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Corrective Actions (Element 7)**

3. The Fuel Oil Chemistry program does not currently open and inspect the diesel fire pump fuel oil 280-gallon tank (T-565). The program will be enhanced to perform visual inspections to detect potential degradation and ultrasonic thickness examination of tank bottom to ensure that significant degradation is not occurring. **Program Elements Affected: Scope of Program (Element 1), Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4)**

4. The Hope Creek Fuel Oil Chemistry program currently performs a visual inspection for water and sediment quarterly on the diesel fuel oil storage 26,500-gallon tanks (1A-T-403, 1B-T-403, 1C-T-403, 1D-T-403, 1E-T-403, 1F-T-403, 1G-T-403, 1H-T-403). The program will be enhanced to perform water and sediment sampling in accordance with ASTM Standard D 2709. Additionally, the current quarterly sample is single low-level sample. The quarterly sample will be enhanced to be a multilevel sample. **Program Elements Affected: Scope of Program (Element 1), Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4)**

5. The Hope Creek Fuel Oil Chemistry program will be enhanced to ensure the internal inspection of the diesel fuel oil storage 26,500-gallon tanks (1A-T-403, 1B-T-403, 1C-T-403, 1D-T-403, 1E-T-403, 1F-T-403, 1G-T-403, 1H-T-403) includes visual inspections to detect potential degradation and ultrasonic thickness examination of tank bottoms to ensure that significant degradation is not occurring. **Program Elements Affected: Scope of Program (Element 1), Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4)**

6. The Hope Creek Fuel Oil Chemistry program will be enhanced to perform quarterly particulate sampling in accordance with modified ASTM 2276-00, Method A for the diesel fire pump fuel oil tank (T-565). The modification consists of using a filter with a pore size of 3.0 μm, instead of 0.8 μm. **Program Elements Affected: Scope of Program (Element 1), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), Monitoring and Trending (Element 5), Acceptance Criteria (Element 6)**

7. The Hope Creek Fuel Oil Chemistry program will be enhanced to perform a one-time inspection of each of the 550-gallon diesel fuel oil day tanks to confirm the absence of any significant aging effects. **Program Elements Affected: Scope of Program (Element 1), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4)**

These enhancements will be implemented prior to the period of extended operation. In addition, the one-time inspections will be performed prior to the period of extended operation.

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling are being adequately managed. The following examples of operating experience provide objective evidence that the Fuel Oil Chemistry aging management program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. On 11/05/2003 during routine sampling of the diesel fuel oil tank (1G-T-403) sediment was observed in the purge volume prior to obtaining the fuel oil sample from the bottom drain valve. After performing the proper flushes, a sample was obtained and sent to an off-site laboratory for analysis. Additionally, 8-gallons were purged from the sample line, thus removing any remaining sediment from the bottom of the tank. After further investigation it was determined that there was a discrepancy in the 2 sampling techniques used during the routine task (bottom sample and a sample bomb, which is taken 6-12 inches from the tank bottom). Typically the bottom drain sample is placed in a glass bottle (to accommodate visual inspection) and the sample bomb is typically transferred to a poly bottle. In the case of the samples taken on 11/05/2003, the bottles used were reversed from those typically used. As a result, along with inadequate labeling of the sample point, the wrong analysis was performed on the samples. The sample drawn using the sample bomb (the one in the glass bottle) was visually inspected and there was no water or sediment observed. The sample drawn from the bottom drain (the one in the poly bottle) was being analyzed for particulate amount. This analysis result was likely to be unsatisfactory because the particulates settle at the bottom of the tank. This is why regular particulate sampling is done via the bomb method and not from the bottom of the tank. Additional samples were drawn on 11/06/2003 and were analyzed. For the bottom drain sample, no sediment and no water was observed. For the bomb sample, analysis results were <0.01 mg/L, which is well below the 10 mg/L specification. The sampling procedure was enhances to specify the type of bottle used and the expectations on sample labeling. This operating experience provides objective evidence that the fuel oil chemistry program identifies unsatisfactory results through routine sampling of the fuel oil tanks and provides timely investigation and resolution of the issue. Additionally, the fuel oil chemistry program initiates corrective actions to prevent reoccurrence of the similar events.

2. On 02/04/2004 it was identified that the particulate concentration of the 1H-T-403 diesel fuel oil tank increased from <0.01 mg/L to 3.86 mg/L. The sample that showed the increase to 3.86 mg/L was taken on 01/30/04. The previous sample of <0.01 mg/L was taken on 11/06/03. Sample results were verified with duplicate testing. However, further investigation revealed that the samples taken on 01/30/04 were processed incorrectly. This was due to a bad sampling technique. The procedure was then analyzed, and the chemistry department decided to add a pre-job brief prior to the sampling evolutions to enhance the quality of the testing. New samples were taken and particulate concentration was found to be <0.01 mg/L. This operating experience provides objective evidence that the fuel oil chemistry sampling activities identify abnormal test results due to improper techniques or procedures and puts barriers in place to prevent reoccurrence in the future.

3. In September of 2004 an inspection and cleaning of the Diesel Fire Pump Fuel Oil Tank (T-565) identified that the inside of the tank was corroded and that the liner was degraded. The Diesel Fire Pump Fuel Oil Tank was drained, steam cleaned and inspected. The inspection showed minor internal surface rust and scaling at some joints, but it was not excessive. The minor rust and scaling would in no way affect the structural integrity of the tank. The apparent cause of the rust was water in the bottom of the tank. Preventive maintenance actives were put into place to drain water and sediment from the bottom of the tank to prevent reoccurrence. This provides objective evidence that periodic inspection of the tanks identifies degradation prior to the loss of intended function. In addition, this example illustrates the implementation of corrective actions in order to prevent degraded conditions for occurring in the future.

The operating experiences discussed above are examples of abnormal conditions that were identified by routine monitoring activities and corrective actions that were put in place to correct or prevent reoccurrence. Over the past five years the Hope Creek Fuel Oil Chemistry program has not experienced any significant issues. The examples provided above were the only significant concerns identified during review of the operating experience over the past five years. This provides objective evidence that the current Fuel Oil Chemistry aging management program is effective in mitigating the aging effect of loss of material at Hope Creek. There is sufficient confidence that the implementation of the Fuel Oil Chemistry aging management program will effectively identify degradation prior to failure.

Conclusion

The enhanced Hope Creek Fuel Oil Chemistry aging management program will provide reasonable assurance that the loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, and fouling will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.21 Reactor Vessel Surveillance

Program Description

The Reactor Vessel Surveillance Program is an existing program that manages the loss of fracture toughness due to neutron irradiation embrittlement of the reactor vessel beltline materials. The program meets the requirements of 10 CFR 50, Appendix H. The program evaluates neutron embrittlement by projecting Upper Shelf Energy (USE) for reactor materials and impact on Adjusted Reference Temperature for the development of pressure-temperature limit curves. Embrittlement evaluations are performed in accordance with Regulatory Guide 1.99, Rev. 2. The Hope Creek Reactor Vessel Surveillance Program is also part of the BWRVIP Integrated Surveillance Program (ISP) described in BWRVIP-86-A and BWRVIP-116, and approved by the NRC. The schedule for removing surveillance capsules is in accordance with the timetable specified in BWRVIP-86-A for the current operating term and in accordance with BWRVIP-116 for the period of extended operation.

Hope Creek is a host plant for the ISP and will remove one capsule in the current operating term as part of the ISP schedule. Hope Creek will also participate in the ISP during the period of extended operation [designated as the ISP(E)]. As described in BWRVIP-116 Hope Creek's third and last capsule will be removed during the period of extended operations for testing as part of the ISP(E). If the capsule is withdrawn for some other reason, it will be stored in a manner that maintains it in a condition that would permit its future use.

The Hope Creek pressure vessel has LPCI safety injection nozzles in the beltline region of the reactor pressure vessel. The extent of embrittlement for these nozzles has been determined to be bounded by other beltline material. The fluence values at the inlet and outlet recirculation nozzles are also bounded by the beltline material.

The program monitors plant operating conditions to ensure appropriate steps are taken if reactor vessel exposure conditions are altered, such as the review and updating of 60-year fluence projections to support upper shelf energy calculations and pressure-temperature limit curves. The program also includes condition monitoring by removal and analysis of surveillance capsules as part of the BWRVIP ISP. These measures are effective in detecting the extent of embrittlement to prevent significant degradation of the reactor pressure vessel during the period of extended operation.

NUREG-1801 Consistency

The Reactor Vessel Surveillance Program is consistent with the aging management program XI.M31, Reactor Vessel Surveillance, specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

Prior to the period of extended operation, the following enhancement will be implemented in the following program elements:

1. Hope Creek will implement the requirements of BWRVIP-116, “BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal,” including the conditions specified by the NRC in its Safety Evaluation dated February 24, 2006. **Program Elements Affected: Element 6 and Element 8**

2. If future plant operations exceed the limitations specified in RG 1.99, the impact of plant operation changes on the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified. Similarly, if future plant operations exceeds the bounds established by surveillance data that are to determine Upper Shelf Energy or P-T limits, then the impact of plant operation changes on the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified. Additionally, if all the surveillance capsules are removed, then operating restrictions will be established to ensure that the plant is operated within the conditions to which the surveillance capsules were exposed. If the reactor vessel exposure conditions (neutron flux, spectrum, irradiation temperature, etc.) are altered, then the basis for the projection to 60 years is reviewed; and, if deemed appropriate, a revised fluence projection is prepared and the effects of the revised fluence analysis on neutron embrittlement calculations will be evaluated. If necessary an active surveillance program will be re-instituted for Hope Creek. The employment of additional surveillance specimens will be coordinated through the BWRVIP Integrated Surveillance Program (ISP). Any changes to the reactor vessel exposure conditions and the potential need to re-institute a vessel surveillance program will be discussed with the NRC staff prior to changing the plant's licensing basis. **Program Elements Affected: Element 4 and Element 9**

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that loss of fracture toughness due to neutron irradiation embrittlement are being adequately managed. The following examples of operating experience provide objective evidence that the Reactor Vessel Surveillance Program will be effective in assuring that intended function(s) would be maintained consistent with the CLB for the period of extended operation:

1. Only one surveillance capsule has been removed from the Hope Creek reactor vessel. The 30^{o} capsule was removed from the Hope Creek vessel in the spring of 1994 (refueling outage RF05) as part of the reactor surveillance program. General Electric performed the analysis of the capsule specimens. The results of the analysis indicated that the capsule received an average fast neutron fluence (E > 1.0 MeV) of 1.42 x 10^{17} n/cm^2 after 6.01 EFPY of plant operation. Using this measured value the fluence at the reactor vessel inner wall was then calculated to be 1.42 x 10^{17} n/cm^2, which projected to a 32 EFPY fluence of 7.5 x 10^{17} n/cm^2.

   Charpy tests of surveillance capsule materials exhibited a more than adequate USE for continued safe operation. The projected USE for 32 EPFY calculated from the measured RPV wall fluence using RG 1.99 methods demonstrated the bounding USE was greater than the 50 ft-lb criterion specified in RG 1.99. Additionally, The Adjusted Reference Temperature (ART) was calculated to be 72.5^{o}F and 32.8^{o}F for the limiting plate and weld, respectively. These values were used to generate new P-T limit curves for Hope Creek.

   This example provides objective evidence that the existing Reactor Vessel Surveillance program is capable of monitoring the aging effects associated with the loss of fracture toughness due to neutron irradiation embrittlement of the reactor vessel beltline materials.

2. In accordance with the requirements of the Reactor Vessel Surveillance program the effects of neutron embrittlement are analyzed when plant operating conditions change. In 2004, as part of the license amendment to increase rated power to 3952 MWt (EPU), the effects of higher power in the form of increased fluence were evaluated. The fluence was calculated using a NRC approved methodology to account for the operating conditions of EPU.

   The new fluence at the limiting beltline material was calculated to be 1.1 x 10^{18} n/cm^2 at the inner surface of the pressure vessel. Using the new fluence values the impact on Upper Shelf Energy (USE) and plant P-T curves was evaluated. New Adjusted Reference Temperatures (ART) values were calculated in accordance with RG 1.99 Revision 2. Upper Shelf Energy calculations confirmed that the USE values remained above the 50 ft-lb criterion specified in RG 1.99 for the remainder of the current 40-year life of the plant. The output from this effort was a new set of P-T limit curves for the new EPU power conditions. This example illustrates that the program monitors for changes in plant operating conditions and when appropriate, reevaluates the effects of neutron embrittlement in accordance with the appropriate industry standards.

Hope Creek removed one surveillance capsule from the reactor vessel and tested it in accordance with ASTM E-185. The test results show that the shift in Charpy curves of the irradiated capsule was within the predictions of RG. 1.99 Revision 2. The projected upper shelf energy (USE) for 32 EPFY, calculated using data from the test and RG. 1.99 methods, indicated that the bounding USE is greater than 50 ft-lb criteria specified in RG. 1.99.

There is sufficient confidence that the implementation of the Reactor Vessel Surveillance aging management program will effectively identify degradation prior to failure. The program requires that, if future plant operations exceed the limitations specified in RG 1.99, the impact of plant operation changes on the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified. Similarly, if future plant operation exceeds the bounds established by surveillance data that are used to determine Upper Shelf Energy or P-T, then the impact of plant operation changes on the extent of reactor vessel embrittlement will be evaluated and the NRC will be notified. Assessments of the Reactor Vessel Surveillance program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The enhanced Reactor Vessel Surveillance aging management program will provide reasonable assurance that the aging effects and mechanisms will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.22 One-Time Inspection

The One-Time Inspection aging management program is a new program that will provide reasonable assurance that an aging effect is not occurring, or that the aging effect is occurring slowly enough to not affect a components intended function during the period of extended operation, and therefore will not require additional aging management. The program will be credited for cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out, (b) an aging effect is expected to progress very slowly in the specified environment, but the local environment may be more adverse than that generally expected, or (c) the characteristics of the aging effect include a long incubation period. Major component types covered by the program include piping, piping elements and piping components, reactor vessel and nozzles, heat exchangers and tanks.

The One-Time Inspection aging management program will be used for the following:

1. To confirm the effectiveness of the Water Chemistry program to manage the loss of material, cracking, and the reduction of heat transfer aging effects for aluminum, copper alloy, ductile cast iron, gray cast iron, nickel alloy, steel, stainless steel and cast austenitic stainless steel in treated water, steam, sodium pentaborate, and reactor coolant environments.

2. To confirm the effectiveness of the Fuel Oil Chemistry program to manage the loss of material aging effect for, copper alloy, steel, galvanized steel and stainless steel in a fuel oil environment.

3. To confirm the effectiveness of the Lubricating Oil Analysis program to manage the loss of material and the reduction of heat transfer aging effects for copper alloy, gray cast iron, steel and stainless steel in a lubricating oil environment.

4. To confirm loss of material in carbon steel piping and fittings is insignificant in an air/gas-wetted (internal) environment.

The new program elements include (a) determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects and mechanisms, and operating experience; (b) identification of the inspection locations in the system or component based on the aging effect; (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined; and (d) evaluation of the need for follow-up examinations to monitor the progression of aging if age-related degradation is found that could jeopardize an intended function before the end of the period of extended operation. When evidence of an aging effect is revealed by a one-time inspection, the engineering evaluation of the inspection results will identify appropriate corrective actions.

The inspection sample includes one-time inspection of more susceptible materials in potentially more aggressive environments (e.g., low or stagnant flow areas) to manage the effects of aging. Qualified personnel following station procedures that are based on applicable codes and standards, including ASME, and 10 CFR 50, Appendix B, will perform the inspections. Examination methods will include volumetric examination (UT or RT) or visual examination (VT-1, VT-3, or equivalent). Acceptance criteria are in accordance with industry guidelines, codes, and standards, including ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition, 2003 Addenda.

The One-Time Inspection aging management program is a condition monitoring program with elements that are effective in detecting the identified aging effects and evaluating the need for follow-up examinations to monitor the progression of aging if age-related degradation is found that could jeopardize an intended function before the end of the period of extended operation.

The inspections will be scheduled within 10 years prior to the period of extended operation, as close to the end of the current operating license as practical with margin provided to ensure completion and evaluation of the inspection results including identification of any appropriate corrective actions prior to commencing the period of extended operation.

NUREG-1801 Consistency

The One-Time Inspection Program is consistent with the ten elements of aging management program XI.M32, “One-Time Inspection Program”, specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

The One-Time Inspection aging management program will be used to verify the system-wide effectiveness of aging management programs that are designed to prevent or minimize aging to the extent that it will not cause a loss of intended function during the period of extended operation. The program provides inspections that either verifies that unacceptable degradation is not occurring or that triggers additional actions that will assure the intended function of affected components will be maintained during the period of extended operation. Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately identified and managed. The following examples of operating experience demonstrate that the inspection techniques to be utilized for the One-Time Inspection program can be used to identify degrading conditions, and that deficiencies identified are entered into the corrective action process, where they are evaluated and appropriate action is taken. These examples coupled with the discussion that follows concerning the overall condition of the involved systems provide objective evidence that the One-Time Inspection program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation.

1. In April 2006 during refueling outage RF13 planned in vessel internal inspections (VT-1), indications were noted at four locations on the reactor vessel steam dryer assembly.

    a. At the first location, two indications were found above weld CH-7a. Weld CH-7a is on dryer bank C, on the 0-degree side, outside the steam outlet partition plate, near the bottom of the hood. Both indications were horizontal in the heat-affected zone of the weld on the 1/8-inch thick plate. The area of the indications was 4 inches wide.
    b. At the second location, an indication was found near the bottom of weld BV-5 on the 1/8-inch thick steam outlet partition plate. Weld BV-5 is the vertical weld between "B" dryer hood and the steam outlet partition plate on the 180-degree side of the dryer. The indication was vertical on the heat-affected zone of the weld and was located on the partition plate side of the weld. The indication was about 1.25 inches long and ended at the bottom of the plate.
    c. At the third location, an indication was found on the support ring at azimuth 230-degrees, top side, 5 inches in length in a circumferential orientation.
    d. At the fourth location, two indications were found on the threads near the tack welds on the lifting rod at 140 degrees. The indications were on the threads and stop before the root of the threads. The indications were in the heat-affected zone of the tack welds. The threads are used to connect the lifting rod to the lifting lug.

    All of this information was entered into the corrective action process for evaluation and corrective actions. Engineering performed an evaluation that included a review of these as well as other past-identified indications on the steam dryer assembly. The evaluation determined all of the steam dryer indications were IGSCC with the potential to continue to grow with slow crack growth rates. The evaluation concluded that there was no impact on the structural integrity of the dryer assembly and therefore no potential for loose parts being generated as a result of these indications.

    The evaluation also concluded there was insignificant impact to the lifting or hold-down function of the lifting assembly and therefore a use-as-is disposition was justified. The evaluation also concluded that there was no need to expand the inspection scope as the majority of the welds were already within the scope of the inspections being performed. The evaluation received several reviews including a third party independent review. Corrective actions consisted of adding the visual exam of these indications during every refueling outage until the indications are shown to be arrested. This action was captured in the ISI long term plan.

This example provides objective evidence that visual inspections (VT-1) similar to those that will be used as part of the One-Time Inspection program provide an effective method to identify degrading conditions such as cracking. This example also demonstrates that when degraded conditions are detected they are entered into the corrective action process where they are appropriately evaluated for cause and any required corrective actions. The inspections performed as part of the One-Time Inspection program will be performed similar to the above and any degraded conditions detected will be entered into the corrective action process. This will ensure effective condition monitoring of piping and components within the scope of license renewal.

2. On 4/25/2006 it was reported in the corrective action process that radiography (RT) performed on one of the service water pump lubrication water reservoirs (component H1EA-10-T-543) revealed several areas of the reservoir had experienced a loss of material due to microbiologically influenced corrosion (MIC). There were two service water pump lubrication water reservoirs at Hope Creek, which supply backup bearing and packing lubricating water for the service water pumps during initial pump starting operations. Both of these reservoirs had been experiencing loss of material due to MIC in the past, and recurring work orders were already in place to perform periodic RT monitoring so degradation could be detected and repairs made before any failures would occur.

   As a result of the reported problem a detailed repair plan was developed for the degraded reservoir. Consideration was given to replacing some of the materials with more corrosion resistant materials during the repairs, but ultimately a station decision was made not to repair, but to modify the design of the system to remove the reservoirs completely to eliminate the potential for continued MIC problems. Modifications were performed in October 2007 during refueling outage RF14 that consisted of a re-design of the pump lubrication subsystem eliminating all of the reservoirs and the replacement of piping with an AL-6XN alloy, which is a corrosion resistant, iron-base austenitic stainless steel alloy. The design changes have provided a simple and more reliable source of lubrication water to the service water pumps.

   This example provides objective evidence that appropriate inspection techniques can be used to identify degrading conditions, and that deficiencies identified are entered into the corrective action process, where they are evaluated and appropriate action is taken. The One-Time Inspection program will utilize appropriate inspection techniques and will enter any degraded conditions identified into the corrective action process resolution. These actions will ensure effective condition monitoring of piping and components within the scope of license renewal.

3. On 03/09/2005 it was reported in the corrective action process that pipe wall thickness data (UT) taken on the extraction steam supply nozzle on the #2B feedwater heater indicated various degrees of loss of material. Additional inspections were performed and flow accelerated corrosion was determined to be the most probable cause of the loss of material. Corrective actions consisted of engineering evaluating the data to determine required corrective actions. Through trending analysis, FAC engineers predicted that the wall thickness at the end of cycle 13 would still have ample margin to support operations. Additional analysis was independently performed by the stress analysis group, which also concluded that the pipe was qualified for continued operation based upon calculations performed with a safety margin of four. Repairs were also specified and consisted of internal weld buildup of the affected nozzles. The scheduling of the repairs was based upon the degree of degradation of the nozzles with some repairs of the nozzles completed during refueling outage R13 (April 2006) and remaining to be completed during refueling outage R15 (April 2009).

   This example provides objective evidence that the inspection techniques to be utilized in the One-Time Inspection program will be capable of identifying degraded conditions such as loss of material and that deficiencies entered into the corrective action process are evaluated for appropriate corrective actions. These actions will ensure effective condition monitoring of piping and components within the scope of license renewal.

A review of Maintenance Rule and System Health reports for those systems common to those that credit the One-Time Inspection program for aging management was conducted. The review revealed the aging effects that the One-Time Inspection program is credited for are not contributing to any adverse trend in performance or loss of component intended functions for these systems. The overall condition of the systems with respect to the applicable aging effects, coupled with the one-time inspections to confirm that an aging effect is not occurring, or that the aging effect is occurring slowly enough to not affect a components intended function during the period of extended operation provide sufficient confidence that the implementation of the One-Time Inspection program will effectively identify and manage degradation that could lead to failure. Assessments of the One-Time Inspection program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The new One-Time Inspection program will provide reasonable assurance that the identified aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.23 Selective Leaching of Materials

Program Description

The Selective Leaching of Materials aging management program is a new program that consists of one-time inspections to determine if loss of material due to selective leaching is occurring. The scope of the program will include components made of susceptible materials and located in potentially aggressive environments. Components include valve bodies, heat exchanger components, pump casings, piping and fittings, strainer bodies, and tanks. Susceptible materials at Hope Creek are gray cast iron, copper alloy with greater than 15% zinc and aluminum bronze with greater than 8% aluminum. Environments include raw water, closed cooling water, soil (ground water), and treated water.

The Selective Leaching of Materials aging management program will be implemented prior to the period of extended operation. The program will provide for visual inspections, hardness tests, and other appropriate examinations, as required, to identify and confirm existence of the loss of material due to selective leaching. If degradation is found, the condition of affected components will be evaluated to determine the impact on their ability to perform intended functions during the period of extended operation. Condition monitoring and expanded sampling will be utilized, as required, to ensure the components perform as designed.

The Selective Leaching of Materials Program will develop a new procedure to perform visual inspections and hardness tests to determine if selective leaching is occurring. As such, there are no preventative or mitigative attributes associated with this program. In treated water and closed cycle cooling water environments, chemistry is monitored in accordance with the Water Chemistry and Closed-Cycle Cooling Water System Programs, respectively, to minimize corrosive contaminants and to control pH. In some cases, corrosion-inhibiting additives are used. These activities are considered effective in reducing selective leaching.

These one-time inspections will be performed in the last 10 years of the current term, prior to entering the period of extended operation.

NUREG-1801 Consistency

The Selective Leaching of Materials program is consistent with the ten elements of aging management program XI.M33, Selective Leaching of Materials, specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that loss of material due to selective leaching is being adequately managed. The following examples of operating experience provide objective evidence that the Selective Leaching of Materials program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. Industry operating experience has identified that aluminum bronze is susceptible to selective leaching in a raw water environment. During the Hope Creek corrective action program review, it was identified through visual inspection of a valve that de-alloying of aluminum bronze valves in the Service Water System brackish water environment is occurring. A cross section of an aluminum bronze valve was cut out and acid etched to show the selective leaching. A sample cross section of the valve was sent to a laboratory for confirmation of selective leaching and assessment of material properties.

   In December of 2000, Service Water System aluminum bronze valves that are susceptible to de-alloying were placed into the Valve Material Condition Improvement Project. As part of this project, gradual replacement of the valves that are susceptible to selective leaching with new valves started back in 2000. So far, a large portion of these valves are replaced, and the final phase of this valve replacement is planned for 2010. The maintenance activities for these components are tracked in the Corrective Action Program, and so far no failures have been identified for them. This example provides objective evidence that operating experience is being used to assess the potential for selective leaching, and that the corrective actions are in place to proactively replace the valves that are susceptible to selective leaching.

2. Operating experience at Salem in December 2003 has identified graphitization of gray cast iron submerged pump components from long-term immersion in saltwater and brackish water environments. As a result, Hope Creek in 2004 evaluated potentially effected components. Although some portions of the Hope Creek circulating water pumps are gray cast iron and submerged in raw water, environment graphitization has not been observed in the Hope Creek Circulating Water System at the intake structure during maintenance inspections. The Hope Creek pumps are less susceptible to selective leaching due to the water being recirculated as a closed loop treated water system through the cooling tower vice straight from the river. As such, current inspections of these components are performed on a 6-year frequency to ensure their function will be maintained consistent with the current licensing basis. The circulating water pumps are not within the scope of License Renewal. This example provides objective evidence that operating experience at Salem is being used to assess the applicability at Hope Creek for the potential for

selective leaching and demonstrates corrective action to monitor material that is susceptible to selective leaching.

Once implemented, the Hope Creek Selective Leaching of Materials aging management program will manage loss of material such that intended function(s) of components susceptible to selective leaching will be maintained consistent with the current licensing basis for the period of extended operation.

No other occurrences of selective leaching have been identified at Hope Creek. Occurrence identified to date did not cause significant impact to safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Selective Leaching of Materials program will effectively identify degradation prior to loss of intended function. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Selective Leaching of Materials program will be performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The new Selective Leaching of Materials program will provide reasonable assurance that loss of material aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.24 Buried Piping Inspection

Program Description

The Buried Piping Inspection aging management program is an existing program that includes preventive measures such as coating and wrapping to mitigate corrosion and periodic inspection of external surfaces for loss of material to detect and monitor the effects of corrosion on the external surface of buried steel piping and components in a soil (external) environment. The program provides for managing loss of material due to general corrosion, pitting, crevice corrosion and microbiologically-influenced corrosion (MIC). Preventive measures are in accordance with standard industry practices for maintaining external coatings and wrappings.

Hope Creek does not have any buried tanks in the scope of license renewal.

External inspections of buried components using visual techniques will occur opportunistically when they are excavated during maintenance. Inspection of buried carbon steel, galvanized steel, ductile cast iron, and gray cast iron piping and components will be performed in the ten years prior to the period of extended operation. Upon entering the period of extended operation, a focused inspection of each of the above materials shall be performed within the first ten years, unless an opportunistic inspection occurs within this ten-year period.

Any coating and wrapping degradation is reported and evaluated according to site corrective action procedures. External component degradation is reported and evaluated whenever buried commodities are uncovered during yard excavation activities, which includes bolting. The Bolting Integrity program addresses the aging management of buried bolting. In addition, evidence of metal surface corrosion and any leakage detected through periodic testing and visual inspections will be evaluated and used to confirm the system and components ability to perform their intended functions. Any leakage identified is evaluated and appropriate corrective actions are implemented.

The program will be enhanced as described below to provide reasonable assurance that buried piping and components of all steel materials that are in scope of the Buried Piping Inspection program, including carbon steel, galvanized steel, ductile cast iron, and gray cast iron at Hope Creek will perform their intended function during the period of extended operation.

NUREG-1801 Consistency

There are no buried tanks at Hope Creek that are in scope for license renewal. The Buried Piping Inspection aging management program is consistent with the ten elements of aging management program XI.M34, "Buried Piping and Tanks Inspection," specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

Prior to the period of extended operation, the following enhancement will be implemented:

1. The Buried Piping Inspection aging management program will be enhanced to include at least one opportunistic or focused excavation and inspection of carbon steel, galvanized steel, gray cast iron, and ductile cast iron piping and components within ten years prior to entering the period of extended operation. Upon entering the period of extended operation, a focused inspection of each of the above materials shall be performed within the first ten years, unless an opportunistic inspection occurs within this ten-year period. **Program Elements Affected: Detection of Aging Effects (Element 4)**

Operating Experience

Operating experience shows that the program described here is effective in managing corrosion of external surfaces of buried steel piping. However, because the inspection frequency is plant-specific and depends on the plant operating experience, the Hope Creek plant-specific operating experience is further evaluated for the extended period of operation. Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that loss of material due to general, pitting, crevice, and microbiologically influenced corrosion are being adequately managed. The following examples of operating experience provide objective evidence that the Buried Piping Inspection program will be effective in assuring that intended function(s) would be maintained consistent with the CLB for the period of extended operation:

1. In 2008, risk ranking of the Hope Creek buried piping revealed that the portions of the carbon steel Service Water piping were determined to be high risk. As a result, a plan was developed to conduct non-intrusive inspection of the coated carbon steel through-wall penetrations of the 36-inch service water underground spools at the Service Water Intake Structure and Reactor Building penetrations. Non-destructive examination of piping is to take place from the inside diameter of this piping to determine the external condition of the pipe and its external coating. This example provides objective evidence that an active risk ranking methodology is in place and that focused inspection of the outer coating of the buried steel piping was planned as part of this aging management program.

2. In May 2005, water was bubbling up from beneath the asphalt, in front of the Fire Pump House. The 12-inch fire main was excavated to the elbow level and inspection found the leakage to be caused by a loose flange joint. Bolting on the flange was tightened and the leakage stopped. There was no need for further excavation since no deficiencies were identified on the excavated coated ductile cast iron piping. This example provides objective evidence that inspections are performed and buried piping is opportunistically inspected, whenever it is exposed, during any excavation for maintenance.

3. In 2003, the fire main appeared to be broken underground between Fire Hydrant FH-07 and FH-15 in front of the Fire Pump House. Excavation was conducted to the elbow level and found the flange joint to be loose. No deficiency was identified on the exposed portion of the coated cast iron piping. Bolting on the flange was tightened and the leakage stopped. This example provides objective evidence that corrective actions are taken prior to loss of intended function.

A review of plant operating experience showed that excavation of buried piping has occurred, and no instances of significant age related deficiencies were documented. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Buried Piping Inspection program will effectively identify degradation prior to failure. The work planning process provides instructions to do exterior surface inspections when excavations occur. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Buried Piping Inspection program are planned, to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The enhanced Buried Piping Inspection program will provide reasonable assurance that loss of material aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.25 External Surfaces Monitoring

Program Description:

The External Surfaces Monitoring aging management program is a new program that directs visual inspections that are performed during system walkdowns. The program consists of periodic visual inspection of components such as piping, piping components, ducting, and other components within the scope of license renewal. The program provides for management of aging effects through visual inspection of external surfaces for evidence of loss of material.

Materials of construction inspected under this program include Galvanized Steel, Carbon Steel, Gray Cast Iron, and Ductile Cast Iron. For steel components, visual inspections will identify loss of material due to general, pitting and crevice corrosion. General corrosion will manifest itself as visible rust or rust byproducts (e.g., discoloration or coating degradation) and be detectable prior to any loss of intended function.

Examples of components this program inspects are piping and piping elements, ducting, heat exchangers, and tanks. The inspection parameters include material condition of the components, which consists of evidence of unusual rust, corrosion, overheating, blistering, and discoloration; evidence of insulation damage or wetting; degradation, blistering, and pealing of protective coatings; unusual leakage from piping or component bolted joints. Coatings degradation is used as an indicator of possible underlying degradation of the component.

The External Surfaces Monitoring Program is a visual condition monitoring program that does not include preventive or mitigating actions.

Typically, system walkdowns of accessible areas are performed at least quarterly and walkdowns of inaccessible areas are performed at least once per refueling outage. Surfaces that are inaccessible or not readily visible during both plant operations and refueling outages are inspected at such intervals that would provide reasonable assurance that the effects of aging will be managed such that applicable components will perform their intended function during the period of extended operation.

Engineering personnel will determine the acceptance criteria based upon component, material, and environment combinations. Visual inspection activities are performed by qualified personnel in accordance with site controlled procedures and processes. Deficiencies are documented using the corrective action process to document the concern in accordance with the 10 CFR Part 50, Appendix B Corrective Action Program. The corrective action program ensures that conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the problem is determined and an action plan is developed to prevent recurrence.

The external surfaces of components that are buried are inspected via the Buried Piping Inspection and Buried Non-Steel Piping Inspection programs. The external surfaces of above ground tanks are inspected via the Aboveground Steel Tanks and Aboveground Non-Steel Tanks programs. This program does not provide for managing aging of internal surfaces.

NUREG-1801 Consistency

The External Surfaces Monitoring program is consistent with the ten elements of aging management program XI.M36, External Surfaces Monitoring, specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the External Surfaces Monitoring program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. In June 2008, during a plant tour, two control area chilled water pipe flanges and associated bolts were found to have heavy rust. The pipe was not insulated and the rust was caused by condensation. The rust was identified as superficial. The areas that were found to have corrosion were cleaned and insulation installed on the piping.

2. In November 2007, Reactor Core Isolation Cooling valve was found to have surface rust due to exposure to overhead leaking. The overhead leak was fixed and the rusted valve was replaced. The areas that were found to have corrosion were cleaned and painted to prevent further degradation. Follow up walkdowns of the valve did not find surface rust.

3. In June 2002, Control Rod Drive SCRAM inlet valve top bonnet was found to have minor rust. The component was inspected, cleaned and returned to service. Follow up walkdowns of the valve did not find surface rust.

The above examples provide objective evidence that surface corrosion will be entered into the corrective action process so that action will be taken to resolve issues. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the External Surfaces Monitoring program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the External Surfaces Monitoring program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The new External Surfaces Monitoring program will provide reasonable assurance that the identified aging effects will be adequately managed so that the intended functions of structures and components within the scope license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.26 Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components

Program Description

The Hope Creek Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components aging management program is a new program that manages the aging of the internal surfaces of steel piping, piping components and piping elements, tanks and ducting components. This program will manage the aging effect of loss of material. The program includes provisions for visual inspections of the internal surfaces of components not managed under other aging management programs.

Inspections will be performed when the internal surfaces are accessible during the performance of periodic surveillances, during maintenance activities, and during scheduled outages.

For painted or coated surfaces, degradation of surfaces cannot occur without the degradation of the paint or coating. Confirmation of the integrity of the paint or coating is an effective method for managing the effects of corrosion on the steel surface. Paint or coating degradation may be identified by the presence of blistering, cracking, rusting, loss of adhesion, and mechanical damage. For uncoated surfaces, visual inspections will directly monitor for surface degradation including indications of general corrosion.

Inspection locations will be chosen to be a representative sample of the material and environment combinations.

Inspection intervals take into consideration component material and environment and industry and plant-specific operating experience. Results of the periodic inspections are monitored for indications of various corrosion mechanisms and fouling. The extent and schedule of inspections and testing are based on industry and plant specific operating experience, and assure detection of component degradation prior to loss of intended functions.

Indications of degradation that would impact component intended function, including degradation that could result in loss of material or fouling, are reported and will require further evaluation. The acceptance criteria are established in the maintenance and surveillance procedures or are established during engineering evaluation of the degraded condition. If the inspection results are not acceptable, the Corrective Action Program is implemented to assess the material condition and determine whether the component intended function is affected.

NUREG-1801 Consistency

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components aging management program is consistent with the ten elements of aging management program XI.M38, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components, specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Industry operating experience indicates that internal environmental conditions can cause age-related degradation to susceptible plant components. Existing plant procedures for visual inspections of internal surfaces of piping and ducting have identified minimal instances of internal degradation. Continued implementation of these procedures additional procedures to expand the scope of systems and components inspected will be adequate to manage degradation during the period of extended operation. Examples of past degradation identified by the existing procedures include:

1. Extensive maintenance history searches were performed on the ventilation systems in the scope of this program to identify plant operating experience with loss of material or other age related degradation on the internal surfaces of galvanized and carbon steel components. These ventilation systems contain and process air drawn directly from outdoors or air drawn from various plant areas. In system locations where condensation is expected, it is contained by collection and drain systems. Plant operating experience indicates that the ventilation system air environment is a passive environment and its degradation properties on the galvanized and carbon steel materials are not aggressive. No age related degradation issues associated with ventilation system internal surfaces could be found. The results from periodic internal inspections performed since 2002 indicate component conditions are satisfactory and did not indicate internal surface corrosion or degradation. Interviews with ventilation system managers at the station confirmed that ventilation systems have not experience loss a material or other aging degradation on the internal surfaces for the galvanized and carbon steel components in the scope of this program. This operating experience example provides objective evidence that existing maintenance activities will identify internal degradation prior to loss of ventilation system components intended functions.

2. A review of the 2000 ten-year inspection work order on the HPCI pumps was performed. The pumps NDE sheet stated no indications. Also, no corrosion was documented. Interviews with HPCI system managers at the station confirmed that the HPCI pumps have not experienced loss of material or other aging degradation on the internal surfaces. This operating experience example provides objective evidence that existing inspection activities will identify internal degradation prior to loss of the component's intended functions.

3. In August 2008 during a routine walkdown of the Service Water Intake Structure, a thru-wall leak was identified at the equipment drain sump pump discharge header, which is not safety-related and is in the scope of license renewal because of potential spatial interaction with safety-related equipment. The leakage did not impact any safety-related system components, and the leakage was discovered prior to impacting the integrity of the floor structure in the affected areas beneath the leak. The cause was identified as silt accumulation and rust inside of the carbon steel piping due to the brackish water internal environment. The sump pump and a section of the discharge pipe were replaced. Past modifications to the drain system have included piping replacements and sections of the header were replaced with a more corrosion resistant stainless steel material. This operating experience example provides objective evidence that existing plant activities identify nonsafety-related failures prior to significant impact on adjacent safety-related SSCs, and that identified failures are evaluated and corrective actions are taken to preclude recurrence.

4. In April 2004 it was identified during system testing that a check valve in the High Pressure Coolant Injection system was leaking past the seat. The check valve was opened and the internals were found to contain rust. The accumulated rust prevented the check valve plug from moving freely. The valve internals were cleaned and significant loss of material degradation due to the rusting was not reported for the valve body or internals. A valve seat blue check was satisfactory and the valve was reassembled. The check valve was placed back in service and no other incidences of corrosion have occurred with this valve. A similar issue occurred on another check valve in the same line, and the valve was also returned to service after the internals were cleaned. This operating experience provides objective evidence that significant loss of material is not occurring inside carbon steel components in the HPCI system, and that existing maintenance activities provide opportunities for internal inspections that will identify loss of material of pressure boundary components prior to loss of component intended function.

Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The new Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components aging management program will provide reasonable assurance that the aging effect of loss of material will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.27 Lubricating Oil Analysis

Program Description

The Lubricating Oil Analysis aging management program is an existing program that provides oil condition monitoring activities to manage the loss of material and the reduction of heat transfer in piping, piping components, piping elements, heat exchangers, and tanks within the scope of license renewal exposed to a lubricating oil environment. Sampling, analysis, and condition monitoring activities identify specific wear products and contamination and determine the physical properties of lubricating oil within operating machinery. These activities are used to verify that the wear product and contamination levels and the physical properties of lubricating oil are maintained within acceptable limits to ensure that intended functions are maintained.

The program directs the condition monitoring activities (sampling, analyses, and trending), thereby preserving an environment that is not conducive to loss of material, cracking or reduction of heat transfer. The lubricating oil testing (sampling and analysis) and condition monitoring activities identify detrimental contaminants such as water, sediments, specific wear elements, and elements from an outside source. The contaminant levels (e.g., water and particulates) are trended in the program's database, and recommendations are made when adverse trends are observed, which could include inleakage and corrosion product buildup.

Typical parameters analyzed by the Lubricating Oil Analysis program include; viscosity, total acid number (TAN), total water, wear particle count (WPC), wear metals such as iron, chromium, and lead, and contaminants/additives such as silicon, calcium, and zinc.

The Lubricating Oil Analysis program is a condition monitoring program and the monitoring methods are effective in detecting the applicable aging effects and the frequency of monitoring is adequate to prevent significant degradation.

NUREG-1801 Consistency

The Lubricating Oil Analysis aging management program is consistent with the ten elements of aging management program XI.M39, "Lubricating Oil Analysis Program," specified in NUREG-1801 with the following exception:

Exceptions to NUREG-1801

1. NUREG-1801 aging management program XI.M39, "Lubricating Oil Analysis Program" recommends the determination of flash point. Flash point is measured for all new lubricating oil and for in-service Emergency Diesel Generator (EDG) lubricating oil, however, it is not measured for in-service lubricating oil for the remaining components in the scope of the program. **Program Element Affected: Parameters Monitored or Inspected (Element 3)**

Justification for Exception

Flash point is measured for all new lubricating oil and for in-service Emergency Diesel Generator (EDG) lubricating oil. The determination of flash point in lubricating oil is used to indicate the presence of highly volatile or flammable materials in a relatively nonvolatile or nonflammable material, such as found with fuel contamination in lubricating oil. The existing Lubricating Oil Analysis program includes flash point analysis for the EDG in service lubricating oil, which is the only potential application for the introduction of highly volatile or flammable materials, e.g., diesel fuel, into the lubricating oil.

Enhancements

None.

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects/mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the Lubricating Oil Analysis aging management program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. In March 2008, a lubricating oil sample was taken from the “D” Emergency Diesel engine crankcase in accordance with the Predictive Maintenance Program. The total base number (TBN) was in the Fault range for the type of oil. This was an unexpected step change from past experience. The condition was entered into the corrective action program. An additional sample was taken in April 2008 to monitor the condition of the lubricating oil and to ensure that the results of the March 2008 sample were accurate. Split samples were sent to two laboratories. Replacement of the lubricating oil was unnecessary because the TBN results from the two laboratories were consistent and within the normal range for the type of oil. Therefore, this example provides objective evidence that the Lubricating Oil Analysis aging management program is capable of making prudent recommendations based on sample results, performing additional sampling to monitor critical lubricating oil parameters and to verify the validity of earlier samples, and adjusting corrective actions based on all of the analytical information to ensure that intended functions are maintained.

2. In July 2005, a lubricating oil sample was taken from the “B” Primary Condensate Pump motor upper bearing in accordance with the Predictive Maintenance Program. The total acid number (TAN) was just above the Alert limit. The viscosity value was normal. The condition was entered into the corrective action program. A recommendation was made to change the lubricating oil in the following refueling outage. The lubricating oil was changed and the subsequent TAN value returned to the normal range. Therefore, this example provides objective evidence that the Lubricating Oil Analysis program is capable of sampling lubricating oils, analyzing the samples for critical lubricating oil parameters, recognizing a condition

adverse to quality, and implementing corrective actions to restore the critical parameters to the normal ranges.

3. In 2002, a lubricating oil sample was taken from the “C” Residual Heat Removal (RHR) pump motor upper bearing assembly in accordance with the Predictive Maintenance Program. The results indicated high moisture content. A confirmatory analysis was performed and the result was lower moisture content but one still above the limit. The condition was entered into the corrective action program. The extent of condition was limited to the “C” RHR pump motor. Hope Creek entered a Technical Specification Limited Condition Operation (LCO) 02-629 due to a degraded Emergency Core Cooling System (ECCS) pump. The cause of the elevated moisture content was determined to be a degraded lube oil cooler that allowed cooling water to contaminate the lubricating oil. The motor was removed, the lube oil cooler repaired, the bearing housings cleaned, and new lubricating oil added. The moisture content returned to the normal range. The RHR pump motor was restored and the LCO exited. Therefore, this example provides objective evidence that the Lubricating Oil Analysis program is capable of sampling lubricating oils, analyzing the samples for critical lubricating oil parameters, recognizing a condition adverse to quality, and implementing corrective actions to restore the critical parameters to the normal ranges.

There is sufficient confidence that the implementation of the Lubricating Oil Analysis program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Lubricating Oil Analysis program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing Lubricating Oil Analysis program provides reasonable assurance that the loss of material and the reduction of heat transfer aging effects are adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.28 ASME SECTION XI, SUBSECTION IWE

Program Description

The ASME Section XI, Subsection IWE aging management program is an existing condition monitoring program that provides for inspection of primary containment components including steel containment shells and their integral attachments, containment hatches and airlocks, penetration sleeves, pressure retaining bolting, and other pressure retaining components for loss of material and fretting or lockup in an indoor air or treated water environment. The scope of the Hope Creek ASME Section XI, Subsection IWE aging management program is consistent with the scope identified in Subsection IWE-1000 and includes the Class MC pressure retaining components and their integral attachments including wetted surfaces of submerged areas of the pressure suppression chamber and vent system, containment pressure-retaining bolting, and metal containment surface areas, including welds and base metal. Containment seals and gaskets are not included in the scope of this program; instead they are in the scope of the 10 CFR Part 50 Appendix J aging management program. Hope Creek utilizes a steel containment; therefore there are no Class CC containment components or their integral attachments inspected in accordance with Subsection IWL.

The containment original design did not require an internal moisture barrier at the junction of the drywell concrete floor and the steel drywell shell. However, Hope Creek has elected to install a moisture barrier and will include its examination in the scope of the program in accordance with the IWE 2500 requirements. Installation of the moisture barrier is planned prior to the period of extended operation.

The program is implemented through procedures that implement ASME Section XI, Subsection IWE requirements for detecting loss of material, loss of preload and fretting or lockup. The primary containment environments addressed are: air-indoor and treated water.

The program utilizes inspections that detect degradation before loss of intended function. No preventive attributes are associated with these activities. The program implements the requirements of IWE by providing visual examinations (General Visual and VT-3) and augmented inspections (VT-1) for evidence of aging effects that could affect structural integrity or leak tightness of the primary containment. Areas subject to augmented inspection are subject to visual inspection (VT-1) and volumetric (ultrasonic) examination techniques as required by engineering. The program addresses the E-A and E-C examination categories described in Table IWE-2500-1 and as approved per 10 CFR 50.55a. The ASME 2001 Code and 2003 Addenda do not contain categories E-B, E-D, E-F, E-G and E-P. The program specifies examinations of accessible surfaces to detect the aging effects of loss of material and loss of preload as addressed in IWE-3500. The frequency and scope of examinations specified is in accordance with 10 CFR 50.55a and ASME Section XI, Subsection IWE-2400.

The Hope Creek aging management program complies with Subsection IWE of ASME Section XI, 2001 Edition including 2003 Addenda, for steel containment (Class MC) pressure retaining components and their integral attachments, in accordance with the provisions of 10 CFR 50.55a. The requirements of IWE-2430 were removed from this Code year and are not applicable to Hope Creek. The monitoring methods have been demonstrated effective in detecting the applicable aging effects and the frequency of monitoring is adequate to prevent significant aging.

The Hope Creek ASME Section XI, Subsection IWE aging management program provides for periodic inspections for the presence of age related degradation on all accessible surfaces of the containment on a scheduled basis. When examination results require an evaluation or the component is repaired and is found to be acceptable for continued service, the areas containing such flaws, degradation, or repair are reexamined during the next inspection period, in accordance with Examination Category E-C.

The acceptance criteria for the ASME Section XI, Subsection IWE aging management program are in accordance with the requirements of the 2001 Edition with 2003 Addenda of the ASME Code, Subsections IWE-3000 and IWE-3500. In this code year, Table IWE-3410-1 was replaced with a reference to Subsection IWE-3500.

The Hope Creek ASME Section XI, Subsection IWE aging management program implementing procedures and references contain the acceptance criteria for containment surface examinations. Category E-A examinations are conducted by a Certified VT-3 examiner or engineer; and Category E-C examinations are conducted by a Certified VT-1 examiner or engineer. Indications are evaluated and compared to acceptance standards in implementing procedures. The IWE Responsible Individual is responsible for evaluation of examination results. Unacceptable conditions are recorded and documented in accordance with the corrective action process and supplemental examinations are performed in accordance with IWE-3200. Conditions which do not meet the acceptance criteria are accepted by an engineering evaluation or corrected by repair or replacement in accordance with IWE-3122.

Repairs and reexaminations, when required, are performed in accordance with IWA-4000 as required by IWE-3124 and the components are repaired or replaced to the extent necessary to meet the acceptance standards of IWE-3500. Component reexaminations are conducted in accordance with the requirements of IWA-2200 and the results are recorded to demonstrate that the repair meets the owner defined acceptance standards per IWE-3500.

The program will be enhanced, as noted below, to provide reasonable assurance that the ASME Section XI, Subsection IWE program aging effects will be adequately managed during the period of extended operation.

NUREG-1801 Consistency

The ASME Section XI, Subsection IWE aging management program is consistent with the ten elements of aging management program XI.S1, "ASME Section XI, Subsection IWE," specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

1. Install an internal moisture barrier at the junction of the drywell concrete floor and the steel drywell shell prior to the period of extended operation. **Program Elements Affected: Scope of Program (Element 1)**

2. Revise the Hope Creek ASME Section XI, Subsection IWE implementing documents to require inspection of the moisture barrier for loss of sealing in accordance with IWE 2500 after it is installed. The original design for Hope Creek did not require an internal moisture barrier at the junction of the drywell concrete floor and steel drywell shell. **Program Elements Affected: Scope of Program (Element 1)**

3. Verify that the reactor cavity seal rupture drain lines are clear from blockage once prior to the period of extended operation, and one additional time during the first 10 years of the period of extended operation. **Program Elements Affected: Scope of Program (Element 1)**

4. Verify that drains at the bottom of the drywell air gap are clear from blockage once prior to the period of extended operation, and one additional time during the first 10 years of the period of extended operation. **Program Elements Affected: Scope of Program (Element 1)**

5. Investigate the source of any leakage detected by the reactor cavity seal rupture drain line instrumentation and assess its impact on the drywell shell. **Program Elements Affected: Scope of Program (Element 1)**

6. Monitor the drains at the bottom of the drywell air gap for leakage in the event leakage is detected by the reactor cavity seal rupture drain line instrumentation. **Program Elements Affected: Scope of Program (Element 1)**

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the ASME Section XI, Subsection IWE program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. In 2004, the Torus shell and interior coatings were inspected by divers performing underwater IWE program inspections resulting in identification of coating deficiencies, with general corrosion and pitting. There were 16 areas with metal loss reported as ranging from 5 mils to 30 mils. The torus shell thickness in these areas is 1" thick minimum. Evaluation of the loss of material determined that the loss of material is acceptable since the reduction in torus shell thickness had not exceeded 10 percent of the nominal plate thickness and is also well under the 1/8 inch torus corrosion allowance included in the design of the torus shell. Based on this information, the areas described in the corrective action report were determined to be acceptable. However, cleaning and coating of the areas was recommended by engineering to prevent further degradation. The cleaning and underwater coating repair of the affected areas was completed during the subsequent outage. These areas will be re-inspected during future IWE underwater inspections. This example provides objective evidence that the ASME Section XI, Subsection IWE aging management program is capable of both monitoring and detection of the aging effects for coatings and the steel torus shell in submerged areas; and that appropriate corrective maintenance of protective coatings are performed when necessary.

2. In 2004, rust was identified on various components inside the torus shell during IWE program inspections, including a number of penetrations and downcomer supports. The condition of the base metal was acceptable; however, the inside of a number of the penetrations and 32 downcomers supports were recoated to prevent further degradation. This example provides objective evidence that the ASME Section XI, Subsection IWE aging management program is capable of both monitoring and detection of the aging effects associated with the steel containment and coatings, including the torus, and that appropriate corrective maintenance of protective coatings are performed when necessary.

3. In 2007 and 2009, UT examinations were performed to sample thickness of the Drywell shell at various locations, including near the interface of the concrete and drywell shell. The as found UT inspections were acceptable and were in excess of nominal thickness requirements. The original design of Hope Creek did not include a moisture barrier at the interior concrete floor to interior steel shell liner. Inspections of the shell immediately adjacent to the floor areas have found no signs of significant corrosion. This example provides objective evidence that the Hope Creek ASME Section XI, Subsection IWE aging management program is capable of both monitoring and detection of the aging effects associated with the steel containment; and that industry operating experience is used to identify degradation that has occurred at other plants.

The containment at Hope Creek has been found during inspections performed in accordance with ASME Section XI, Subsection IWE to be in acceptable condition. The drywell shell and torus are in good condition. Although minor corrosion has been found on the inside of the torus shell, it is not significant, and the aging management program will detect any future corrosion before the wall thickness is impacted. The drywell shell has shown no signs of significant corrosion, and the aging management program will provide reasonable assurance that significant degradation of the drywell shell will not occur during the period of extended operation. Problems identified did not cause any impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. The condition of the containment, and the evidence that degraded conditions, such as those described above, can be identified and corrected prior to any significant degradation occurring, provides sufficient confidence that the implementation of the ASME Section XI, Subsection IWE program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the ASME Section XI, Subsection IWE program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The enhanced ASME Section XI, Subsection IWE program will provide reasonable assurance that the identified aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained, consistent with the current licensing basis, during the period of extended operation.

B.2.1.29 ASME Section XI, Subsection IWF

Program Description:

The ASME Section XI, Subsection IWF aging management program is an existing program that consists of periodic visual examination of ASME Section XI Class 1, 2, 3, and MC piping and component support members for loss of material, and loss of mechanical function in the following environments: air indoor, air outdoor and treated water. Bolting for supports is also included with these components and inspected for loss of material and for loss of preload by inspecting for missing, detached, or loosened bolts and nuts in the following environments: air indoor, air outdoor and treated water. The program also relies on the design change procedures that are based on EPRI TR-104213 guidance to ensure proper specification of bolting material, lubricant, and installation torque. Identified degradations are entered in the corrective action process for evaluation or correction to ensure the intended function of the component support is maintained.

The program is implemented through corporate and station procedures, which provide inspection and acceptance criteria consistent with the requirements of the American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code, Section XI, Subsection IWF 2001 Edition through the 2003 Addenda as approved in 10 CFR 50.55(a). The monitoring methods are effective in detecting the applicable aging effects and the frequency of monitoring is adequate to prevent significant degradation.

The ASME Section XI, Subsection IWF aging management program utilizes inspections that detect degradation before loss of intended function. No preventive or mitigating attributes are associated with these activities.

In accordance with 10 CFR 50.55a(g)(4)(ii), the ISI program is updated each successive 120-month inspection interval to comply with the requirements of the latest edition of the ASME Code specified twelve months before the start of the inspection interval.

NUREG-1801 Consistency:

The ASME Section XI, Subsection IWF Program is consistent with the ten elements of aging management program XI.S3, “ASME Section XI, Subsection IWF”, specified in NUREG-1801.

Exceptions to NUREG-1801:

None.

Enhancements:

None.

Operating Experience:

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that loss of material, loss of mechanical function, and loss of bolting preload are being adequately managed. The following examples of operating experience provide objective evidence that the ASME Section XI, Subsection IWF program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. In 2003, during the performance of ASME Section XI, Subsection IWE inspections, the inspectors identified light to heavy rust on nuts and washers for two bolts installed on a torus horizontal restraint (MC support). These bolts, nuts and washers are components of the torus horizontal restraint, which is managed by the ASME Section XI, Subsection IWF program. The inspection noted that there was no measurable loss of material. The condition was entered in the corrective action program for evaluation and performance of an extent of condition. As a result, the remaining torus lateral restraint bolts, nuts and washers were inspected during the next refueling outage (RF12). The inspectors noted light to heavy rust on additional washers and nuts. Corrective actions were initiated to remove the rust and re-inspect the washers and nuts. After the rust was removed, the supports were inspected, evaluated, and found acceptable for continued service without repair/replacement. This example demonstrates that examinations conducted in accordance with ASME Section XI, Subsection IWF identify aging effects that could impact the structural integrity of component supports. The example also illustrates that identified degradations are investigated for extent of condition and evaluated for continued service, or repair and replacement.

2. In 2004, failure of a nonsafety-related 8” diameter steam pipe caused loss of condenser vacuum and required operators to manually scram the plant. The direct cause of the event was fatigue due to vibration attributed to operating the system with a failed open air-operated valve (LV1039A) for twenty-five days. Event investigation determined that the failed open valve was caused by failure of the air supply line to the valve operator. The air supply line failure was apparently caused by fretting due to vibration of a loose rod hanger (H25), which rubbed against the air line. After the pipe rupture event, the upper rod of hanger H25 was found to be unscrewed from the eye nut. The jam nut at the eye nut and the upper rod was found to be fully unthreaded and easy to turn. This pipe hanger is nonsafety-related and is not in scope of ASME Section XI, Subsection IWF.

   As a result of the identified loose hanger, an extent of condition was performed to determine if the condition existed on other plant systems, and would include balance of plant (BOP) systems from the adjacent operating station, Salem Unit 1 and Unit 2. Field inspections were conducted on over 5000 BOP hangers. Two hundred six (206) hanger deficiencies were identified. In general, the deficiencies were in the following broad categories: rod or support is bent, rod or support is off vertical, spring can is out of tolerance, support components are loose, and loose jam nuts. Evaluation of the deficiencies determined they have no immediate impact on structural integrity of piping or systems. The deficiencies were attributed to less than adequate installation of the hangers and lack of rigorous formal monitoring activities for nonsafety-related pipe supports. These supports are subject to system engineer walkdowns and are not included in the scope of ASME Section XI, Subsection IWF or other formal programs. The identified deficiencies were accepted by engineering evaluation or repaired in accordance with approved procedures.

In addition to the walkdowns, approximately 10,000 work order records were reviewed for eight Hope Creek balance of plant systems for the period of January 1987 to September 2004. The review identified approximately 50 hangers that had loose jam nuts and approximately 15 disconnected hangers. The loose jam nuts and disconnected hangers were repaired in accordance with Hope Creek procedures. While this operating experience example is not associated directly with the ASME Section XI, Subsection IWF program, it illustrates that the station's corrective action program is an effective program and demonstrates that conditions adverse to quality are thoroughly investigated to determine the extent and root cause, and evaluated for acceptance or repair and replacement and is effective in maintaining the design basis for non-ASME pipe supports.

3. In 2006, Hope Creek conducted visual examination (VT-3) of eight (8) ASME Class 1, 2, 3, and MC component supports in accordance with ASME Section XI, Subsection IWF. The supports consist of a sample of different support types (i.e., anchor, hanger, variable support, etc.) selected from Residual Heat Removal, Main Steam systems, and Metal Containment (MC). The supports were inspected for degradations including corrosion, distortion, spring can functionality and settings, loose bolts and nuts, debris, foreign material, etc. VT-3 qualified examiners observed no unacceptable indications. This example demonstrates that the condition of Hope Creek ASME Class 1, 2, 3, and MC supports are acceptable. Parameters monitored and activities conducted in accordance with ASME Section XI, Subsection IWF provide reasonable assurance that aging effects will be adequately managed during the period of extended operation.

4. In 2006, Hope Creek identified one (1) concrete anchor on the support for the 1" diameter service water pump lube water line and replaced the anchor in accordance with Hope Creek Repair, Replacement Program. The replaced anchor was found broken during a service water intake structure walkdown. Corrosion due to service water leakage or spray was suspected as the failure mechanism for the anchor. An Engineering Evaluation concluded that the support was capable of performing its intended function with consideration for the remaining concrete anchors, but recommended the repair to restore the support to its design configuration. As a part of the extent of condition determination, similar supports at the service water intake structure were inspected. The inspections identified no additional broken concrete anchors. This example demonstrates that identified degradations are investigated for extent of condition and evaluated for continued service, or repair and replacement.

The piping and component supports inspections performed in accordance with the ASME Section XI, Subsection IWF program have been found to be generally in good condition. Although a limited number of supports were identified with problems, such as loose fasteners, corrosion of fasteners, and broken concrete anchor, these problems are not significant and the aging management program will provide reasonable assurance that significant degradation of piping and component supports will not occur during the period of extended operation. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the ASME Section XI, Subsection IWF program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of ASME Section XI, Subsection IWF program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion:

The existing ASME Section XI, Subsection IWF program provides reasonable assurance that the loss of material, loss of mechanical function, and loss of bolting preload aging effects are adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.30 10 CFR Part 50, Appendix J

Program Description

The 10 CFR Part 50, Appendix J aging management program is an existing program that provides for detection of age related pressure boundary degradation due to aging effects such as loss of leakage tightness, loss of material, cracking, loss of sealing or loss of preload in various systems penetrating containment. The program also provides for detection of age related degradation in material properties of gaskets, o-rings, and packing materials for the primary containment pressure boundary access points.

The 10 CFR Part 50, Appendix J program consists of tests performed in accordance with the regulations and guidance provided in 10 CFR Part 50 Appendix J, “Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors,” Option B; Regulatory Guide 1.163, “Performance-Based Containment Leak-Testing Program;” NEI 94-01, “Industry Guideline for Implementing Performance-Based Options of 10 CFR Part 50, Appendix J;” and ANSI/ANS 56.8, “Containment System Leakage Testing Requirements.”

Containment leakage rate tests are performed to assure that leakage through the containment and systems and components penetrating primary containment does not exceed allowable leakage limits specified in the plant technical specifications. An Integrated Leakage Rate Test (ILRT) is performed during a period of reactor shutdown at the frequency specified in 10 CFR Part 50, Appendix J, Option B. Performance of the Integrated Leakage Rate Test (ILRT) per 10 CFR 50, Appendix J demonstrates the leak-tightness and structural integrity of the containment. Local leakage rate tests (LLRT) are performed on isolation valves and containment access penetrations at frequencies that comply with the requirements of 10 CFR Part 50 Appendix J, Option B.

The Integrated Leakage Rate Test measures overall containment leakage and the Local leakage rate tests measure the pressure retaining integrity and leakage rates of individual containment penetrations. The parameters monitored are leakage rates of the containment shells; containment liners; and associated welds, penetrations, fittings and other access openings. The leakage rate acceptance criteria meet the requirements of 10 CFR Part 50, Appendix J, and are part of the current licensing basis (CLB).

The 10 CFR Part 50, Appendix J does not prevent degradation due to aging effects but provides measures for condition monitoring to detect the degradation prior to loss of intended function. The 10 CFR Part 50, Appendix J program detects degradation of the containment shell and liner and components that may compromise the containment pressure boundary, including seals and gaskets. The use of pressure tests verify the pressure retaining integrity of the containment. The Leak Rate Tests (LRT) demonstrate the leak-tightness of containment isolation barriers.

The LRT program documents and trends test results in accordance with the requirements and guidance provided in 10 CFR Part 50 Appendix J. The Leak Rate Test program demonstrates that the test results meet the requirements contained in the acceptance criteria. Tests results that fail to meet the acceptance criteria defined in the plant technical specifications are reported in accordance with approved procedures that meet the requirements of 10 CFR 50.72 and 10 CFR 50.73.

Evaluations are performed for test or inspection results that do not satisfy established criteria and a Notification is initiated to document the issue in accordance with plant administrative procedures.

The 10 CFR Part 50 Appendix B corrective actions program (CAP) ensures that the conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined and an action plan is developed to prevent recurrence. Corrective actions are performed in accordance with applicable procedures that meet the requirements of 10 CFR Part 50 Appendix J and NEI 94-01.

The monitoring methods established in the 10 CFR Part 50 Appendix J Program are effective in detecting the applicable aging effects and the frequency of monitoring is adequate to prevent significant degradation.

NUREG-1801 Consistency

The 10 CFR Part 50, Appendix J aging management program is consistent with the ten elements of aging management program XI.S4, "10 CFR Part 50, Appendix J," specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

The 10 CFR Part 50, Appendix J, LRT program has been effective in preventing unacceptable leakage through the containment pressure boundary. In addition, the implementation of Option B for testing frequency is consistent the plant-specific operating experience. The station operating experienced and assessments described below show the Appendix J program has been effective in preventing unacceptable leakage and has maintained compliance with regulatory driven test frequencies prescribed in Regulatory Guide 1.163, that are governed by the Appendix J program.

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the Appendix J LRT program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. The cumulative maximum leakage test results at Hope Creek in 2007 was approximately 30,700 standard cubic centimeters per minute (sccm), or 40%, of the total allowable technical specification limit of 76,795 sccm. The historic data shows not only that equipment is being adequately maintained but also that the equipment maintenance has been capable of creating a significant safety margin between the Technical Specification allowable limits and the as-tested values. The test results show the effects of aging are effectively being managed for the Primary Containment boundary.

2. A Focused Area Self-Assessment (FASA) conducted for the Hope Creek Appendix J Program was completed in July 2006. The purpose of the FASA is to evaluate the condition of and compliance with the regulatory requirements of Appendix J. The aspects of the program reviewed included program implementation organization, human performance/interface, program scope and continuous improvement. The overall rating for the Appendix J program was considered satisfactory. The assessment demonstrated that industry and plant operating experience are reviewed on a regular basis and that safety parameters are effectively monitored and trended by the program.

3. During the LLRT test in November 2004, system valves were found to have a measured leakage of 11,600 sccm, which exceeds the allowable limit of 5,400 sccm. The valves were declared inoperable and an investigation into the cause of the failures was initiated. The cause of the failure was due to damage to the valve seating area and repairs were made to resolve the degraded condition. This example demonstrates that corrective actions are implemented to repair a condition that causes excessive leakage and also demonstrates that follow-up leakage rate testing is performed to confirm that the deficiency has been corrected.

4. In April 2006, significant seat leakage on the auxiliary feedwater to main feedwater system check valve was discovered during the LLRT tests. The leakage was found to exceed its 5 gpm limit by 15 gpm. The valve was disassembled and inspected and the cause of the failure was due to manufacturing deficiencies on the valve poppet seat. This is a good example that shows degraded conditions are documented and corrective actions are implemented.

The data from the most recent running summary totals in 2007 show the total leakage has adequate margin at 40% of the allowable technical specification limit at Hope Creek. In addition, problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the 10 CFR Part 50 Appendix J Program will effectively identify degradation prior to impacting the primary containment boundary safety function. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Periodic self-assessments of the 10 CFR Part 50 Appendix J Program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing 10 CFR Part 50, Appendix J program provides reasonable assurance that the aging effects are adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.31 Masonry Wall Program

Program Description

The Masonry Wall Program is an existing program implemented as part of the Structures Monitoring Program. The Masonry Wall Program was developed to meet the regulatory requirements of 10 CFR 50.65, the Maintenance Rule; USNRC Regulatory Guide 1.160; and NUMARC 93-01, Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants. Hope Creek has no safety-related masonry walls or masonry walls whose failure during a seismic event could adversely impact a safety-related function. As a result, NRC IE Bulletin 80-11, “Masonry Wall Design”, does not apply.

The Masonry Wall aging management program addresses loss of material, and cracking due to age-related degradation of concrete for masonry walls. The program relies on periodic visual inspections to monitor and maintain the condition of masonry walls within the scope of license renewal, so that the established design basis for each masonry wall remains valid during the period of extended operation.

Masonry walls are inspected for cracking by qualified, experienced engineers, who are qualified per the requirements of the Structures Monitoring Program. The scope of the program will be enhanced to include structures that are not monitored under the current term but require monitoring during the period of extended operation. Details of the enhancements are discussed below.

Inspection frequency is every 5 years maximum, with provisions for more frequent inspections to ensure that observed conditions that have the potential for impacting an intended function are evaluated or corrected with the corrective action process in accordance with the 10 CFR Part 50, Appendix B Corrective Action Program. The corrective action program ensures that conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the problem is determined and an action plan is developed to prevent recurrence.

NUREG-1801 Consistency

The Masonry Wall Program is consistent with the ten elements of aging management program XI.S5, "Masonry Wall Program," specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the program elements:

1. Add buildings, and masonry walls that have been determined to be in the scope of License Renewal.
   a. Auxiliary Boiler Building
   b. Fire Water Pump House
   c. Masonry Wall Fire Barriers
   d. Switchyard
   e. Turbine Building

   Program Elements Affected: Scope of Program (Element 1)

2. Add an Examination Checklist for masonry wall inspection requirements. **Program Elements Affected: Parameters Monitored or Inspected (Element 3)**

3. Specify an inspection frequency of not greater than 5 years for masonry walls. **Program Elements Affected: Detection of Aging Effects (Element 4)**

Operating Experience

The masonry wall inspections show that detection of cracks, and other aging effects in masonry walls are being adequately managed. The inspection history revealed minor degradation of masonry block walls, but none that could impact their intended function. Deficiencies that have been identified have been evaluated and corrected, as appropriate. Concrete masonry walls are used only in non-Seismic Category I Structures. The following examples of operating experience provide objective evidence that the Masonry Wall Program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. In 2006, condition monitoring inspections were performed for Hope Creek masonry walls. The Masonry Wall Program is implemented by the Structures Monitoring Program. The checklist from the Structures Monitoring Program was used for the Main and Power Transformer masonry walls that perform a fire barrier intended function. Inspection results showed no significant degradation, such as efflorescence, spalling, or cracking.

2. In 2007, a corrective action report was issued to document, evaluate and repair cracks in a masonry wall near the turbine building that performed a fire barrier intended function. The cracks were evaluated by a qualified structural engineer. The structural engineer concluded that the cracks have no impact on the design basis of the masonry wall or the fire barrier intended function of the masonry wall. A work order was generated to seal the cracks. This example provides objective evidence that the station's corrective action program and Structures Monitoring Program are

documenting, evaluating, and correcting structural conditions adverse to quality.

3. In 2003, a corrective action report was issued to document and evaluate a fire barrier masonry wall that had a combustible material in the wall joints. The wall was located in the turbine building and the combustible material could affect its firewall rating. The combustible material was used to provide a designed control joint to prevent cracking in the wall. A design change was issued to cut back the joint material and the joints were sealed with an approved caulking. This is another example that the station's Corrective Action Program and Structures Monitoring Program are documenting, evaluating, and correcting structural conditions to maintain the masonry wall design basis.

The above examples provide objective evidence that the periodic structural inspections and corrective action reports are thorough and effectively monitor for age related degradations of masonry walls in the scope of the Masonry Wall Program. The program is effective in monitoring and detecting the various aging effects and mechanisms for the structural components, and environments such that there is no loss of component intended function.

As demonstrated in the operating experience examples above, the Masonry Wall Program is effectively managing the aging effects of masonry walls. Based on these examples, station procedures are utilized to identify and document conditions adverse to quality in accordance with the corrective action program. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Masonry Wall Program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Masonry Wall Program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The enhanced Masonry Wall Program as implemented by the Structures Monitoring Program will provide reasonable assurance that the identified aging effects will be adequately managed so that the intended functions of masonry walls within the scope of license renewal will be maintained consistent with the current licensing basis, during the period of extended operation.

B.2.1.32 Structures Monitoring Program

Program Description

The Structures Monitoring Program is an existing program that provides for aging management of structures and structural components, including structural bolting, within the scope of license renewal. The program was developed based on guidance in Regulatory Guide 1.160 Revision 2, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” and NUMARC 93-01 Revision 2, “Industry Guidelines for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” to satisfy the requirement of 10 CFR 50.65, “Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.”

The program requires monitoring of structures and components in accordance with 10 CFR 50.65 and RG 1.160 Rev. 2, Regulatory Position 1.5.

The scope of the program also includes condition monitoring of masonry walls and water-control structures as described in the Masonry Wall Program and in the RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants, aging management program. As a result, the program elements incorporate the requirements of NRC Regulatory Guide 1.127, “Inspection of Water-Control Structures Associated with Nuclear Power Plants.” Hope Creek has no safety-related masonry walls or masonry walls whose failure during a seismic event could adversely impact a safety-related function. As a result, NRC IE Bulletin 80-11, “Masonry Wall Design”, does not apply.

The structures and structural components are inspected by qualified personnel having a B.S. Engineering degree and/or Professional Engineer license, and a minimum of four years experience working on building structures. Concrete structures are inspected for indications of deterioration and distress including evidence of leaching, loss of material, cracking, and a loss of bond, as defined in ACI 201.1R, “Guide for Making a Condition Survey of Existing Buildings”. Masonry walls are inspected for cracking. Elastomers will be monitored for hardening, shrinkage and a loss of sealing. Earthen structures associated with water-control structures will be inspected for loss of material and loss of form. Component supports will be inspected for loss of material, reduction or loss of isolation function, and reduction in anchor capacity due to local concrete degradation. Exposed surfaces of bolting are monitored for loss of material, due to corrosion, loose nuts, missing bolts, or other indications of loss of preload. The program also relies on plant procedures that are based on the guidance contained in EPRI TR-104213, “Bolted Joint Maintenance and Applications Guide” to ensure proper specification of bolting material, lubricant, and installation torque.

A de-watering system is not relied upon to control settlement and porous concrete is not used in the design of sub-foundations.

The program contains provisions for increased inspection frequency and trending of structures and components in accordance with 10 CFR 50.65 (a)(1), if the extent of degradation is such that the structure or component may not meet its design basis or, if allowed to continue uncorrected until the next normally scheduled assessment, may not meet its design basis.

Underground concrete structures and structures in contact with river water are subject to an aggressive environment. Ground water and river water samples show pH > 5.5 and sulfates <1500 ppm indicating a non-aggressive environment; but chlorides exceed the threshold limit chlorides > 500 ppm which indicates an aggressive environment. The program will be enhanced to perform periodic sampling, testing, and analysis of ground water chemistry for pH, chlorides, and sulfates on a frequency of 5 years. Periodic inspections of the submerged portions of the intake structure will be used as a leading indicator for the condition of below-grade structures, because the groundwater chemistry is bounded by the river water chemistry. This provides reasonable assurance that degradation of inaccessible structures will be detected before a loss of an intended function.

The scope of the program will be enhanced to include structures that are not monitored under the current term but require monitoring during the period of extended operation. Details of the enhancements are discussed below.

Inspection frequency is every 5 years maximum, with provisions for more frequent inspections to ensure that observed conditions that have the potential for impacting an intended function are evaluated or corrected in accordance with the corrective action process.

Evaluations are performed for test or inspection results that do not satisfy established criteria and a corrective action report is issued in accordance with the corrective action process to document the concern in accordance with the 10 CFR Part 50, Appendix B Corrective Action Program. The corrective action program ensures that conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the problem is determined and an action plan is developed to prevent recurrence.

NUREG-1801 Consistency

The Structures Monitoring Program is consistent with the ten elements of aging management program XI.S6, "Structures Monitoring Program," specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

1. The scope of the program will be enhanced to include the following structures and components:
    a. Auxiliary Boiler Building
    b. Fire Water Pump House
    c. Shoreline Protection Dike, and Sheet piles (Reg. Guide 1.127)
    d. Switchyard
    e. Turbine Building
    f. Transmission towers
    g. Yard Structures (Foundations for fire water tanks, manholes, Transformer foundations credited for SBO)
    h. Masonry walls, including fire barriers
    i. Building penetrations that perform flood barrier, pressure boundary, shelter and protection intended functions
    j. Miscellaneous steel (catwalks, vents, louvers, platforms, etc.)
    k. Pipe whip restraints, jet impingement and missile shields
    l. Ice barrier, trash rack (Reg. Guide 1.127)
    m. Panels, racks, cabinets, and other enclosures
    n. Metal-enclosed bus
    o. Components supports including, electrical cable trays, electrical conduit, tubing, HVAC ducts, instrument racks, battery racks, and supports for piping and components that are not within the scope of ASME Section XI, Subsection IWF
    p. Duct banks that contain safety-related cables, and cables credited for SBO or ATWS

    Program Elements Affected: Scope of Program (Element 1)

2. Concrete structures will be observed for a reduction in equipment anchor capacity due to local concrete degradation. This will be accomplished by visual inspection of concrete surfaces around anchors for cracking and spalling. **Program Elements Affected: Parameters Monitored or Inspected (Element 3)**

3. Clarify that inspections are performed for loss of material due to corrosion and pitting of additional steel components, such as embedments, panels and enclosures, doors, siding, metal deck, and anchors. **Program Elements Affected: Parameters Monitored or Inspected (Element 3)**

4. Perform a one-time inspection of the external stainless steel surfaces of the expansion bellows at Condensate Storage Tank Dike for loss of material due to corrosion, within the ten-year period prior to the period of extended operation. **Program Elements Affected: Parameters Monitored or Inspected (Element 3)**

5. Require inspection of penetration seals, structural seals, and elastomers, for degradations that will lead to a loss of sealing by visual inspection of the seal for hardening, shrinkage and loss of strength. **Program Elements Affected: Parameters Monitored or Inspected (Element 3)**

6. Require monitoring of vibration isolators, associated with component supports other than those covered by ASME XI, Subsection IWF. **Program Elements Affected: Parameters Monitored or Inspected (Element 3)**

7. Add an Examination Checklist for masonry wall inspection requirements. **Program Elements Affected: Parameters Monitored or Inspected (Element 3)**

8. Parameters monitored for wooden components will be enhanced to include: change in material properties, loss of material due to Insect damage and moisture damage. **Program Elements Affected: Parameters Monitored or Inspected (Element 3)**

9. Specify an inspection frequency of not greater than 5 years for structures including submerged portions of the service water intake structure. **Program Elements Affected: Detection of Aging Effects (Element 4)**

10. Require individuals responsible for inspections and assessments for structures to have a B.S. Engineering degree and/or Professional Engineer license, and a minimum of four years experience working on building structures. **Program Elements Affected: Detection of Aging Effects (Element 4)**

11. Perform periodic sampling, testing, and analysis of ground water chemistry for pH, chlorides, and sulfates on a frequency of 5 years. **Program Elements Affected: Detection of Aging Effects (Element 4)**

12. Require supplemental inspections of the affected in scope structures within 30 days following extreme environmental or natural phenomena (large floods, significant earthquakes, hurricanes, and tornadoes). **Program Elements Affected: Detection of Aging Effects (Element 4)**

13. Perform a chemical analysis of ground or surface water in-leakage when there is significant in-leakage or there is reason to believe that the in-leakage may be damaging concrete elements or reinforcing steel. **Program Elements Affected: Detection of Aging Effects (Element 4)**

14. Implementing procedures will be enhanced to include additional acceptance criteria details specified in ACI 349.3R-96. **Program Elements Affected: Acceptance Criteria. (Element 6)**

Operating Experience

The Structures Monitoring Program inspections show that aging effects and mechanisms are being adequately managed. The inspection history revealed minor degradation of structural components, but none that could impact their intended function. The Structures Monitoring Program inspections at Hope Creek have confirmed that the structures are in good condition and showed insignificant aging or degradation. Deficiencies that have been identified have been evaluated and corrected, as appropriate. The following examples of operating experience provide objective evidence that the Structures Monitoring Program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. The Structures Monitoring Program was implemented on the schedule as required by 10 CFR 50.65(a). Baseline inspections of all structures in the scope of Maintenance Rule were completed in 1997. Additional inspections were completed consistent with the program frequency. The following examples of findings were extracted from inspection reports for the following structures and components.

   Roofing Examination:

   In 2008, condition monitoring inspections were performed on various roofs in accordance with the Structures Monitoring Program. Roof inspections were performed for all the safety-related buildings for material condition of the roofing and drainage systems. The inspection results showed no significant findings, no ponding or spillover at drains and gutters. Also, there was no accumulation of debris at drains, scuppers or gutters, which would cause blockage. Corrective action reports were generated, resulting in the performance of minor housekeeping to correct as found conditions. These deficiencies were minor in nature and would not have affected the intended function of the roofing system.

   Reactor Building:

   In 2007, condition monitoring inspections of the Reactor Building including the Primary Containment and Torus were performed. The structural inspections results indicated that the areas were satisfactory. There was minor rust on the torus horizontal restraint end plates that connect to the wall. Additionally, there was some minor surface rusting of the Reactor Building floor framing steel. None of these conditions found warranted immediate repair.

   Service Water Intake Structure:

   In 2008, condition monitoring inspections were performed for the Hope Creek Service Water Intake Structure exterior concrete walls at the tidal zone. An interior inspection of the submerged walls for the 'D' train pump well was also performed. Since the traveling water screen preventive maintenance (PM) activity required the pump well to be dewatered, the inspection was able to included inaccessible areas of usually submerged walls. The submerged concrete walls for the 'D' train pump well and exterior concrete walls for the entire Service Water Intake Structure, showed no evidence of degradation. There was some minor erosion from water flow at the wall corners that was noted as acceptable by the station structural engineer. Similar submerged wall inspections of the 'A', 'B' and 'C' train pump wells are planned to be performed when the respective pump wells are dewatered for the other traveling water screen PM activities.

Masonry Walls:

In 2006, condition monitoring inspections were performed for Hope Creek masonry walls. The checklist from the Structures Monitoring Program was used for the Main and Power Transformer fire barrier masonry walls. Inspection results showed no significant degradation, such as efflorescence, spalling, or cracking.

Shoreline Protection and Dike:

In 2008, condition monitoring inspections were performed for the Hope Creek Shoreline Protection and Dike structures. The inspection results showed the Shoreline Protection and Dike structures to be in conformance with design drawings with no notable defects. There were no noticeable changes, based on pictures from last year's inspection report.

The above examples provide objective evidence that the periodic structural inspections are thorough and effectively monitor for age related degradations of structural component types in the scope of the Structures Monitoring Program. The program is effective in monitoring and detecting the various aging effects and mechanisms for the structures, components, and environments such that there is no loss of structure or component intended function.

2. In 2003, a corrective action report was issued to document, evaluate and repair degraded emergency diesel generator exhaust hoods. The exhaust hoods provide shelter and protection for the diesel exhaust stacks and are located on the roof of the Auxiliary Building. Material condition report identified overall corrosion of carbon steel components, cracked grout and corroded/displaced exhaust seal assembly. The condition was evaluated by a qualified structural engineer. The engineer concluded that the condition does not adversely impact the exhaust hood from performing its design function. A work order was generated to repair the grout and corroded elements, restoring them to its design condition. The work order report indicated the grout and the exhaust hood corroded components were repaired in accordance with station procedures. This example provides objective evidence that the station’s corrective action program and Structures Monitoring Program are documenting, evaluating, and correcting structural conditions adverse to quality.

3. In 2006, a corrective action report was issued to document, evaluate and repair cracking of the Fire Water Storage Tanks’ foundations. The noted condition was evaluated by a qualified structural engineer. The structural engineer concluded that the condition did not adversely impact the foundation’s structural integrity and concluded the cause was due to shrinkage of concrete. A work order was generated to seal the cracks to

prevent water intrusion and freeze-thaw action. The work order report indicated the concrete cracks were sealed in accordance with station procedures. This is another example that provides objective evidence that the station's corrective action program and Structures Monitoring Program are documenting, evaluating, and correcting structural conditions adverse to quality.

As demonstrated in the operating experience examples above, the Structures Monitoring Program is effectively managing the aging effects of structures. Based on these examples, station procedures are utilized to identify and document conditions adverse to quality in accordance with the corrective action program. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Structures Monitoring Program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Structures Monitoring Program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The enhanced Structures Monitoring Program will provide reasonable assurance that aging effects will be adequately managed so that the intended functions of structures within the scope of license renewal will be maintained consistent with the current licensing basis, during the period of extended operation.

B.2.1.33 RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants

Program Description

The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants aging management program is an existing program that will be enhanced to require inspection of water-control structures that are in scope for license renewal consistent with the requirements of NRC RG 1.127. These structures include the Service Water Intake Structure and Shoreline Protection and Dike structures. Structural components and commodities of the structures that are monitored under the program include reinforced concrete members, structural steel and earthen water-control structures (embankments, dikes). The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants aging management program addresses age-related deterioration, degradation due to extreme environmental conditions, and the effects of natural phenomena that may affect the safety function of the water control structures. The program will be used to manage loss of material, cracking, and change in material properties for concrete components; loss of material and loss of preload for steel and metal components; and loss of material and loss of form for earthen water control structures in the following environments: air-indoor, air-outdoor, groundwater/soil and water-flowing. Elements of the program are designed to detect degradations and take corrective actions to prevent a loss of an intended function.

The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants is implemented through the Structures Monitoring Program (10 CFR 50.65), and is based on the guidance provided in NRC RG 1.127 and ACI 349.3R. Inspections of water-control structures are conducted by or under the direction of experienced engineers, who are qualified per the requirements of the Structures Monitoring Program, and are conducted systematically using checklists and other documents as required to minimize the possibility of overlooking significant features. Technical evaluations are performed if observed degradations have the potential for impacting the intended function of the water-control structures.

Accessible structures are monitored on a frequency of 5 years consistent with the frequency for implementing the requirements of the 10 CFR Part 50.65, Maintenance Rule. The program will be enhanced to include an inspection frequency of 5 years for structures/components submerged in water.

The program will be enhanced, as noted below, to provide reasonable assurance that water-control structures aging effects will be adequately managed during the period of extended operation.

Safety and performance instrumentation such as seismic instrumentation, horizontal and vertical movement instrumentation, uplift instrumentation, and other instrumentation described in RG 1.127 are not incorporated in the design of Hope Creek water control structures. Thus inspection activities related to safety and performance instrumentation are not applicable, and are not specified in the implementing documents.

The existing program contains no requirements for monitoring the adequacy and quality of maintenance and operating procedures. According to RG 1.127, this requirement applies to the maintenance and operating procedures that pertain to the safety of dams and is not applicable to the station program.

Hope Creek complies with RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants as applicable to the Service Water Intake Structure. Conformance to NRC's RG 1.127 was part of Hope Creek's original design basis. Elements of the program have been incorporated in the Structures Monitoring Program aging management program.

NUREG-1801 Consistency

The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program is consistent with the ten elements of aging management program XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

1. Shoreline Protection and Dike structures will be added to the program. **Program Element Affected: Scope of Program (Element 1)**

2. Parameters monitored for wooden components will be enhanced to include change in material properties and loss of material due to insect damage and moisture damage. **Program Element Affected: Parameters Monitored or Inspected (Element 3)**

3. The inspection requirement for submerged concrete structural components will be enhanced to require that inspections be performed by dewatering a pump bay or by a diver if the pump bay is not dewatered. **Program Element Affected: Detection of Aging Effects (Element 4)**

4. Specify an inspection frequency of not greater than 5 years for structures including submerged portions of the Service Water Intake Structure. **Program Element Affected: Detection of Aging Effects (Element 4)**

5. Require supplemental inspections of the in scope structures within 30 days following extreme environmental or natural phenomena (large floods, significant earthquakes, hurricanes, and tornadoes). **Program Element Affected: Detection of Aging Effects (Element 4)**

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. In 2004, industry OE18658 was evaluated for potential generic implication at Hope Creek. The OE subject was that the plant's intake structure was experiencing significant concrete spalling of the floors and walls inside the structure. The cause of the spalling was chloride induced reinforcement corrosion. The interior portion of the plant's intake structure was exposed to significant saltwater leakage from various plant components. The Hope Creek service water intake structure can be exposed to a similar environment therefore there is a potential for this condition to occur. The disposition of this generic evaluation was that all site safety-related structures are subject to condition monitoring in accordance with the structures monitoring program. Additionally, this type of industry OE would be considered in the evaluation of other water control structures in scope for license renewal. This example provides objective evidence that industry OE is reviewed for applicability to the station and consideration is given for process enhancements if it was deemed necessary to capture these industry events.

2. In 2008, inspections were performed on submerged concrete walls and other structural components of the "D" Service Water Intake Structure pump bay to support the station equipment Preventative Maintenance (PM) requirements and for the condition monitoring of structures for Hope Creek. For the interior submerged concrete walls and the exterior submerged walls, there was no evidence of any deficiency or degradation. There was some minimal erosion at the wall corners that was noted as acceptable by the station structural engineer. There was corrosion noted on the support plates that provide the structural attachments for the submerged portion of the service water pump and screen to the structure. The upper support plates had significant corrosion that warranted an engineering evaluation of the condition. The evaluation noted that the design basis was maintained and adequate for all design basis events. The lower support plates were deemed acceptable since they exhibited less corrosion. Additionally, the ladder that goes down to the bay floor was noted as exhibiting signs of corrosion and degradation. One of the lateral support anchors was severely corroded around the nut of the anchor bolt. The corrosion of these components was a result of the submerged raw water environment that these components were subject to during plant operation. The engineering

evaluation judged the ladder to be acceptable and a notification was initiated to perform corrective maintenance on the ladder and anchorage during the next inspection period for this bay. As a result of the corrective action plan for the degradations noted from this inspection and to provide for a focused inspection of the normally submerged interior structural components of the service water pump bays, future inspections will be performed under a separate Preventative Maintenance (PM) condition monitoring inspection task to coincide with the traveling water screen/equipment station Preventative Maintenance task. This example provides objective evidence that this program will be capable of both monitoring and detecting aging affects associated with water control structures. In addition enhancement in the Preventative Maintenance Orders were coordinated such that structural inspections are preformed when equipment is removed and inaccessible areas are exposed.

3. In 2003 it was observed that there were cracks and spalling of the concrete of the strainer room roof curb in the northeast corner of the service water intake structure roof at elevation 135'. Upon further investigation by site engineering, additional cracking was noted in the concrete roof slab, concrete curbs and concrete hatch plugs on the various roof elevations. The condition of the roof's structural design basis was evaluated by site engineering. The cracks in the curb and slab are minor and not significant from an aspect of structural integrity of the building. The cracks in the northeast and southwest corners of the roof are also considered minor and did not pose any structural concerns. In addition there is reinforcing steel at the corners that prevents the cracked sections from falling. The spalling and cracks on the hatch plug corners do not impair the structural integrity on the components. The likely cause of the cracks in the slab is a result of expansion and contraction, due to changes in temperature, followed by the effects of freeze-thaw in winter. The crack in the curbs are most likely due to the shear effects experienced from the slab expansions, followed by the effects of weather. Cracks and spalls at the hatch plug corners are due to impacts during hatch plug lifts. The degraded conditions were repaired in accordance with engineering guidance and concrete repair specifications. This example provides objective evidence that the station's corrective action program is documenting, evaluating, and correcting structural conditions adverse to quality.

An overview of inspection results shows that water-control structures are in good condition, except for a few minor issues that are documented and repaired as noted in example 3 above. As discussed in the operating experience examples above, the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program has not shown any adverse trend in performance. Based on these examples, station procedures are utilized to identify conditions adverse to quality and documented in accordance with the corrective action program. Problems that are identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The enhanced RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants program will provide reasonable assurance that the loss of material, cracking, loss of preload, change in material properties, hardening, loss of strength, and loss of form aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.34 Protective Coating Monitoring and Maintenance Program

Program Description

The Protective Coating Monitoring and Maintenance program is an existing program that manages cracking, blistering, flaking, peeling, and delamination of Service Level I coatings subjected to indoor air in the containment structure. Although Hope Creek is committed to Regulatory Guide 1.54, Rev. 0, the Protective Coating Monitoring and Maintenance Program defines Service Level I coating as “a coating system used in areas in reactor containment where the coating failure could adversely affect the operation of post-accident fluid systems and thereby impair safe shutdown”, which is consistent with the definition of Service Level 1 coatings in Regulatory Guide 1.54, Rev. 1. Since the 1998 response to GL 98-04, the Protective Coating Monitoring and Maintenance Program has been updated to be consistent with ASTM D 5163-05(a) guidelines.

The Hope Creek Protective Coating Monitoring and Maintenance Program is consistent with the guidance in ASTM D 5163-05(a) in that the program monitors the conditions of the Service Level I coatings during refueling outages and uses the corrective action program to resolve non-conforming coatings and those experiencing degradation. The scope of the existing Protective Coating Monitoring and Maintenance program includes monitoring and trending activities, which is an expansion beyond the program described in the Hope Creek response to GL 98-04, which is based on Regulatory Guide 1.54, Rev. 0 and its referenced ANSI standards (since withdrawn).

The Protective Coating Monitoring and Maintenance Program requires individuals responsible for inspecting, coordinating, and evaluating the conditions of the coatings to have a minimum of 2 years of experience in assessing the conditions of Service Level I coatings. The program identifies instruments and equipment to be used for inspections.

The Protective Coating Monitoring and Maintenance Program requires that all accessible areas of containment are included in the inspection plan. During every refueling outage, a walkdown is performed by qualified individuals knowledgeable in nuclear coatings to conduct visual examinations and perform physical testing as necessary on the coatings to monitor their condition over time.

The Protective Coating Monitoring and Maintenance Program requires that an initial walk-though is conducted, followed by more thorough inspections on previously designated areas, and areas noted during the initial walk-through as being deficient and requiring repair.

Guidance is provided in the program for the characterization of defects including blistering, cracking, flaking, peeling, delamination, and rusting. When appropriate, additional testing (e.g., adhesion and dry film thickness) may be specified in order to characterize the severity of observed deficiencies. In accordance with the program, the coatings evaluator dispositions all coating deficiencies in the written inspection report, describing the size and number of visible defects, their locations, and a disposition as whether to repair the defects in the current outage, or to continue to monitor the defects.

The Protective Coating Monitoring and Maintenance program is a condition monitoring program. The monitoring methods are effective in detecting the applicable aging effects and the frequency of monitoring is adequate to prevent significant degradation. The program is consistent with the coating monitoring requirements of Regulatory Guide 1.54, Rev. 1, and GL 98-04, and follows the guidelines contained in ASTM D 5163-05(a).

NUREG-1801 Consistency

The Protective Coating Monitoring and Maintenance Program is consistent with the ten elements of aging management program XI.S8, "Protective Coating Monitoring and Maintenance Program," specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Hope Creek responded to GL 98-04 providing information on their protective coatings program, and an assessment of their emergency core cooling systems (ECCS) operations. Hope Creek implemented a coatings condition monitoring program consistent with ASTM D 5163, which is consistent with that described in Regulatory Position C4 in Regulatory Guide 1.54, Rev. 1. The coatings condition monitoring program is an effective program for managing degradation of Service Level I coatings, and consequently performs a preventive means to mitigate loss of material due to corrosion of carbon steel structural elements inside containment.

Demonstration that the effects of aging are effectively managed is achieved through objective evidence. The following examples of operating experience provide objective evidence that the Protective Coating Monitoring and Maintenance Program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. In 2001, an inspection of the Hope Creek service level I coatings was performed during the refueling outage. The inspection methodology was based on the guidelines of ASTM D 5163. The inspections covered five areas: (1) primary containment outside of the torus, (2) drywell at elevations 100-ft and 109 through 127-ft, (3) drywell head and flange, (4) interior of the torus, and (5) drywell at elevation 87-ft. The inspection consisted of visual examinations, including references to industry pictorial standards, on the various metal and concrete surfaces in the selected areas. The summary of inspections in the coatings report indicated that the coatings applied to metal and concrete surfaces were in good condition. Recommendations were made for future maintenance work in the drywell and torus and documented in the Hope Creek corrective action program. This example provides objective evidence that the Protective Coating Monitoring and Maintenance Program is effective in monitoring, trending, and assessing the condition of the service level I coatings and documenting coating conditions.

2. In 2004, a diver inspection was performed in the torus during the refueling outage. The purpose of the inspection was to assess the conditions of the underwater torus coatings and underlying metallic surfaces of the torus. The inspectors found thirty-nine (39) areas with coating deficiencies, all of which were due to mechanical damage as opposed to other forms of disbondment such as cracking, peeling, and delamination. The loss of material due to corrosion of the underlying steel (maximum loss was measured at 28 mils) at the areas of the 39 identified coating deficiencies was within the acceptance criteria of 94 mils. Although the mechanism of the coating deficiencies were not related to the coatings' ability to adhere to the substrate and that the observed loss of material on the torus metal surfaces were within the acceptance criteria, coating repairs were performed during the 2004 outage. This example provides objective evidence that the Protective Coating Monitoring and Maintenance Program is effective in assessing and correcting the conditions of the service level I coatings underwater in the torus.

3. During the 2009 refueling outage, the Hope Creek service level I coatings in the drywell were inspected following the guidelines of ASTM D 5163. Due to limited access, the coatings assessment was limited to coatings applied to steel and concrete surfaces at Elevations 102-ft and 87-ft. The first area assessed was the concrete floor to drywell shell interface at Elevation 87-ft to determine the condition of the coatings. The coatings did not exhibit any signs of peeling or delamination. There was no visible corrosion on the drywell shell. The remaining coating inspections consisted of visual examinations on the various metal and concrete coated surfaces. The summary of inspections in the coatings report indicated that the coatings applied to metal and concrete surfaces were in good condition. There were many instances of small areas of mechanically-damaged coatings bounded by sound coatings. These conditions were documented in the corrective action program and were satisfactorily addressed in the 2009 outage. This example provides objective evidence that the Protective Coating Monitoring and Maintenance Program is effective in assessing and correcting the conditions of the service level I coatings.

There is sufficient confidence that the implementation of the Protective Coating Monitoring and Maintenance Program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Protective Coating Monitoring and Maintenance Program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing Protective Coating Monitoring and Maintenance Program provides reasonable assurance that the cracking, blistering, flaking, peeling, and delamination aging effects are adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.35 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Program Description

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements aging management program is a new condition monitoring program that will be used to manage accessible non-EQ cables and connections within the scope of license renewal that are subject to adverse localized environments caused by heat, radiation, or moisture.

Cables and connections subject to an adverse localized environment are managed by visual inspection of the insulation or jacket. A representative sample of accessible electrical cables and connections installed in adverse localized environments or ambient conditions in excess of 60-year service limiting environments will be visually inspected for signs of accelerated age-related degradation such as embrittlement, discoloration, cracking, swelling, or surface contamination. The representative sample of accessible cables and connections will be inspected prior to the period of extended operation, with an inspection frequency of at least once every 10 years. If an unacceptable condition or situation is identified for a cable or connection, a determination will be made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connections. Additional inspections, repair or replacement are initiated as appropriate under the Corrective Action Process. Trending actions are not included as part of this program.

This program considers the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205, SAND96-0344, and EPRI TR 109619. Connections included in the scope of this program are splices, terminal blocks, connectors, containment electrical penetration assembly connections, and the insulation portion of fuse blocks. Non-EQ cables used in low-level signal applications that are sensitive to reduction in insulation resistance such as radiation monitoring and neutron monitoring are included in the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Aging Management Program; therefore, they are not included in the scope of this program.

NUREG-1801 Consistency

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is consistent with the ten elements of aging management program XI.E1, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements, specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

As noted in NUREG-1801, industry operating experience has shown that adverse environments caused by heat or radiation for electrical cables and connections may exist next to or above steam generators, pressurizers or hot process pipes, such as feedwater lines. These adverse environments have been found to cause degradation of the insulating materials on electrical cables and connections that is visually observable, such as color changes or surface cracking. These visual indications can be used as indications of degradation.

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that cable and connection age related degradation due to adverse environmental conditions are being adequately managed. Operating experience has demonstrated that Hope Creek personnel have successfully identified degraded cable insulation through visual observations made during unrelated maintenance activities. The following examples of operating experience provide objective evidence that the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program will be effective in assuring that intended function(s) would be maintained consistent with the current licensing basis for the period of extended operation:

1. In June 1997, OE 8425, Heat Damage to Cables in Cable Trays was written and distributed from the Farley Nuclear Plant. An evaluation and assessment of the Hope Creek cable tray configuration against the experience at Farley Station was performed. Actions were taken by the station staff to visually inspect the field for similar conditions at Hope Creek. The field inspections validated that similar adverse condition did not exist at Hope Creek as described in the Farley Nuclear Plant OE report. This example illustrates that the Hope Creek electrical cables and connections aging management program will be effective in utilizing industry OE in visually assessing cables and connections in local adverse environments.

2. On April 17, 2006, a motor lead damaged by heat exposure was visually discovered at Hope Creek. An engineering evaluation of the cable condition was performed. The damaged portion of the cable was removed and new cable was spliced into place to eliminate the heat-damaged cable completely. This example illustrates that the electrical cables and connections aging management program will be effective in detecting the aging effects of cable, and the effectiveness of implementing the corrective action program in response to finding unacceptable visual indications.

3. On March 2, 2004 a power cord in the Radiation Monitoring System was visually discovered to have degraded outer insulation (jacket) by an engineer during a periodic system walkdown. No other cable degradation was observed in the system. The system was evaluated to be operable. The power cable was replaced prior to any loss of function in accordance with the corrective action program. This example illustrates that the Hope Creek

electrical cables and connections aging management program will be effective in detecting the aging effects of cable, and the effectiveness of implementing the corrective action program in response to finding unacceptable visual indications.

These examples demonstrate that Hope Creek maintenance technicians and engineering staff are responsive to industry OE and demonstrate a history of visually assessing cable and connections installed in the field for similar situations as described in industry operating experience notices. Moreover, these operating experience examples demonstrate that the Hope Creek maintenance technicians are knowledgeable and demonstrate a history of reporting degraded cable conditions when discovered during unrelated routine maintenance activities.

Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to resolve the conditions. There is sufficient confidence that the implementation of the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program will be performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

This new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program will provide reasonable assurance that the identified aging effects will be adequately managed so that the intended functions of these components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.36 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits

Program Description

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits aging management program is a new condition monitoring program that will be implemented to manage the in-scope portions of the Leak Detection and Radiation Monitoring System, and the Neutron Monitoring System not included in the Hope Creek EQ Program. This program applies to sensitive instrumentation cable and connection circuits with low-level signals that are in scope for license renewal and are located in areas where the cables and connections could be exposed to adverse localized environments caused by heat, radiation, or moisture. These adverse localized environments can result in reduced insulation resistance causing increases in leakage currents.

The high voltage low-level signal instrumentation circuits from the Leak Detection and Radiation Monitoring System, Neutron Monitoring System and other Hope Creek License Renewal systems, which are not part of the scope of this aging management program, have been excluded because they either do not perform an intended function, are included in the Hope Creek EQ program, or are not subject to adverse localized environments.

Calibration results and findings of surveillance programs will be assessed for cable aging degradation prior to the period of extended operation and at least once every 10 years afterwards for the in-scope portions of the Leak Detection and Radiation Monitoring System. Cable testing results will be assessed for cable aging degradation prior to the period of extended operation and at least once every 10 years afterwards for the in-scope portions of the Neutron Monitoring System.

This new aging management program will be implemented prior to the period of extended operation.

This program considers the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205, SAND96-0344, and EPRI TR-109619.

NUREG-1801 Consistency

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits aging management program is consistent with the ten elements of aging management program XI.E2, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Industry operating experience has identified occurrences of cable and connection insulation degradation in high voltage, low level instrumentation circuits performing radiation monitoring and neutron monitoring functions. The majority of occurrences are related to cable and connection insulation degradation inside of containment near the reactor vessel or to a change in an instrument readout associated with a proximate change in temperature inside the containment.

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the Electrical Cables and Connections Not Subject to 10 CR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. General Electric Service Information Letter (GE SIL) 564 Rev 1, Verification of SRM, IRM and LPRM Detector Response, was issued December 2003. The SIL provides a methodology for verifying that SRM, IRM and LPRM detectors and signal path cabling are operating properly prior to reactor startup. It recommended that BWR owners perform the tests presented in the SIL before startup from any outage wherein under-vessel work activities could affect nuclear instrumentation detector or signal path integrity. The impact of this information on the equipment at Hope Creek was assessed. An engineering evaluation identified changes to the maintenance procedures and maintenance items that further improved the long-term performance of the Neutron Monitoring System. This example provide objective evidence that this program will use industry operating experience to make improvements in monitoring and detecting cable and connector problems in instrumentation circuits.
2. In November 2004, a common cause analysis was initiated in response to an adverse trend with problems with instrumentation cables located under the reactor vessel. A cross discipline team was formed to investigate the failures to identify the causes of the problems with instrumentation located under the reactor vessel. For example, the SRM and IRM J-Loop cable were found to be failing at a higher rate than prior experience. It was found that the J-loop connectors under vessel each had insulating sleeves installed over the connector for electrical insulation. Water (from refueling maintenance activities) tended to collect in the top of the sleeve promoting the formation of a puddle and eventual leaching of water into the connector.

It was determined that the best solution is to remove the sleeves to improve the cable water resistance. The problem with water collecting at the SRM and IRM J-Loop cable connector was resolved. This example provides objective evidence that the program will detect problems with instrumentation cable and connections and take corrective actions prior to the loss of intended function because this program will review calibration and test data for adverse trends that could indicate possible insulation degradation. This example also demonstrates the corrective action process is effective in evaluating and resolving problems with instrumentation cable and connections.

3. In April 2002, a degraded sensor cable was discovered on the Turbine Building Circulating Water Sump Radiation Monitor. The degraded cable was discovered during a system restoration after installing an unrelated design change. Specifically, about 30 seconds after the Turbine Building Circulating Water Sump Radiation Monitor was placed into service, the radiation monitor spiked, tripping the Turbine Building Circulating Water Sump off per design. Subsequent troubleshooting revealed that the sensor connector cable had degraded and the connector was loose from repeated cleaning and handling. The radiation monitor spiking was due to vibration-induced noise caused by water flowing through the system piping. The cable was replaced and detector checked. This example provides objective evidence that the program will detect problems with instrumentation cable and connections prior to the loss of intended function. This example also demonstrates the corrective action process is effective in evaluating and resolving problems with instrumentation cable and connections.

Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The new Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrument Circuits program will provide reasonable assurance that the identified aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.37 Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Program Description

The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is a new program that manages inaccessible medium voltage cables that are exposed to significant moisture simultaneously with significant voltage.

Significant moisture is defined as periodic exposure to moisture that last more than a few days (e.g., cable in standing water). Periodic exposure to moisture that last less than a few days (i.e., normal rain and drain) is not significant. Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time.

Development of this program will consider the technical information and guidance provided in NUREG/CR-5643, IEEE Standard P1205, SAND 96-0344, and EPRI TR-109619. In scope, non-EQ, inaccessible medium voltage cables subject to significant moisture and voltage will be tested as part of this aging management program. These medium voltage cables will be tested using a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state-of-the-art at the time the test is performed. Cable testing will be performed at least once every ten years. The first tests will be completed prior to the period of the extended operation.

Manholes and cable vaults associated with the cables included in this aging management program will be inspected for water collection. In scope, non-EQ, inaccessible cables subject to significant moisture and voltage will be evaluated, so that draining or other corrective actions can be taken. The frequency of manhole and cable vault inspections for accumulated water and subsequent pumping will be based on existing practices and adjusted based on inspection results. This adjustment in inspection frequency recognizes that the objective of the inspections, as a preventive action, is to keep the cables infrequently submerged, thereby minimizing their exposure to significant moisture. This adjustment in inspection frequency also recognizes that a recurring inspection, set at the optimum frequency, would result in the cables being submerged only as a result of event driven, rain and drain, type occurrences. The maximum time between inspections will be no more than two years. The first inspections will be completed prior to the period of extended operation.

NUREG-1801 Consistency

The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements aging management program is a new aging management program that is consistent with NUREG-1801 aging management program XI.E3, “Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.”

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

The Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is a new preventive and condition monitoring program that manages inaccessible medium voltage cable exposed to significant moisture simultaneously with significant voltage. Demonstration that the effects of aging are effectively managed is achieved through objective evidence which shows that the localized damage and breakdown of insulation leading to electrical failure due to moisture intrusion and water trees are being adequately managed. The following examples of operating experience at Hope Creek provide objective evidence that the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program will be effective in assuring that intended functions will be maintained consistent with the current licensing basis for the period of extended operation:

1. In response to NRC Generic Letter 2007-01, Inaccessible or Underground Power Cable Failures that Disable Accident Mitigation Systems or Cause Plant Transients, Hope Creek was reported to have no history of failures of inaccessible or underground medium voltage cables. A cable condition-monitoring program has not yet been implemented for medium voltage cable. However, a representative sample of medium voltage cables have been routinely monitored since initial plant operations as part of existing maintenance procedures for periodically megger testing rotating electrical equipment. These tests include the power cables from the electrical switchgear to the equipment motor windings. Polarization Index (PI) testing for rotating equipment is performed with the power feeder cable connected. This example provides objective evidence that in-scope 4 kV cable insulation is in satisfactory condition, and detection methods exist such that if any aging effects of interest for this new program do occur, they would be detected prior to loss of intended function.

2. In August 2007 the cable vaults for class 1E motor feeds and controls for service water were observed to be potentially flooded in the vicinity of the Manhole 102 yard area. The vaults were observed at the time to be under standing water from recent heavy rain. Each vault contains four power cables, one medium voltage 5 kV cable (Okonite with EPR insulation and Hypalon jacket) and three other 480-volt cables. The power cable in question is designed for direct burial. A corrective action process notification was initiated to address the impact on the cable vaults. The Hope Creek yard area in the vicinity of the cable vaults was re-graded to minimize rainwater (and brackish service water yard dumps) from pooling on top of the vaults, creating a swale from the vault area to the storm drain south of the vault. Corrective actions included a technical evaluation. Two cable vaults have been inspected. The cables were found submerged in water. The water was pumped out of the cable vault. The cable vault structure was found to be in good material condition. The remaining cable vaults are scheduled for inspection. This example provides objective evidence that corrective actions are taken to in response to industry operating experience and to minimize the water intrusion into the cable vaults.

3. A self-assessment was conducted in February 2008 evaluating critical medium voltage underground cable in response to industry generic operating experience. The assessment addressed testing practices, spare cable contingencies and potential vulnerabilities. The report concluded that existing underground medium voltage cable insulation (EPR) is considered to be the best material for this application. Best industry practices were evaluated for cable monitoring and testing, and follow-up actions were created to develop the test program and institute preventive maintenance activities for this shielded cable. This example provides objective evidence that industry operating experience will be used to improve the program such that if any aging effects of interest do occur, they would be detected prior to loss of intended function.

Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The new Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements aging management program will provide reasonable assurance that the inaccessible medium voltage cables exposed to significant moisture and significant voltage will be adequately managed so that the intended functions of these cables will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.38 Metal Enclosed Bus

Program Description

The Metal Enclosed Bus aging management program is a new condition monitoring program that will manage the aging of in-scope metal enclosed busses at Hope Creek.

The internal portions of the in-scope metal enclosed bus enclosures will be visually inspected for cracks, corrosion, foreign debris, excessive dust build-up and evidence of moisture intrusion. The bus insulation will be visually inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. The internal bus supports will be visually inspected for structural integrity and signs of cracks. Bolted connections are not accessible, but will be checked (sampled) for loose connection using thermography from outside the metal enclosed bus.

Metal enclosed busses are to be free from unacceptable visual indications of surface anomalies, which suggest that conductor insulation degradation exists. In addition no unacceptable indication of corrosion, cracks, foreign debris, excessive dust buildup or evidence of moisture intrusion is to exist. An unacceptable indication is defined as a noted condition or situation that, if left unmanaged, could lead to a loss of intended function. Bolted connections will be confirmed to be within the acceptance criteria of administrative program procedures.

This new aging management program will be implemented prior to the period of extended operation. In addition, the first inspections will be completed prior to the period of extended operation and every 10-years thereafter.

NUREG-1801 Consistency

The Metal Enclosed Bus aging management program is consistent with the ten elements of aging management program XI.E4, “Metal Enclosed Bus,” specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Industry experience has shown that failures have occurred on metal enclosed busses caused by cracked insulation and moisture or debris buildup internal to the metal enclosed bus. Experience has also shown that bus connections in the metal enclosed busses exposed to appreciable ohmic heating during operation may experience loosening due to repeated cycling of connected loads.

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that the aging effects of loosening of bolted connections and reduced insulation resistance (of standoff insulators) and the associated aging mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the new Metal Enclosed Bus program will be effective in assuring that intended function will be maintained consistent with the current licensing basis for the period of extended operation:

1. An electrical transient occurred in the Hope Creek switchyard in January 2006 in an outdoor section of non-segregated metal enclosed bus (MEB) associated with the 13.8 kV Island Substation, which is not in scope for license renewal. The electrical fault was caused by a breakdown of insulation properties between bus bars caused by tracking across a dislodged insulating boot (over an interconnecting joint). The cause of the dislodged insulating boot was improper installation of the bus bar protective boots. The last corrective maintenance action was worked ten years earlier. A lack of effective preventive maintenance (PM) also contributed to this electrical transient. This particular MEB section had no routine preventive maintenance tasks scheduled to periodically inspect this MEB section. Corrective actions included installing new boots with an approved design, established appropriate PM tasks for this MEB section, and completed extent of condition inspections of adjoining transformers MEB sections for similar conditions (which were found to be satisfactory). The affected MEB sections were cleaned, the transformers were tested satisfactorily, and the MEB section was return to service. This example provides objective evidence that corrective actions are taken for conditions adverse to quality, and that the new Metal Enclosed Bus program will be capable of both monitoring and detecting the aging effects associated with MEB insulation.

2. Visual inspections were performed in March 2005 of 4kV outdoor metal bus and connections to the Station Service Transformers. The inspections found deterioration of an alignment cover (flexible boot) on the outdoor portions of metal enclosed bus, with layers peeling off of the boot from the inside. The observed condition was that the boot “is starting to deteriorate” and was therefore recommended for replacement at the next opportunity. This boot is located at the transition from hard metal bus duct to the Station Power Transformers. The 'boot' is a protective covering over the links, comprised of a neoprene rubber material (exposed to sunlight) called an Alignment Joint Assembly. It also functions to accommodate thermal expansion and vibration. The preventive maintenance activity checks the flexible rubber joint for rips or holes, and is performed on a 3-year frequency in parallel with transformer maintenance. There are 8 total Alignment Joint Assemblies (two of which are in scope for license renewal) and all were subsequently replaced or repaired, with no plant impact or operational problems experienced. These Alignment Joint Assemblies were original plant equipment, and

had been in service for over 20 years at the time of their replacement. A recurring task PM activity exists to systematically replace the exterior (outdoor) Alignment Joint Assemblies in scope for license renewal on the 1AX501 and 1BX501 transformers. No significant age-related degradation was detected during these metal bus inspections. The bus enclosures were found to be clean, with no evidence of overheating of bus connections. These activities demonstrate that the bus is generally accessible for visual inspection and in good condition, such that if any aging effects of interest for this program do occur, they would be detected during future inspections. This example provides objective evidence that corrective actions are taken prior to loss of intended function, and that the new Metal Enclosed Bus program will be capable of both monitoring and detection of the aging effects associated with bus insulation.

3. A 3-year preventive maintenance (PM) activity was performed in November 2004 to inspect/clean 4.16 kV non-segregated bus 10A109 near the 1BX501 Station Service Transformer located outdoor. Bus bar tape and Raychem coverings were found to be deteriorated, specifically sunken in towards the bus bar with some bubbling observed. The fill putty and insulation tape were removed and repaired. No insulator cracks or loose bolts were identified. The work scope included removal of access covers and inspection for the accumulation of dust and debris, moisture and corrosion, as well as confirmatory megger testing. The PM activity demonstrated that the bus is accessible for visual inspection, such that if any aging effects of interest for this program do occur, they would be detected during future inspections. This example provides objective evidence that corrective actions are taken prior to loss of intended function, and that the new Metal Enclosed Bus program will be capable of both monitoring and detection of the aging effects associated with bus insulation and bolted connections.

Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. Since only a small portion of metal bus in scope for license renewal at Hope Creek is located outdoors, the corresponding operating experience has been good, and experience has shown that aging degradation is a slow process, a 10-year inspection frequency is an adequate period to preclude failures. There is sufficient confidence that the implementation of the new Metal Enclosed Bus program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Metal Enclosed Bus program will be performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The new Metal Enclosed Bus program will provide reasonable assurance that the loosening of bolted connections and reduced insulation resistance aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.1.39 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Program Description

The Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is a new one-time inspection program that will be used to confirm the absence of an aging effect with respect to electrical cable connection stressors. The aging effect and mechanism of concern is the loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation.

A representative sample of cable connections within the scope of License Renewal will be selected for one-time testing prior to the period of extended operation to confirm that there is no age related degradation of the electrical connection metallic parts, and if occurring, to determine the extent of any such degradation. The scope of this sampling program will consider application (medium and low voltage), circuit loading (high loading), and location (high temperature, high humidity, vibration, etc). The technical basis for the sample selection will be documented.

The specific type of test performed will be a proven test for detecting loose connections, such as thermography or contact resistance measurement, as appropriate to the application.

NUREG-1801 Consistency

The Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements aging management program is consistent with the ten elements of aging management program XI.E6, " Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," specified in NUREG-1801 with the following exceptions:

Exceptions to NUREG-1801

NUREG-1801 describes an aging management program for electrical cable connections in Chapter XI: XI.E6 “Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.” An NRC and industry effort is in progress, working towards the issuance of a revision to XI.E6, via the Interim Staff Guidance (ISG) process. The latest draft revision of this ISG was presented for public comment in the September 6, 2007, Vol. 72, No. 172 issue of the Federal Register as: Proposed License Renewal Interim Staff Guidance LR-ISG-2007-02: Changes to Generic Aging Lessons Learned (GALL) Report Aging Management Program (AMP) XI.E6, “Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements” Solicitation of Public Comment. The exception for this aging management program is that the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements aging management program is consistent with NUREG-1801 as it is modified by the September 6, 2007 proposed revision of LR-ISG-2007-02. **Program Elements Affected: Scope of Program (Element 1), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), Monitoring and Trending (Element 5), and Corrective Actions (Element 7).**

Enhancements

None.

Operating Experience

Operating experience has demonstrated that Hope Creek has successfully identified loose connections through the effective use of thermography. Hope Creek experience is in alignment with the industry in that electrical connections have not experienced a high degree of failures and that existing Hope Creek installation and maintenance practices are effective.

The following examples of operating experience provide objective evidence that the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements aging management program will be effective in confirming the absence of an aging effect with respect to electrical cable connection stressors prior to the period of extended operation:

1. In June 2007 a routine thermography survey found a hot connection during an eight-hour service test on battery charger 1D-D-413. Specifically, the DC positive output lug connection was found to be 62 degrees F hotter than its associated DC negative output lug connection. A temperature difference of 135 degrees F or more requires immediate action. Normally, both lug connections should be about the same temperature. The charger was operating at 200A for a routine surveillance test. No other abnormal temperatures were reported. Previous routine thermography of this connection during normal operating conditions indicated no elevated temperatures. The connection was repaired and retested satisfactorily. This example provides objective evidence that the appropriate use of thermography will detect loose electrical connections prior to a loss of function. This also demonstrates that the thermography acceptance criterion is effective in utilizing the corrective action process to resolve the problem prior to the loss of intended function.

2. In January 2007 a routine thermography survey found elevated temperatures on a fuse block associated with a switchgear cubicle space heater circuit. Some electrical connections temperatures were found to be 16 to 50 degrees F higher than ambient. A temperature difference of 135 degrees F or more requires immediate action. Normally, all of the connections should be about the same temperature. The fuse holder and its electrical connections were repaired and retested satisfactorily prior to the loss of function. This example provides objective evidence that thermography will detect loose electrical connections prior to a loss of function. This also demonstrates that the thermography acceptance criterion is effective in utilizing the corrective action process to resolve the problem prior to the loss of intended function.

3. In March 2006, a routine thermography survey discovered a hot spot on a terminal strip connector in a breaker cubicle. The connection was found to be 31 degrees F higher than the other associated terminal strip connections. A temperature difference of 135 degrees F or more requires immediate action. Normally, all of the associated terminal strip connections should be about the same temperature. This condition required the connections to be monitored more frequently until the breaker cubicle could be de-energized for repairs. The terminal strip connections were repaired and tested satisfactorily. This example provides objective evidence that thermography will detect loose electrical connections prior to a loss of function. This also demonstrates that actions are taken to increase the monitoring of electrical connections that are discovered to be hotter than expected. Lastly, this example demonstrates that the thermography acceptance criterion is effective in utilizing the corrective action process to resolve the problem prior to the loss of intended function.

Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Electrical Cable Connections Not Subject to 10 CR 50.49 Environmental Qualification Requirements program will effectively confirm the absence of aging degradation of metallic cable connections. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found.

Conclusion

The new Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program will provide reasonable confirmation of the absence of an aging effect with respect to electrical cable connection stressors prior to the period of extended operation so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.2 Plant Specific Aging Management Programs

This section provides summaries of the plant specific programs credited for managing the effects of aging.

B.2.2.1 High Voltage Insulators

Program Description

The High Voltage Insulators aging management program is a new condition monitoring program that manages the degradation of insulator quality at Hope Creek due to the presence of salt deposits or surface contamination.

The scope of the program includes high voltage insulators in the 500 kV switchyard, portions of the 13.8 kV buses, and the 500 kV Salem-Hope Creek crosstie. The High Voltage Insulators program includes visual inspections to detect unacceptable indications of insulator surface contamination. An unacceptable indication is defined as a noted condition or situation that, if left unmanaged, could lead to a loss of intended function. Corrective actions include subsequent cleaning (i.e., washing) of a contaminated insulator. The visual inspections will be performed on a twice per year frequency, will be effective in detecting the applicable aging effects and the frequency of monitoring is adequate to prevent significant degradation.

This new program will be implemented prior to the period of extended operation so that the intended functions of components within the scope of license renewal will be maintained during the period of extended operation.

Aging Management Program Elements

The results of an evaluation of each element against the 10 elements described in Appendix A of the Standard Review Plan of License Renewal Applications for Nuclear Power Plants, NUREG-1800, are provided below.

Scope of Program – Element 1

The High Voltage Insulators program is a new program that manages the aging effect of degradation of insulator quality. The scope of the program includes insulators in the 500 kV switchyard, portions of the 13.8 kV buses, and the 500 kV Salem-Hope Creek crosstie conductors. The high voltage insulators are those credited for supplying power to in-scope components for recovery of offsite power following a station blackout.

Degradation of insulator quality due to presence of any salt deposits and surface contamination could occur in high voltage insulators. NUREG-1801 recommends further evaluation of a plant-specific aging management program for plants located such that the potential exists for salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution). Various airborne materials such as dust, salt and industrial effluents can contaminate insulator surfaces. A large buildup of surface contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover. The buildup of surface contamination is washed away by rain, as evident in the operating history for Hope Creek. The glazed porcelain insulator surface aids this contamination removal. The High Voltage Insulators program relies upon condition monitoring of the insulator surface to visually identify degradation and manage the aging mechanisms of salt deposits and surface contamination on high voltage insulators.

Preventive Actions – Element 2

The High Voltage Insulators aging management program is not a preventive or mitigation program. The High Voltage Insulators aging management program is a condition monitoring program that relies upon visual inspections of insulator surface in order to manage the degradation of insulator quality due to the presence of salt deposits or surface contamination.

Parameters Monitored or Inspected – Element 3

Walkdowns are periodically conducted to visually inspect material conditions in the switchyards. Inspections of high voltage insulators will be performed visually to determine a threshold for implementing corrective actions. These inspections will detect the presence and extent of any aging degradation due to the presence of salt deposits.

Porcelain insulators typically have a shiny surface; if the surface is dull, then contamination is present. Typically heavy contamination will be apparent by the buildup at the base area of a vertical insulator. Similarly, for insulators in the dead-end horizontal configuration, significant drip marks are an indication that the location should be monitored. The most important area that signifies heavy contamination is when contamination is observed on the inside ridges of the underside of the bells. Evidence of salt deposits or surface contamination will be monitored and inspected to ensure high voltage insulator intended function during the period of extended operation.

No actions are taken as part of this program with respect to performance monitoring, or to prevent or mitigate aging degradation. The High Voltage Insulators aging management program is a condition monitoring program that relies on visual inspections of insulator surface in order to manage the degradation of insulator quality due to the presence of salt deposits or surface contamination.

Detection of Aging Effects – Element 4

System walkdowns in the switchyards are conducted periodically, and include a visual inspection of high-voltage insulator surface conditions in accordance with system engineering walkdown procedures. These walkdowns will continue into the period of extended operation, and will detect any aging degradation due to the presence of salt deposits or surface contamination. These inspections will be performed visually to determine a threshold for implementing corrective actions.

The high-voltage insulators within the scope of this program are to be visually inspected at least twice per year. This is an adequate period to detect aging effects before a loss of component intended function since experience has shown that aging degradation is a slow process. A twice per year inspection interval will provide multiple data points during a 20-year period, which can be used to characterize the degradation rate.

The buildup of surface contamination is typically a slow, gradual process that is even slower for rural areas with generally less suspended particles and contaminant concentrations in the air than urban areas. Hope Creek is located in a rural area, not near heavy industry that would provide a source for contaminants. There has only been one event associated with insulator contamination, which was not age-related or time-dependent. Therefore, operating history and plant location support a twice per year inspection frequency, which in turn provides reasonable assurance that the aging effect of degraded insulator quality will be detected prior to failure and loss of intended function.

Monitoring and Trending – Element 5

Monitoring activities will be prescribed by procedures that contain consistent qualitative criteria for insulator surface contamination levels (e.g. slight, moderate and heavy), and results will be documented providing a predictable extent of degradation. Visual techniques and a twice per year frequency are appropriate for monitoring high voltage insulators and have been employed with success by transmission and distribution organizations. Qualitative criteria for insulator surface contamination levels (e.g. slight, moderate and heavy), will allow a predictable extent and rate of surface contamination degradation. The results will be trended, from inspection to inspection, providing a basis for timely corrective actions such as insulator cleaning/washing, prior to a loss of insulator intended function.

Acceptance Criteria – Element 6

Visual inspection of high voltage insulators will be prescribed by procedures that contain consistent qualitative criteria for insulator surface contamination levels (e.g. slight, moderate and heavy), and the results will be documented providing a predictable extent of degradation. Inspection findings are to be within the acceptance criteria of these procedures, to ensure that high voltage insulator intended function is maintained under all current licensing basis design conditions during the period of extended operation.

Quantitative acceptance criteria are not utilized; qualitative criteria are specified to ensure that high voltage insulator intended function will be maintained. Guidance for insulator surface conditions is in accordance with accepted industry practice.

Visual inspection of high voltage insulators will be prescribed by site-specific procedures that contain consistent qualitative criteria for insulator surface contamination levels (e.g. slight, moderate and heavy), and the results will be documented providing a predictable extent of degradation.

Corrective Actions – Element 7

Unacceptable high voltage insulator visual inspection results will be subject to an evaluation under the corrective action process. The evaluation will consider the significance of the inspection results, the extent of the concern, the potential causes for not meeting the inspection acceptance criteria, the corrective actions required. Corrective actions will be implemented when inspection results do not meet the acceptance criteria. The corrective action process is governed by 10 CFR 50, Appendix B and is implemented by corporate administrative procedures. The corrective action process generically applies to all station activities, even when not specifically invoked by a procedure line item.

If the deficiency is assessed to be a significant condition adverse to quality, the cause of the condition is determined and an action plan is developed to preclude repetition. Engineering analysis of identified degradation of high voltage insulators will confirm that the intended function will be maintained consistent with the current licensing basis, or the structure or component will be repaired or replaced.

Confirmation Process – Element 8

The confirmation process is implemented by site quality assurance (QA) procedures. QA procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. The completion and effectiveness of corrective actions are ensured by site quality assurance (QA) procedures. When corrective actions are necessary, the corrective action process assures that the cause of the adverse condition is determined and corrective actions are effective in precluding repetition. This process defines how the effectiveness of corrective actions is monitored to prevent recurrence.

The High Voltage Insulators program relies on condition monitoring activities to detect and correct the presence of salt deposits and surface contaminants on switchyard insulators. The High Voltage Insulators program is a condition monitoring program, and is not a prevention or mitigation program.

Administrative Controls – Element 9

The procedures used to implement the High Voltage Insulators program are included in the quality assurance program that provides for formal reviews and approvals. Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B.

The High Voltage Insulators program consists of administratively controlled procedures, which are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. The High Voltage Insulator aging management program is included in the license renewal UFSAR supplement.

Operating Experience – Element 10

Industry operating experience illustrates the potential for loss of insulator quality due to salt deposits and surface contamination on switchyard insulators. Demonstration that the new High Voltage Insulator program will be effective is achieved through objective evidence that shows the aging effect of degradation of insulation quality caused by the presence of salt deposits and surface contamination is being adequately managed. The following examples of operating experience provide objective evidence that the new High Voltage Insulators program will be effective in assuring that the intended function will be maintained consistent with the current licensing basis for the period of extended operation:

1. Industry operating experience shows the potential for loss of offsite power due to salt deposits on switchyard insulators. In March 1993, Crystal River Unit 3 experienced a loss of the 230 kV switchyard (normal offsite power to safety-related buses) when a light rain caused arcing across salt-laden 230 kV insulators and opened switchyard breakers. In March 1993, the Brunswick Unit 2 switchyard experienced a flashover of some high-voltage insulators attributed to a winter storm. Since 1982, Pilgrim experienced several losses of offsite power when ocean storms deposited salt on the 345 kV switchyard, causing the insulator to arc to ground. In response to this industry experience, existing 6-month inspections of Hope Creek 13 kV insulators were expanded to include the 500 kV insulators for salt contamination. The switchyard was inspected using thermography and corona detection equipment in the winter and summer of 2002, and no significant contamination buildup was found. The response and actions associated with this industry experience were revisited in 2003 following the effects of Hurricane Isabel. Switchyard insulator inspections were instituted along with contingency planning for an insulator cleaning strategy. Steps for initiating inspection of switchyard insulator surfaces were added to severe weather abnormal operating procedures upon forecast of severe weather. This example provides objective evidence that industry operating experience will be applied towards this new program, and corrective actions will be taken when the quality of insulator surfaces is threatened by storms and contamination.

2. One plant-specific event occurred at Hope Creek on September 18-19, 2003, when Hurricane Isabel passed a considerable distance to the south

and west of the site. Strong winds with gusts in excess of 60 mph caused switchyard insulators to become coated with salt. The rain had stopped prior to the strongest winds, leaving the salt spray to dry on switchyard insulators. Hope Creek operated throughout the storm. The combination of salt on the insulator surface and atmospheric moisture caused a flashover. Circuit breakers opened to isolate the fault on the Salem end of the line, without a significant effect on Salem plant equipment. Circuit breakers also opened to isolate the fault from Hope Creek and (by design) resulted in loss of the 1AX501 bus and loading of emergency diesel generators. Due to other malfunctions, an automatic reactor scram was initiated. The high voltage insulators were subsequently cleaned/washed prior to returning the unit to operation. This event demonstrates that corrective actions are taken when high voltage insulator degradation is found and, because this is the only high voltage insulator-related event of record, flashover due to salt contamination of insulators at Hope Creek is considered rare.

3. Visual inspection of Hope Creek switchyard high voltage insulators is performed twice per year for evidence of salt and contamination. These inspections have been in place since 1996, and have not found or observed degraded insulator quality other than “slight” surface contamination, even during periods of excessively dry weather, which would warrant cleaning or other corrective measures. This component history demonstrates that minor contamination is washed away by rainfall or snow, and cumulative build up has not been experienced and is not expected to occur (with the exception of infrequent storms like Hurricane Isabel). Visual inspection results for high voltage insulators are evaluated as part of Transmission & Distribution outage inspections as well as switchyard system walkdowns. This example provides objective evidence that the aging effect of degraded insulation quality is capable of being detected and that the mechanisms of salt deposit and surface contamination on high voltage insulators will be managed prior to loss of intended function.

The operating experience for the High Voltage Insulators program provides sufficient confidence that the implementation of the High Voltage Insulators program will effectively identify degradation prior to failure.

Exceptions to NUREG-1800

None.

Enhancements

None.

Conclusion

The new High Voltage Insulators aging management program will provide reasonable assurance that the aging effect of degradation of insulator quality due to the presence of salt deposits or surface contamination will be adequately managed so that the intended function of high voltage insulators within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.2.2 Periodic Inspection

Program Description

The Periodic Inspection aging management program is a new program that manages the aging of piping, piping components, piping elements, ducting components, tanks and heat exchanger components. This program will manage the aging effects of loss of material, reduction of heat transfer and hardening and loss of strength. This program will also manage cracking of the stainless steel standby diesel generator exhaust expansion joints. The program includes provisions for visual inspections of stainless steel, aluminum, copper alloy and elastomer components not managed under other aging management programs. The program also includes provisions for ultrasonic wall thickness measurements to detect loss of material. Identified deficiencies due to age related degradation are evaluated under the corrective action program.

Aging Management Program Elements

The results of an evaluation of each element against the 10 elements described in Appendix A of the Standard Review Plan of License Renewal Applications for Nuclear Power Plants, NUREG-1800, are provided below.

Scope of Program – Element 1

The scope of the Periodic Inspection aging management program includes piping, piping components, piping elements, heat exchanger components, tanks and ducting components. This aging management program includes stainless steel, aluminum, copper alloy and elastomer components not included in other aging management programs.

Preventive Actions – Element 2

The Periodic Inspection aging management program is a condition monitoring program and does not include activities for prevention or mitigation of aging effects. The program includes activities to periodically inspect for applicable aging effects. This program includes visual inspections and ultrasonic (UT) wall thickness measurements. The inspection frequencies are established based on plant and industry operating experience, and provide reasonable assurance that significant aging effects will be detected and corrective actions taken prior to loss of component intended function.

Parameters Monitored/Inspected – Element 3

The Periodic Inspection program is a condition monitoring program that performs periodic focused visual inspections or UT wall thickness measurements to detect loss of material aging effects. The Periodic Inspection aging management program will detect loss of material, reduction of heat transfer and hardening and loss of strength aging effects on components in the scope of this program prior to loss of the component intended function. The program will also detect cracking of standby diesel exhaust expansion joints prior to loss of intended function. The program includes visual inspections of heat transfer surfaces to detect the presence and extent of fouling that could result in reduction of heat transfer. The program also includes visual inspections of elastomer components for hardening and loss of strength. Visual inspection may include physical manipulation to assist in detecting hardening and degradation of elastomer components.

Detection of Aging Effects – Element 4

The Periodic Inspection aging management program will detect loss of material, reduction of heat transfer and hardening and loss of strength aging effects on components in the scope of this program prior to loss of the component intended function. The program will also detect cracking of standby diesel exhaust expansion joints prior to loss of intended function. The aging effects are detected by direct visual inspection of component surfaces and UT wall thickness measurements. The focused visual inspections and UT wall-thickness measurements will detect the presence and extent of loss of material aging effects. The focused visual inspections will also detect the presence and extent of fouling that could result in reduction of heat transfer on heat exchanger coils. Visual inspections of elastomer components will detect the presence and extent of hardening and loss of strength. Visual inspection may include physical manipulation to assist in detecting hardening and degradation of elastomer components.

Focused visual inspections will be performed on a representative sample of components in the scope of this program. Visual inspections will be performed on component surfaces that are either normally accessible or made accessible during periodic component disassembly.

Piping system UT wall thickness measurements will be performed on a representative sample of piping locations selected from systems in the scope of this program that are not normally opened for maintenance. Locations will be selected to include the material and environment combinations applicable to the piping and piping system component internal surfaces in the scope of this program. Piping system UT wall thickness measurements will be evaluated to determine if significant loss of material is occurring for the material and environment combination. Selected UT locations will include systems and areas within systems considered most susceptible to aging effects, based on system operating conditions and plant operating experience.

A ten-year inspection frequency is established based on plant and industry operating experience. Most components in the scope of this program are subject to an environment of uncontrolled air, including outdoor air and ventilation system air. Although this environment is assumed to contain moisture, condensation and contaminants, plant operating experience has not indicated significant aging effects for aluminum, stainless steel and copper alloy components in this environment. The elastomer components in this program are located indoor and not subject to significant UV exposure. The program also includes copper alloy and stainless steel components subject to a raw water environment, and stainless steel components subject to diesel exhaust. For stainless steel and copper alloy components in this program and subject to these environments, operating experience indicates that a ten year inspection frequency will be adequate to detect loss of material prior to loss of the component intended function.

Monitoring and Trending – Element 5

The Periodic Inspection program performs focused visual inspections or UT wall thickness measurements to detect loss of material aging effects. The program includes visual inspections to detect the presence and extent of fouling that could result in reduction of heat transfer. The program also includes visual inspections of elastomer components for hardening and loss of strength. Visual inspection may include physical manipulation to assist in detecting hardening and degradation of elastomer components. The program also includes visual inspections of the standby diesel exhaust expansion joints for cracking. These periodic inspection activities provide an effective technique to identify the extent of degradation on component surfaces prior to loss of component intended function. The inspections will be performed on a representative sample of component, material and environment combinations. Inspection frequencies are established based on industry and plant specific operating experience. Identified degradation will be entered into the corrective action process to determine the impact on the component intended function, including any required repairs or subsequent monitoring and trending requirements.

Acceptance Criteria – Element 6

The Periodic Inspection program manages loss of material, cracking, reduction of heat transfer and hardening and loss of strength aging effects on components in the scope of the program. Acceptance criteria for loss of material are based on the original equipment design wall thickness and any corrosion allowance requirements. Identified degradation is evaluated against the minimum wall thickness required for the component to perform its intended function under applicable design basis conditions, to determine if corrective actions are required. Acceptance criteria for reduction of heat transfer are based on identification of fouling on the external heat transfer surfaces of cooling coils. Identified fouling is removed by cleaning as part of the maintenance activity associated with the inspection. Acceptance criteria for standby diesel expansion joint cracking are based on preventing exhaust gas leakage that could impact engine operation. Acceptance criteria for hardening and loss of strength of elastomer components are based on visual indications of degradation such as cracking, tears or perforations in the elastomer material, and may also include physical manipulation to detect hardening and cracking.

Corrective Actions – Element 7

Evaluations are performed for inspection results that do not satisfy acceptance criteria and a notification is initiated to document the concern in accordance with plant administrative procedures that meet the requirements of 10 CFR Part 50, Appendix B. The corrective action program and specific corrective action steps as specified in procedures ensure that any conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined and an action plan is developed to preclude recurrence.

Identified degradation will be evaluated against the requirements for the system and component to perform its intended function under applicable design basis conditions, to determine if corrective actions are required. The minimum system and component requirements are determined by analysis and are based on applicable design basis operating and environmental conditions.

Confirmation Process – Element 8

The confirmation process is implemented by site quality assurance (QA) procedures. The review and approval processes and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B.

Administrative Controls – Element 9

The procedures used to implement the Periodic Inspection aging management program are included in the quality assurance program that provides for formal reviews and approvals. Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. This aging management program is included in the Hope Creek license renewal UFSAR supplement.

Operating Experience – Element 10

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the Periodic Inspection program will be effective in assuring that the intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. Extensive maintenance history searches were performed on the Hope Creek ventilation systems in the scope of this program to identify plant operating experience with loss of material or other age-related degradation on the surfaces of stainless steel, aluminum and copper alloy ventilation system components. These ventilation systems contain and process air drawn directly from outdoors or air drawn from various plant areas. In

system locations where condensation is expected, it is contained by collection and drain systems. Plant operating experience indicates that the ventilation system air environment is not corrosive to stainless steel, aluminum and copper alloy materials. No age-related degradation issues associated with ventilation system internal surfaces were found. The results from periodic internal inspections performed since 2003 indicate component conditions are satisfactory, and did not indicate internal surface corrosion or degradation. Interviews with ventilation system managers at the station confirmed that ventilation systems have not experienced loss a material or other aging degradation on the stainless steel, aluminum and copper alloy components in the scope of this program. This operating experience example provides objective evidence that existing maintenance activities will identify internal degradation prior to loss of intended functions.

2. In response to industry operating experience (INPO SEN 226, Stress Corrosion Cracking on a Portion of Safety Injection System Piping, December 2001), periodic external visual inspections were performed on outdoor stainless steel piping, to confirm that potential external salt contamination from the Delaware River has not resulted in degradation of the piping. Inspections were performed in January 2005 and September 2007. All of the inspection results have been satisfactory, with no indication of age related degradation. This operating experience provides objective evidence that stainless steel components in the scope of this aging management program and subject to the outdoor air environment at Hope Creek are not experiencing loss of material.

3. On March 26, 2003 a small tear was discovered on the Hope Creek Technical Support Center Ventilation Fan discharge flexible connection while performing a preventive maintenance task. The corrective action process was initiated. Further evaluation found that the tear was on the outer shell of the flexible connection and did not affect the ventilation system function. The tear was repaired. This example demonstrates that degraded elastomer flexible connections are identified by visual inspection prior to loss of system or component intended function, and that when deficient conditions are found during unrelated work activities, they are entered into the corrective action program for evaluation and resolution. This ensures the proper corrective actions are taken to ensure the intended functions of the components are maintained.

Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Periodic Inspection program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Periodic Inspection program are performed to identify areas that need improvement to maintain the quality performance of the program.

Exceptions to NUREG-1800

None.

Enhancements

None.

Conclusion

The new Periodic Inspection aging management program will provide reasonable assurance that loss of material, cracking, reduction of heat transfer, hardening and loss of strength aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.2.3 Aboveground Non-Steel Tanks

Program Description

The Aboveground Non-Steel Tanks program is a new program used to manage the aging effects of the external surfaces of aboveground non-steel tanks in the scope of license renewal. The tank within the scope of this program is the stainless steel Condensate Storage Tank. The condensate storage tank is supported on a concrete foundation.

The Aboveground Non-Steel Tanks program is credited for managing loss of material on the tank external surfaces, including the exterior bottom surface that is not accessible for direct visual inspection. Visual inspection activities are credited for the entire outer surface of the tank, up to the surface in contact with the concrete foundation. Loss of material on the inaccessible tank bottom external surfaces is detectable by thickness measurements of the tank bottom. The condition of the tank bottom outer surface will be confirmed by performing a UT inspection of the tank bottom from inside the tank.

This program also includes inspection of grout installed at the interface edge between the tank bottom and the concrete foundation for signs of degradation. The tank vent bird screen will be visually inspected for loss of material.

Aging Management Program Elements

The results of an evaluation of each element against the 10 elements described in Appendix A of the Standard Review Plan of License Renewal Applications for Nuclear Power Plants, NUREG-1800, are provided below.

Scope of Program – Element 1

The scope of the Aboveground Non-Steel Tanks aging management program includes outdoor non-steel tanks in the scope of license renewal. The tank within the scope of this program is the stainless steel Condensate Storage Tank. The program consists of periodic visual inspection of the accessible tank external surfaces. The condition of the tank bottom outer surface will be confirmed by performing a UT inspection of the tank bottom from inside the tank.

This program also includes inspection of grout installed at the interface edge between the tank bottom and the concrete foundation for signs of degradation. The tank vent bird screen will be visually inspected for loss of material.

Preventive Actions – Element 2

The Aboveground Non-Steel Tanks aging management program is a condition monitoring program and does not include activities for prevention or mitigation of aging effects. The program includes periodic visual inspection activities, including inspection of grout installed at the interface edge between the tank bottom and the concrete foundation for signs of degradation. The program also includes a UT inspection to confirm the condition of the inaccessible tank bottom outer surface. The tank vent bird screen will be visually inspected for loss of material. The five year visual inspection frequency is established based on plant and industry operating experience, and provides reasonable assurance that significant aging effects will be detected and corrective actions taken prior to loss of component intended function.

Parameters Monitored/Inspected – Element 3

For the accessible outer surface of the tank, up to the surface in contact with the concrete foundation, the condition of the surface is monitored by direct visual inspection to identify loss of material degradation. Focused visual inspections will detect significant loss of material due to pitting and crevice corrosion prior to loss of the tank intended function. Grout installed at the interface edge between the tank bottom and the concrete foundation will be periodically inspected for degradation. The tank vent bird screen will be visually inspected for loss of material.

For the inaccessible tank bottom surface, the condition of the surface is confirmed by performing a UT wall-thickness inspection from inside the tank.

The focused visual inspections and UT wall-thickness measurements will detect the presence and extent of loss of material aging effects. Visual inspections will detect grout degradation that could allow water to get under the tank bottom.

Detection of Aging Effects – Element 4

The Aboveground Non-Steel Tanks aging management program will detect loss of material aging effects on the tank external surfaces before there is a loss of the tank intended function. For the accessible outer surface of the tank, up to the surface in contact with the concrete foundation, the condition of the surface is monitored by direct visual inspection to identify loss of material degradation. Focused visual inspections will detect significant loss of material due to pitting and crevice corrosion prior to loss of the tank intended function. Grout at the interface edge between the tank bottom and the concrete foundation minimizes water and moisture intrusion at the interface. Therefore, grout installed at this interface will be periodically inspected for degradation that could allow water to get under the tank bottom. The tank vent bird screen will be visually inspected for loss of material. The five year visual inspection frequency will detect degradation prior to loss of intended function, based on industry and plant-specific operating experience.

For the inaccessible tank bottom surface, the condition of the surface is confirmed by performing a UT wall-thickness inspection from inside the tank. UT data will be taken at a sufficient number of locations on the tank bottom to determine if significant loss of material degradation is occurring. The UT inspection will be performed prior to entering the period of extended operation. Wall-thickness measurement results will be evaluated to confirm that the tank intended function is maintained. If significant degradation is identified, the condition will be monitored and trended, and corrective action taken prior to loss of the tank intended function.

The Aboveground Non-Steel Tanks aging management program is not a sampling program since the condensate storage tank is the only tank in the program.

Monitoring and Trending – Element 5

For the accessible outer surface of the tank, up to the surface in contact with the concrete foundation, the condition of the surface is monitored by direct visual inspection to identify loss of material degradation. Focused visual inspections will detect significant loss of material due to pitting and crevice corrosion prior to loss of the tank intended function. A periodic visual inspection is an effective technique to identify loss of material on component external surfaces prior to loss of component intended function, based on industry and plant-specific operating experience.

For the inaccessible tank bottom surface, the condition of the surface is confirmed by performing a UT wall-thickness inspection from inside the tank. Wall thickness measurements will be compared to design requirements to determine if significant loss of material degradation is occurring. The UT inspection will be performed prior to entering the period of extended operation. Wall-thickness measurement results will be evaluated to confirm that the tank intended function is maintained. A UT wall thickness inspection is an effective technique to identify loss of material on inaccessible tank bottom external surfaces prior to loss of component intended function, based on industry and plant-specific operating experience.

Significant degradation identified by visual inspections or UT wall thickness measurements will be entered into the corrective action process to determine the impact on the tank intended function, including any required repairs or subsequent monitoring and trending requirements.

Acceptance Criteria – Element 6

This program manages loss of material on the external surfaces of outdoor non-steel tanks in the scope of license renewal. The tank within the scope of this program is the stainless steel Condensate Storage Tank. Acceptance criteria for the inspections in this program are based on the original equipment design wall thickness and corrosion allowance requirements for the tank pressure boundary components. Results meeting these criteria are considered to be without degradation, and the intended function will therefore be maintained under all CLB conditions. Identified degradation will be evaluated against the minimum wall thickness required for the tank to perform its intended function under applicable design basis conditions, to determine if corrective actions are required. The minimum required material thickness is determined based on consideration of pressure retaining requirements and structural requirements under applicable design basis operating and environmental conditions.

Acceptance criteria for the inspections in this program are quantitative, in that the requirement is to maintain a predetermined wall thickness. Visual inspections are qualitative in that they are relied upon to determine if any material loss is occurring based on the visually observable surface conditions. Indications of significant pitting or crevice corrosion, or other significant degradation will require additional evaluation to quantify the material loss and compare it to the applicable design requirements. Visual inspections of grout are qualitative in assessing the extent of degraded or missing grout. UT measurements of the tank bottom are quantitative inspections. Visual and UT inspections are performed by qualified personnel in accordance with approved station procedures.

Corrective Actions – Element 7

Evaluations are performed for inspection results that do not satisfy acceptance criteria and a notification is initiated to document the concern in accordance with plant administrative procedures that meet the requirements of 10 CFR Part 50, Appendix B. The corrective action program and specific corrective action steps as specified in procedures ensure that any conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined and an action plan is developed to preclude repetition.

Identified degradation will be evaluated against the minimum wall thickness required for the tank to perform its intended function under applicable design basis conditions, to determine if corrective actions are required. The minimum required material thickness is determined by analysis based on consideration of pressure retaining requirements and structural requirements under applicable design basis operating and environmental conditions.

Confirmation Process – Element 8

The confirmation process is implemented by site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B.

Administrative Controls – Element 9

The procedures used to implement the Aboveground Non-Steel Tanks aging management program are included in the quality assurance program that provides for formal reviews and approvals. Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. This aging management program is included in the Hope Creek license renewal UFSAR supplement.

Operating Experience – Element 10

The following examples of operating experience provide objective evidence that the Aboveground Non-Steel Tanks program will be effective in assuring that the intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. In response to industry operating experience (INPO SEN 226, Stress Corrosion Cracking on a Portion of Safety Injection System Piping, December 2001), periodic external visual inspections have been performed on stainless steel piping attached to the Condensate Storage Tank, to confirm that potential external salt contamination from the Delaware River has not resulted in degradation of the piping. Inspections have been performed in January 2005 and September 2007. All of the inspection results have been satisfactory, with no indication of age related degradation. This operating experience provides objective evidence that stainless steel components subject to the outdoor air environment at Hope Creek, and located in proximity to the stainless steel Condensate Storage Tank in the scope of this aging management program, are not experiencing loss of material.

2. Extensive maintenance history searches were performed to identify plant operating experience with loss of material or other aging degradation on the external tank surfaces for the stainless steel Condensate Storage Tank in the scope of this program. This tank is not coated. No age related degradation issues were identified associated with the external surfaces of this tank.

During over 20 years of operation, there has been no degradation of the tank external surfaces exposed to the outdoor air environment. The good physical condition of the Condensate Storage Tank supports the conclusion that inspection of the external surfaces every 5 years will be more than adequate to identify any degradation before it could result in loss of intended function. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Aboveground Non-Steel Tanks program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Aboveground Non-Steel Tanks program are performed to identify areas that need improvement to maintain the quality performance of the program.

Exceptions to NUREG-1800

None.

Enhancements

None.

Conclusion

The new Aboveground Non-Steel Tanks aging management program will provide reasonable assurance that the loss of material aging effect will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.2.4 Buried Non-Steel Piping Inspection

Program Description

The Buried Non-Steel Piping Inspection aging management program is an existing condition monitoring program that manages the buried reinforced concrete piping and components in the Service Water System that are exposed to an external soil or groundwater environment for cracking, loss of bond, increase in porosity and permeability, and loss of material. The program relies on inspections of the external surfaces of piping and components to identify cracking, loss of bond, increase in porosity and permeability and loss of material.

The Buried Non-Steel Piping Inspection aging management program also manages the aging effects on buried stainless steel piping and components in the Condensate Storage and Transfer System and the Fire Protection System that are exposed to an external soil environment. The program relies on visual inspections of the external surfaces of the piping and components to identify loss of material. Inspection of buried components identifies coating degradation, if coated, or base metal corrosion, if uncoated.

Opportunistic and focused inspections are performed to manage the effects of exterior surface and coating degradation on the pressure-retaining capacity of buried piping and components. Buried piping and components are inspected when they are excavated for maintenance or any other reason.

At least one opportunistic or focused excavation and inspection of buried piping and components within the scope of this program will be performed within ten years prior to entering the period of extended operation. Upon entering the period of extended operation at least one focused excavation and inspection of buried piping and components within the scope of this program will be performed within the first ten years, unless an opportunistic excavation and inspection occurs within this ten year period.

Areas with high susceptibility of exterior surface degradation, consequence of failure and areas with a history of exterior surface and coating degradation problems are identified and prioritized. Probabilistic arguments were not used in the development of the Buried Non-Steel Piping Inspection aging management program. Aging effects are managed by a condition monitoring program.

Aging Management Program Elements

The results of an evaluation of each element against the 10 elements described in Appendix A of the Standard Review Plan of License Renewal Applications for Nuclear Power Plants, NUREG-1800, are provided below.

Scope of Program – Element 1

The Buried Non-Steel Piping Inspection aging management program is an existing program that manages cracking, loss of bond, loss of material and increase in porosity and permeability, through the use of opportunistic and focused inspections. The program relies on condition monitoring inspections of the external surfaces of piping and components to identify external surface degradation and detect the aging effects listed above. Opportunistic or focused inspections are performed when the components are excavated for maintenance or for any other reason. The program directs engineering to perform inspections of piping and components exposed during excavation. Inspection of buried components identifies coating degradation, if coated, or base metal corrosion, if uncoated.

The Buried Non-Steel Piping Inspection aging management program consists of system components within the scope of license renewal that are buried and included in the Service Water System, the Condensate Storage and Transfer System and the Fire Protection System. This includes the buried reinforced concrete piping in the Service Water System that extends from the carbon steel spool piece at the Service Water Intake Structure to the interface of the Reactor Building and the buried stainless steel piping in the Fire Protection System that extends from the Reactor Building into the ground in several locations. Additionally, the Buried Non-Steel Piping Inspection aging management program consists of buried stainless steel piping in the Condensate Storage and Transfer System that extends from the Condensate Storage Tank piping to a buried seismic anchor block credited for structural support. Opportunistic and focused inspections are performed when the piping and components are excavated for maintenance or for any other reason.

The Buried Non-Steel Piping Inspection aging management program will be enhanced to include at least one opportunistic or focused excavation and inspection of buried reinforced concrete piping and components and at least one opportunistic or focused excavation and inspection of stainless steel buried piping and components within ten years prior to entering the period of extended operation. Upon entering the period of extended operation at least one focused excavation and inspection of buried reinforced concrete piping and components and at least one opportunistic or focused excavation and inspection of stainless steel buried piping and components will be performed within the first ten years, unless an opportunistic excavation and inspection occurs within this ten year period.

Areas with high susceptibility of exterior surface degradation, consequence of failure and areas with a history of exterior surface and coating degradation problems are identified and prioritized. Probabilistic arguments were not used in the development of the Buried Non-Steel Piping Inspection aging management program. Aging effects are managed by a condition monitoring program.

Preventive Actions – Element 2

The Buried Non-Steel Piping Inspection aging management program is not a preventive or mitigation program. The Buried Non-Steel Piping Inspection aging management program is a condition monitoring program that relies on opportunistic or focused inspections of the buried reinforced concrete piping and components in the Service Water System and the buried stainless steel piping and components in the Condensate Storage and Transfer System and the Fire Protection System that is exposed to an external soil or groundwater environment. The buried reinforced concrete piping and components are inspected for cracking, loss of bond, increase in porosity and permeability, and loss of material. The buried stainless steel piping and components are inspected for loss of material.

Parameters Monitored/Inspected – Element 3

The Buried Non-Steel Piping Inspection aging management program is a condition monitoring program that relies on opportunistic or focused inspections of the buried reinforced concrete piping and components in the Service Water System that are exposed to an external soil or groundwater environment to inspect for cracking, loss of bond, increase in porosity and permeability, and loss of material. The Buried Non-Steel Piping Inspection aging management program also relies on opportunistic or focused inspections of the buried stainless steel piping and components in the Condensate Storage and Transfer System and the Fire Protection System that are exposed to an external soil environment to inspect for loss of material.

These aging effects will be identified through visual inspections of the external surfaces of the piping and components. Opportunistic or focused inspections are performed when the piping is excavated for maintenance or for any other reason. External surfaces are inspected by visual techniques whenever buried piping and components are uncovered during excavation activities. Inspection of buried components identifies coating degradation, if coated, or base material degradation, if uncoated. At least one opportunistic or focused excavation and inspection of buried piping and components within the scope of this program will be performed within ten years prior to entering the period of extended operation. Upon entering the period of extended operation at least one focused excavation and inspection of buried piping and components within the scope of this program will be performed within the first ten years, unless an opportunistic excavation and inspection occurs within this ten year period.

The Buried Non-Steel Piping Inspection aging management program is not a performance monitoring program nor is it a preventive or mitigation program.

Detection of Aging Effects – Element 4

The Buried Non-Steel Piping Inspection aging management program is a condition monitoring program that performs opportunistic or focused inspections on the buried piping and components in the scope of this program to detect and inspect the buried reinforced concrete piping and components in the Service Water System that are exposed to an external soil or groundwater environment for cracking, loss of bond, increase in porosity and permeability, and loss of material and will detect degradation of the component prior to loss of its intended function. Opportunistic or focused inspections to detect cracking, loss of bond, increase in porosity and permeability, and loss of material will be specified by engineering through specific procedures and will be based on accepted industry practices. Examination methods include visual inspections of the external surface of buried piping and components. The methods used to inspect for degradation are implemented in accordance with accepted industry standards.

The Buried Non-Steel Piping Inspection aging management program will inspect the buried stainless steel piping and components in the Condensate Storage and Transfer System and the Fire Protection System that are exposed to an external soil environment for loss of material and will detect degradation of the component prior to loss of its intended function. Examination methods include visual inspections of the external surface of buried piping and components. The methods used to inspect for degradation are implemented in accordance with accepted industry standards.

These inspections are an effective method to ensure that degradation of external surfaces has not occurred and the intended function is maintained. External inspections of buried components will occur opportunistically when they are excavated during maintenance, in addition to focused inspections. The inspections will be performed on all of the areas made accessible to support the maintenance activity.

At least one opportunistic or focused excavation and inspection of buried piping and components within the scope of this program will be performed within ten years prior to entering the period of extended operation. Upon entering the period of extended operation at least one focused excavation and inspection of buried piping and components within the scope of this program will be performed within the first ten years, unless an opportunistic excavation and inspection occurs within this ten year period. Areas with high susceptibility of exterior surface degradation, consequence of failure and areas with a history of exterior surface and coating degradation problems are identified and prioritized. If necessary, engineering will determine expanded inspection scope based on technical evaluations if the initial inspection results are unacceptable.

Operating experience supports this frequency of inspection. A review of plant operating experience at Hope Creek shows that there have been no underground leaks that developed as a result of failure of the external surface of buried stainless steel or reinforced concrete piping. Although failure of buried piping has occurred, it has been determined that the buried piping leaks were caused by degradation of the inside of the buried piping. In 2004, it was determined that the service water loop underground headers joint epoxy coating was blistering internally. The cause of this blistering was due to exposure of the bell and spigot joints and other piping joints to river water on the internal surface of the pipe and not due to external age related degradation. There have been no inspections of buried stainless steel piping at Hope Creek to date. Additionally there have been no failures of buried stainless steel piping at Hope Creek to date.

Focused visual inspections will be performed on a representative sample of components, material and environment combinations. Visual inspections will be performed on external piping and component surfaces that are made accessible during opportunistic or focused excavations and inspections. Visual inspections will be performed on a representative sample of piping and component external surfaces in the scope of this program.

Significant degradation identified during inspection activities are entered into the corrective action program. The degraded condition is evaluated, and corrective actions are established if necessary to preclude recurrence.

Monitoring and Trending – Element 5

Opportunistic or focused inspections are appropriate for detecting cracking, loss of bond, increase in porosity and permeability, and loss of material aging effects prior to loss of intended function, based on plant specific and industry operating experience. External piping and component degradation is repaired and evaluated whenever buried commodities are uncovered during excavation and inspection activities. These inspection activities provide an effective technique to identify the extent of degradation on piping and component surfaces prior to loss of component intended function. The inspections will be performed on a representative sample of component, material and environment combinations. Results of the inspection activities will be monitored and indications of significant degradation will be entered into the corrective action process for evaluation. The evaluation will determine the need for follow-up examinations to monitor the progression of aging if age-related degradation is found that could jeopardize system and component intended functions. In addition, the engineering evaluation will either demonstrate acceptability or specify the appropriate repair or replacement.

The data collected will be evaluated and quantified by engineering, and appropriate corrective actions will be taken for any adverse findings. Engineering evaluation requires an assessment of the rate of degradation, such that timing of the next scheduled inspection will occur before a loss of intended function. Significant degradation identified by visual inspections will be entered into the corrective action process. The corrective action process will include a notification and evaluation of the degraded condition against the acceptance criteria. Notifications are trended within the corrective action program. Significant loss of material identified by the external surface inspection will be quantified in terms of remaining wall thickness, and compared to minimum wall thickness design requirements. Subsequent inspection results will be compared to previous results for trending and confirmation of adequate inspection frequency. Follow up examinations will be required if necessary to determine the extent of the degraded condition, thus expanding the sample size and locations of inspections or adjusting the inspection frequency as appropriate.

Acceptance Criteria – Element 6

Acceptance criteria are specified in the implementing procedure or work order in accordance with the applicable regulatory or industry requirements. Inspection data is evaluated to determine wear rate, remaining life and the time to the next inspection or repair/replacement. External component degradation is reported and evaluated whenever buried commodities are uncovered during yard excavation activities. In addition, evidence of surface degradation and any leakage detected through periodic testing and visual inspections will be evaluated and used to confirm the system and components ability to perform their intended functions. Any leakage identified is evaluated and appropriate corrective actions are implemented. Guidance for acceptance criteria relating to localized wall thinning and is contained in engineering documents and is used in the evaluation methodology.

Acceptance criteria are specified to ensure that the structure and component intended function(s) will be maintained under all CLB design conditions. Guidance for local wall thinning evaluations is in accordance with applicable regulatory or industry codes.

Any acceptance criteria not currently defined in the UFSAR will be defined by engineering and accepted based on procedures, regulatory requirements and accepted industry practices to maintain intended functions under CLB loads.

All qualitative inspections will be performed to the same predetermined criteria as quantitative inspections in accordance with approved site procedures. Acceptance criteria for loss of material are quantitative, in that the requirement is to maintain a predetermined wall thickness. Visual inspections are qualitative in that they are relied upon to determine if any wall loss is occurring based on the visually observable surface conditions. Indications of significant degradation will require additional evaluation to quantify the material loss and compare it to the applicable design requirements. Inspections are performed by qualified personnel in accordance with approved station procedures.

Corrective Actions – Element 7

Evaluations will be performed for inspection results that do not meet the acceptance criteria and a Notification is initiated to document the concern in accordance with the requirements of 10 CFR Part 50, Appendix B and in accordance with plant administrative procedures. The corrective action program ensures that the conditions adverse to quality are promptly corrected, including root cause determination and prevention of recurrence.

If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined and an action plan is developed to preclude repetition. Engineering analysis of identified degradation will confirm that the structure or component intended function will be maintained consistent with the CLB, or the structure or component will be repaired or replaced.

Confirmation Process – Element 8

The confirmation process is implemented by site quality assurance (QA) procedures, review and approval processes, and administrative controls which are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. The completion and effectiveness of the preventive and corrective actions are monitored by the site’s quality assurance (QA) procedures.

The Buried Non-Steel Piping Inspection program relies on condition monitoring activities and strategies to ensure long-term operability of buried piping and components. The Buried Non-Steel Piping Inspection program is a condition monitoring program, not a prevention and mitigation program.

Administrative Controls – Element 9

The procedures used to implement the Buried Non-Steel Piping Inspection program are included in the quality assurance program that provides for formal reviews and approvals. Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B.

The Buried Non-Steel Piping Inspection program consists of administratively controlled procedures, which are controlled as stated in the item above. This aging management program is included in the Hope Creek license renewal UFSAR supplement.

Operating Experience – Element 10

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects/mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the Buried Non-Steel Piping Inspection program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. A review of plant operating experience at Hope Creek shows that there have been no underground leaks that developed as a result of failure of the external surface of buried stainless steel or reinforced concrete piping. Although failure of buried piping has occurred, it has been determined that the buried piping leaks were caused by degradation of the inside of the buried piping. Degradation of inside surfaces of piping is managed through other aging management programs.

2. In 2004, it was determined that the service water loop underground headers joint epoxy coating was blistering internally. The cause of this blistering was due to exposure of the bell and spigot joints and other piping joints to river water on the internal surface of the pipe and not due to external age related degradation. This blistering was grit blasted, cleaned, NDE examined, prepared and recoated using new coating ENECON coating. All joints were rescanned and were found to have adequate metal thickness. No immediate need for installation of WEKO seals was warranted. The exterior surface of the buried reinforced concrete piping of the Service Water system has a tar and fiber material, which protects the joints from outside, and no problems have been identified or suspected with the coating. The service water headers joints are inspected once every three years internally, one loop every 18 months. This provides objective evidence that susceptible buried piping is internally inspected on a routine basis, and any indication of degradation would be evaluated. Additionally, this operating example provides objective evidence that excavation and inspection of piping and components have been occurring opportunistically when underground pipe is exposed for other maintenance.

A review of plant operating experience showed that excavation of buried non-steel piping has occurred, and no instances of significant age related deficiencies were documented. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Buried Non-Steel Piping Inspection program will effectively identify degradation prior to failure. The work planning process provides instructions to do exterior surface inspections when excavations occur. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Buried Non-Steel Piping Inspection program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Exceptions to NUREG-1800

None.

Enhancements

1. At least one opportunistic or focused excavation and inspection of buried reinforced concrete piping and components will be performed within ten years prior to entering the period of extended operation. Upon entering the period of extended operation at least one focused excavation and inspection of buried reinforced concrete piping and components will be performed within the first ten years, unless an opportunistic excavation and inspection occurs within this ten year period. **Program Elements Affected: Scope of Program (Element 1), Parameters Monitored or Inspected (Element 3) and Detection of Aging Effects (Element 4)**

2. At least one opportunistic or focused excavation and inspection of buried stainless steel piping and components will be performed within ten years prior to entering the period of extended operation. Upon entering the period of extended operation at least one focused excavation and inspection of buried stainless steel piping and components will be performed within the first ten years, unless an opportunistic excavation and inspection occurs within this ten year period. **Program Elements Affected: Scope of Program (Element 1), Parameters Monitored or Inspected (Element 3) and Detection of Aging Effects (Element 4)**

3. Guidance for inspection of concrete aging effects. Instructions will include inspection for cracking, loss of bond, loss of material and increase in porosity and permeability. **Program Elements Affected: Scope of Program (Element 1), Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), and Monitoring and Trending (Element 5)**

Conclusion

The enhanced Buried Non-Steel Piping Inspection aging management program will provide reasonable assurance that cracking, loss of bond, increase in porosity and permeability, and loss of material will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.2.5 Boral Monitoring Program

Program Description

The Boral Monitoring Program is an existing program that monitors the Boral test coupon inspection and/or testing results at other Boiling Water Reactor (BWR) sites. If these results indicate a problem with the Boral neutron absorbing material potentially affecting its intended function (i.e., absorb neutrons), Hope Creek will initiate inspection and/or testing of its Boral test coupons in the Hope Creek spent fuel pool (SFP).

Aging Management Program Elements

The results of an evaluation of each element against the 10 elements described in Appendix A of the Standard Review Plan of License Renewal Applications for Nuclear Power Plants, NUREG-1800, are provided below.

Scope of Program – Element 1

The Boral Monitoring Program is an existing program that monitors the Boral test coupon inspection and/or testing results at other Boiling Water Reactor (BWR) sites. If these results indicate a problem with the Boral neutron absorbing material potentially affecting its intended function (i.e., absorb neutrons), Hope Creek will initiate inspection and/or testing of its Boral test coupons in the Hope Creek spent fuel pool (SFP). This practice is consistent with the Hope Creek UFSAR and previous NRC information.

Preventive Actions – Element 2

The Boral Monitoring Program is an existing program that monitors the Boral test coupon inspection and/or testing results at other Boiling Water Reactor (BWR) sites. If these results indicate a problem with the Boral neutron absorbing material potentially affecting its intended function (i.e., absorb neutrons), Hope Creek will initiate inspection and/or testing of its Boral test coupons in the Hope Creek spent fuel pool (SFP). The assumption is that the spent fuel pool environments, including the pool's water chemistry and radiation field, and the Boral material characteristics are consistent enough so that the results at other BWR sites are representative of the results if the Hope Creek Boral test coupons were inspected and/or tested. The Boral Monitoring Program aging management programs used at these other BWR sites is a condition monitoring program and does not include activities for prevention or mitigation of aging effects.

The Boral Monitoring Program aging management program used at these other BWR sites is a condition monitoring program and does not rely on preventive actions.

Parameters Monitored/Inspected – Element 3

The Boral surveillance performed by other Boiling Water Reactor (BWR) sites include visual inspections and/or testing of their Boral test specimens or coupons to monitor changes in physical properties of the Boral in the spent fuel pool. Examination of the Boral test coupon include visual examination and photography, and may include dimensional measurements, weight and density/specific gravity measurement, and neutron attenuation measurement. The Boral test coupon is visually examined to detect aging affects such as corrosion, pitting, swelling, or other degradation. The Boral test coupon may be photographed if, in the judgment of the technician, there is any information of significance that should be photographically documented. Dimensional measurements such as length, width and thickness are taken to document if physical changes are occurring in the Boral test coupon. The Boral test coupon is weighed and in some instances, the density/specific gravity is calculated to determine if there any changes in the physical properties. A measurement by neutron attenuation is performed to determine if there has been any change in the Boron-10 content.

These inspections and/or testing are performed by a qualified contractor or measurement laboratory and will ensure against unexpected degradation of the Boral neutron-absorbing material.

Detection of Aging Effects – Element 4

The Boral surveillance performed by other Boiling Water Reactor (BWR) sites include visual inspections and/or testing of the Boral test specimens or coupons to monitor changes in physical properties of Boral. These Boral test coupons are in the spent fuel pool and subject to irradiated fuel assemblies to ensure that the Boral test coupons of the BWR sites are representative of their Boral in their spent fuel pool storage racks. Also, the assumption is that the spent fuel pool environments and the Boral neutron absorbing material characteristics are consistent enough for the other BWR sites so that the inspection and/or testing results from other sites are representative of the results if the Hope Creek Boral test coupons were examined. Examination of the Boral test coupon include visual examination and photography, and may include dimensional measurements, weight and density/specific gravity measurement, and neutron attenuation measurement. The Boral test coupon is visually examined to detect aging affects such as corrosion, pitting, swelling, or other degradation. The test coupon may be photographed if, in the judgment of the technician, there is any information of significance that should be photographically documented. Dimensional measurements such as length, width and thickness may be taken to document if physical changes are occurring in the test coupon, which could indicate a change in the Boral material affecting its intended function. The Boral test coupon is weighed and in some instances, the density/specific gravity is calculated to determine if there any changes in the physical properties. A measurement by neutron attenuation is performed to determine if there has been any change in the Boron-10 content. The Boral test coupons for these other BWR sites are removed in accordance with a prescribed schedule that is site specific. Hope

Creek will request test reports from the Boral surveillance program of these other BWR sites every two years for evaluation and trending.

The use of operating experience from these other BWR sites should result in more industry operating experience data or test reports than would be obtained with a Hope Creek Boral coupon testing surveillance program. Generally these BWR sites' surveillance programs would retrieve a coupon or coupons for examination every refueling cycle for about the first five refueling cycles after initiating their surveillance program. Then their surveillance program would continue with a frequency of approximately once every five refueling cycles to perform examinations on their Boral test coupons going forth. Other BWR sites' surveillance programs utilize an inspection frequency that may be based on a multi-year surveillance (i.e., every two years), therefore different from what was previously described. Using multiple BWR sites for obtaining Boral coupon test results will ensure that a sufficient number of test reports are available for evaluation and trending to provide reasonable assurance that the Hope Creek Boral Monitoring Program will maintain the intended function of the Boral neutron absorbing material during the period of extended operation.

Monitoring and Trending – Element 5

The Boral Monitoring Program monitors the Boral test coupon inspection or testing results at other Boiling Water Reactor (BWR) sites. If these results indicate a problem with the Boral neutron absorbing material potentially affecting its intended function (i.e., absorb neutrons), Hope Creek will initiate inspection and/or testing of its Boral test coupons in the Hope Creek spent fuel pool (SFP). The assumption is that the spent fuel pool environments and the Boral neutron absorbing material characteristics are consistent enough for the other BWR sites so that the inspection and/or testing results from other sites are representative of the results if the Hope Creek Boral test coupons were inspected and/or tested. This assumption is justified since the industry testing results do not show significant variation from BWR site to BWR site. Hope Creek will request test reports from the Boral surveillance program of these other BWR sites every two years for evaluation and trending. The test results will be used to assess the condition of the Boral neutron absorbing material used in the Hope Creek spent fuel pool storage racks. The test results will provide the information and data needed to perform trending for indication of a potential degradation that may impact the performance of the Boral neutron absorbing material. A summary of test results received from other BWR Boral surveillance will be entered into the plant document retrieval system. If these results indicate a problem with the Boral neutron absorbing material affecting its intended function (i.e., absorb neutrons), Hope Creek will initiate inspection and/or testing of its Boral test coupons. Test results obtained from seven BWR sites for the period of 2004 through 2007, have provided evidence that supports the use of the existing Boral Monitoring Program for detecting and managing the aging affects of Boral. The test results from these seven BWR sites can be summarized as follows: examinations of the coupons involved visual observations, dimensional measurements (length, width and thickness), weight and density determinations and neutron attenuation measurements and the examination results were that material performance was satisfactory. Additionally, there were some minor issues noted (e. g., clad pitting, clad blistering, and light oxide film of the clad) but there has been no impact on the Boral neutron absorbing material affecting its intended function. Using the test results from these seven BWR sites provides supporting data and documentation that supports the conclusion that using operational experience provides reasonable assurance that the detecting and managing of aging affects from other BWR sites can be used to predict the potential aging affects of the Boral material used in the Hope Creek spent fuel pool storage racks. Hope Creek intends to continue the current Hope Creek Boral Monitoring Program practice into the period of extended operation.

Acceptance Criteria – Element 6

The Boral Monitoring Program monitors the Boral test coupon inspection and/or testing results at other Boiling Water Reactor (BWR) sites. Hope Creek will request test reports from the Boral surveillance programs of these other BWR sites every two years for evaluation and trending. These BWR sites' Boral surveillance programs have acceptance criteria that are focused on the type of inspection and/or testing that are performed within their surveillance program. The Boral surveillance performed by other BWR sites may include visual inspections and/or testing of the Boral test specimens or coupons. The Boral surveillance program performed by other BWR sites vary from a qualitative type program such that visual inspections only are performed to a quantitative type program such that in addition to visual inspections, dimensional measurements are performed along with testing of the Boron-10 content. These programs monitor changes in physical properties of the Boral by performing visual examinations and/or test measurements on representative Boral test coupons so that the intended function "absorb neutrons" will be maintained during the period of extended operation.

The acceptance criteria utilized for the Boral neutron absorbing material will be based on the type of test results that are obtained from the other BWR site's test report. For those BWR sites that perform only a qualitative visual examination to assess the condition of their Boral neutron absorbing material, the Hope Creek qualitative acceptance criteria will be based on those results. If the conclusion from the BWR site's test report indicates satisfactory results, no addition action is required but to document the receipt of that test report for trending in the accordance with the Hope Creek Boral Monitoring Program. If the test report conclusion indicates performance less than satisfactory, the test report information will be entered into the Hope Creek corrective action program for further evaluation. The corrective action process will perform an evaluation to determine if the test results are acceptable or if further action is required, such as requesting additional previous or historical test results from the same BWR site that can be used for correlating trends of the Boral neutron absorbing material performance. Additionally, if as a result of historical trending of these test results shows that an divergence or inconsistency in the test report results indicates potential degradation of the Boral neutron absorbing material performance corrective actions will be initiated. This could trigger the requirement to retrieve one Boral test coupon from the Hope Creek spent fuel pool and initiate inspection and/or testing and evaluation in accordance with the Boral Monitoring Program. For those BWR sites that perform quantitative examinations of their coupons that include visual observations, dimensional measurements (length, width and thickness), weight and density determinations and neutron attenuation measurements, the quantitative acceptance criteria is 1) the increase in thickness at any point should not exceed 10% of the initial thickness at that point and 2) a decrease of no more than 5% in Boron-10 content, as determined by neutron attenuation, is acceptable. If the conclusion from the BWR site's test report indicates satisfactory results, no addition action is required but to document the receipt of that test report for trending in the accordance with the Hope Creek Boral Monitoring Program. If the test report conclusion indicates at least one of the two acceptance criteria is unsatisfactory, the test report information will be entered into the Hope Creek corrective action program for further evaluation. Additionally, this could trigger the requirement to retrieve one Boral test coupon from the Hope Creek spent fuel pool and initiate inspection, testing and evaluation in accordance with the Boral Monitoring Program. Utilizing the Hope Creek Boral Monitoring Program and the Corrective Action Program in performing evaluations and trending of test results provide reasonable assurance that the Hope Creek Boral Monitoring Program will maintain the intended function of the Hope Creek Boral neutron absorbing material during the period of extended operation.

Corrective Actions – Element 7

See response to Element 6 above. Evaluations are performed for inspection results that do not satisfy acceptance criteria and a notification is initiated to document the concern in accordance with plant administrative procedures that meet the requirements of 10 CFR Part 50, Appendix B. The corrective action program and specific corrective action steps as specified in procedures ensure that any conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined and an action plan is developed to preclude recurrence.

Confirmation Process – Element 8

The corrective action program and specific corrective action steps as specified in procedures ensure that any conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined and an action plan is developed to preclude recurrence.

The Boral Monitoring Program aging management program used at these other BWR sites is a condition monitoring program and does not rely on preventative or mitigative actions.

Degraded conditions are documented in accordance with the 10 CFR Part 50, Appendix B corrective action program. This program ensures that conditions adverse to quality are promptly corrected, with follow-up activities as required to confirm that the corrective actions were completed. If the condition is assessed to be significantly adverse to quality, the cause of the condition is determined and an action plan is developed to prevent recurrence. In addition, the components in the scope of this program are periodically monitored. Continued periodic inspections will confirm the effectiveness of prior corrective actions taken.

Administrative Controls – Element 9

The procedures used to implement Boral Monitoring Program aging management program are included in the quality assurance program that provides for formal reviews and approvals. Site quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. This aging management program is included in the Hope Creek license renewal UFSAR supplement.

Operating Experience – Element 10

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects are being adequately managed. The following examples of operating experience provide objective evidence that the Boral Monitoring Program will be effective in assuring that the intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. Trending recent test results from other BWR sites for the past five years demonstrates that the Boral neutron absorbing material is performing satisfactorily and no significant degradations have been have been observed or documented. Industry operating experience was obtained from seven Boiling Water Reactor (BWR) sites for Boral test coupons. These seven test reports show no aging effect significantly impacting the intended function. Utilizing the operating experience from existing Boral surveillance programs at these other BWR sites provides a technical basis to demonstrate that Hope Creek does not need to implement an inspection and/or testing surveillance program of their Boral test coupons. Below is summary of the industry operating experience for these seven BWR sites:

    These BWR plants submit their Boral test coupon(s) to a qualified vendor for inspection and testing in accordance with the vendor's Boral surveillance program. The inspection and testing of these test coupon(s) generally involves visual observations and photography, dimensional measurements (length, width and thickness), weight and density determinations, and neutron attenuation measurements. Additionally, most of the BWR plants included B-10 areal density measurements with the surveillance program. The vendor prepares a report documenting the inspection and testing results and submits the report to the BWR plant. The following summarizes the inspection and testing results from the various BWR plants:

    The visual inspections of the coupon showed that with the exception of some localized pitting and some blistering of the aluminum skin of the coupons exposed to the spent fuel pool water, the condition of the coupons were as expected. It was noted that both the pitting and blistering were conditions of appearance and did not affect the function of the material. Within the accuracy of the measurements for the length, width, and thickness measurements, there were no significant changes from the initial pre-irradiated benchmarked measurements. The coupon showed a slight increase in weight and density that were within the expected accuracy of the measurements. The neutron attenuation test results showed that there was no loss of Boron-10 from the coupon. The conclusion from the inspection and tests results was that the Boral neutron absorbing material in the spent fuel storage racks have retained their dimensional and neutron-absorption properties and capable of continuing to perform their intended function to absorb neutrons.

The summary of the inspection and testing results for the seven BWR plants discussed above provides objective evidence that the use and trending of industry operating experience demonstrates that the Boral neutron absorbing material will be capable of continuing to perform its intended function absorb neutrons.

2. Hope Creek has had no fuel assembly or blade guide movement impacted by Boral deformation (e.g., swelling, blistering). Almost every cell of the spent fuel pool racks have been accessed except for those cells listed as "DO NOT USE". Station procedure “Supplemental Hope Creek Special Nuclear Material and Core Component Storage Information,” describes the Spent Fuel Pool cells that are considered as "DO NOT USE" cells. Older fuel assemblies (i.e., early plant discharges) have been moved to support Dry Cask Storage campaigns and Thermal Management requirements. There have been no problems experienced either removing fuel assemblies from these cells or inserting other fuel assemblies into these cells. There are 15 cells on the “DO NOT USE” list due to high cell friction. These cells failed drag tests in 1989 (1 cell) and 1992 (14 cells) soon after installation of the spent fuel pool racks and are thus not attributable to Boral deformation. The spent fuel pool racks were installed in multiple phases at Hope Creek. The other cells on this “DO NOT USE” list have interference problems (i.e., with hangers, equipment stored in the spent fuel pool, identification strips, the refueling bridge), have damage at the top of the cells, contain failed fuel assemblies, or contain other equipment (i.e., dummy bundle). There is one cell where the fuel assembly sits high in the cell but this behavior has not been attributed to Boral deformation. Camera inspection did not show Boral swelling or blistering. Therefore, based on the actual usage of the spent fuel pool racks, Hope Creek has no problems with the Boral performance and there is reasonable assurance that the Hope Creek Boral performance is no different from the industry Boral performance. It is acceptable to continue to monitor industry Boral performance rather than perform inspections and /or testing of the Hope Creek Boral test coupons.

As discussed in the examples above, the operating experience of the Boral Monitoring Program did not show any adverse trend in performance. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of the Boral Monitoring Program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Boral Monitoring Program are performed to identify areas that need improvement to maintain the quality performance of the program.

Exceptions to NUREG-1800

None.

Enhancements

None.

Conclusion

The existing Boral Monitoring Program aging management program provides reasonable assurance that reduction of neutron-absorbing capacity and loss of material/general corrosion aging effects are adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.2.2.6 Small-Bore Class 1 Piping Inspection

Program Description

The Small-Bore Class 1 Piping Inspection program is a new program that will manage the aging effect of cracking in small-bore (greater than or equal to NPS 1 and less than NPS 4) Class 1 piping through the use of a combination of volumetric examinations and visual inspections. This new program is comprised of the existing ASME Section XI ISI (Risk Informed Inservice Inspection, RI-ISI) program that performs volumetric and visual examinations for selected Class 1 small-bore butt welds and other selected small-bore socket welds, and a 100% inspection of all accessible Class 1 socket welds in the recirculation system using volumetric or other industry approved techniques. The RI-ISI program provides a robust inspection selection process and is based upon the susceptibility to degradation and the consequences of a piping failure, which is founded on actual service experience with nuclear plant piping failure data. The RI-ISI program requires volumetric and VT-2 examinations on a frequency and number determined by ASME Code Case N-578-1 and the Hope Creek ISI Program Plan. These ongoing inspections combined with a 100% inspection of all accessible Class 1 socket welds in the recirculation system using volumetric or other industry approved techniques will be effective in identifying any age related or underlying deficiencies. Any deficiencies identified are evaluated under the corrective action program.

The Small-Bore Class 1 Piping Inspection program will effectively manage the aging effect of cracking in small-bore (greater than or equal to NPS 1 and less than NPS 4) Class 1 piping by identifying and evaluating cracking prior to loss of intended function.

Aging Management Program Elements

The results of an evaluation of each element against the 10 elements described in Appendix A of the Standard Review Plan of License Renewal Applications for Nuclear Power Plants, NUREG-1800, are provided below.

Scope of Program – Element 1

The scope of the Small-Bore Class 1 Piping Inspection aging management program will include a 100% inspection of the accessible Class 1 socket welds in the recirculation system, as well as ongoing ASME Section XI ISI (Risk Informed Inservice Inspection, RI-ISI) volumetric and visual examinations for selected Class 1 small-bore butt welds and other selected small-bore socket welds. The selected inspections include locations that are susceptible to cracking. The program will include measures to verify that unacceptable cracking indications are not occurring in Class 1 small-bore piping.

The Small-Bore Class 1 Piping Inspection aging management program manages the aging effects for the applicable systems, components, and environments.

Preventive Actions – Element 2

The Hope Creek Small-Bore Class 1 Piping Inspection aging management program is a condition monitoring program and does not include activities for preventing or mitigating aging degradation. The Hope Creek ASME Section XI ISI (Risk Informed Inservice Inspection, RI-ISI) program also does not prevent degradation due to aging effects but provides measures for monitoring to detect weld degradation after its occurrence but prior to loss of intended function. Therefore, no guidance is provided on preventive or mitigating activities.

Parameters Monitored/Inspected – Element 3

Volumetric examinations, or other approved inspection techniques will inspect 100% of all the accessible Class 1 socket welds of the recirculation system to identify degrading welds. Other selected accessible socket welds and small-bore butt welds are inspected to detect cracking caused by stress corrosion cracking, and thermal and mechanical loading. The aspects of program inspection techniques included in the Risk Informed Inservice Inspection (RI-ISI) program are based on the EPRI RI-ISI Topical Report, EPRI TR-112657, and ASME Code Case N-578-1. The elements of the RI-ISI program include the identification of risk important piping segments, the selection of the elements that are to be inspected within the risk important piping, and the identification of the appropriate inspection methods. The Hope Creek RI-ISI program requires examination of selected “high” risk and “medium” risk weld locations to detect cracking in small-bore Class 1 piping.

The inspections include locations that are susceptible to cracking. The program will include measures to verify that unacceptable cracking indications are not occurring in small-bore Class 1 piping. The program inspections detect degradation of components before loss of their intended function. This program is independent of methods to mitigate or prevent degradation.

Detection of Aging Effects – Element 4

The Hope Creek Small-Bore Class 1 Piping Inspection aging management program detects aging effects before there is a loss of the structure and component intended functions. The parameters monitored and inspected ensure the structure and component intended functions will be adequately maintained for license renewal under all CLB design conditions. The aspects of program inspection techniques are appropriate for detecting degrading welds caused by cracking due to stress corrosion, and thermal and mechanical loading. All accessible Class 1 recirculation system small-bore socket welds are inspected for degraded conditions as well as other selected small-bore socket and butt welds, as directed by the RI-ISI program requirements. The program inspection techniques are included in the RI-ISI program and are based on the EPRI RI-ISI Topical Report, EPRI TR-112657, and ASME Code Case N-578-1. For small-bore Class 1 piping, the RI-ISI program requires examination of selected “high” risk and “medium” risk weld locations to detect cracking. Volumetric examinations, or other approved inspection techniques will inspect 100% of all the accessible Class 1 socket welds of the recirculation system to identify degrading welds. Other selected accessible socket welds and small-bore butt welds are inspected to detect cracking caused by stress corrosion cracking, and thermal and mechanical loading.

Historical small-bore piping weld failures on the reactor recirculation system provide the basis for conservatively inspecting all accessible small-bore socket welds in the recirculation system using industry standard inspection techniques.

Monitoring and Trending – Element 5

The intent of the Small-Bore Class 1 Piping Inspection aging management program is to identify conditions such as flaws or other indications that may be precursors to leaks or ruptures in a system's pressure boundary. The process for selecting inspection locations is based upon risk significant components and structures. EPRI TR-112657 and Code Case N-578-1 provide a robust selection process and inspection schedule and is founded on actual service experience with nuclear plant piping failure data. This new program will detect cracking in small-bore Class 1 piping before there is a loss of the intended function for the inspected piping.

All inspections are based on susceptibility, accessibility, dose considerations, operating experience, and limiting locations of the total population of small-bore Class 1 piping locations. The frequency of the inspections will detect cracking and age related degradation prior to loss of intended function, based on industry and plant-specific operating experience. A risk informed inspection schedule directs appropriate inspections to be performed on a timely basis and results of the inspections are evaluated in accordance with station corrective action procedures, which direct additional inspections as required. This demonstrates the program is not based solely on detecting aging degradation but evaluates corrective action items that prevent a loss of intended functions.

Acceptance Criteria – Element 6

Examinations that reveal flaws or relevant indications exceeding acceptance criteria may be acceptable by supplemental examinations, corrective measures, repair/replacement activities, or analytical evaluations in accordance with ASME Code Case N-578-1. The alternative criteria for additional examinations contained in Code Case N-578-1 provide more guidance for examination method and categorization for parts to be examined. The supplemental inspections performed on accessible recirculation system piping will be evaluated, reviewed, and dispositioned consistent with ASME Section XI code requirements.

Acceptance criteria for the inspections in this program are based on inspection criteria specified in the RI-ISI program implementation procedures. The conditional acceptance criteria ensure that the structure and component intended function are maintained under all CLB design conditions. The acceptance criteria include, but are not limited to evaluations from thickness profiles, excess surface signals, tip signal plots, to name a few. Focused transducers may be used for flaw sizing and characteristics.

Acceptance criteria for the inspections in this program are based on results meeting ASME Code Case N-578-1, Subarticle-2430 criteria. The alternative criteria for additional examinations contained in Code Case N-578-1 provide more guidance for acceptance criteria. Results meeting these criteria are considered to be without degradation, and the intended function will therefore be maintained under all CLB conditions. Identified degradation will be evaluated to verify the ability to perform its intended function under applicable design basis conditions, and to determine if corrective actions are required. The ability of pressure retaining component requirements and structural requirements under applicable design basis operating and environmental conditions are evaluated.

Acceptance criteria for the volumetric inspections in this program are quantitative, in that the requirement is to maintain the CLB design conditions. Visual inspections are qualitative in that they are relied upon to determine if any cracking is occurring based on the visually observable surface conditions. Indications of significant cracking or other significant degradation will require additional evaluation to quantify the material and compare it to the applicable design requirements. Visual and volumetric inspections are performed by qualified personnel in accordance with approved station procedures meeting all applicable ASME code requirements.

Corrective Actions – Element 7

Evaluations are performed for inspection results that do not satisfy acceptance criteria and a notification is initiated to document the concern in accordance with plant administrative procedures that meet the requirements of 10 CFR Part 50, Appendix B. The corrective action program and specific corrective action steps as specified in procedures ensure that any conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined and an action plan is developed to preclude recurrence.

Identified weld degradation will be evaluated for the structure and components ability to perform its intended function under applicable design basis conditions, and to determine if corrective actions are required. The degradation is evaluated based on pressure retaining and structural requirements under applicable design basis operating and environmental conditions.

Confirmation Process – Element 8

The corrective action program and specific corrective action steps as specified in procedures ensure that any conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined and an action plan is developed to preclude recurrence.

The Small-Bore Class 1 Piping Inspection aging management program is a condition monitoring program.

The site corrective action program, quality assurance (QA) procedures, site review and approval process, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. Evaluations will be performed for inspection results that do not satisfy established criteria and a notification report will be initiated to document the concern in accordance with the 10 CFR Part 50, Appendix B corrective action program. The 10 CFR Part 50, Appendix B corrective action program address the corrective actions, confirmation process, and administrative controls and ensures that the conditions adverse to quality are promptly corrected. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined and an action plan is developed to preclude recurrence and review extent of condition. Continued periodic inspections will confirm the effectiveness of prior corrective actions taken.

Administrative Controls – Element 9

Administrative controls for this program are in accordance with station procedures, and include a formal review and approval process.

Administrative controls for this program are in accordance with regulatory and station procedures. The RI-ISI program requirements are maintained and controlled by the RI-ISI Program Implementation Procedure. Administrative controls for the implementation of the new supplemental inspection program have been established and will be maintained in accordance with the Hope Creek station procedure review and approval process.

Operating Experience- Element 10

The evaluations use a combination of volumetric and visual inspection techniques with demonstrated capability to detect cracking in piping weld and base material. The application of the specific inspection technique for small-bore Class 1 piping is appropriate to detect cracking before the examination.

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the Small-Bore Class 1 Piping Inspection program will be effective in assuring that intended function(s) will be maintained consistent with the CLB for the period of extended operation:

1. Small-bore pipe cracking in the reactor recirculation loop was first observed in February 1987 on the Loop “A” discharge valve seat drain. After the condition was discovered, an investigation into the cause of the crack was performed as was an industry review to determine corrective action required to prevent a recurrence of the event. The analysis found the cause of the cracking was initiated by an original root weld imperfection which was then propagated by the recirculation pump speed induced piping vibrations. The section of the failed pipe weld was removed and replaced with a shorter piece to raise the natural resonant frequency of the piece and the issue was believed to be solved.

   Later in that year during a mid-cycle outage, cracks were observed at the flow transmitter instrument line on the outer radius of the “B” suction loop elbows. In addition, more failures were observed at the “A” loop discharge valve bonnet and packing gland vents. The damaged vent connections were found to be caused by vibration fatigue and the corrective actions were to cut and cap the drain lines.

Following similar failures of recirculation system isolation valve seat drain assemblies and instrumentation piping in 1988, 2001, and 2005, engineering evaluations recommended the recirculation pump speeds are limited to reduce small-bore piping vibration. Additional corrective actions included detailed fatigue analyses, weld repairs, piping replacements, and the implementation of a non-destructive examination program. Together these corrective action items have prevented additional failures from occurring on the recirculation piping system since 2005.

This OE show that adverse conditions are identified and the corrective action items implemented are effective in preventing adverse conditions from occurring in the recirculation piping system.

2. In October 2001, while performing a primary containment walkdown at the beginning of the 10th refueling outage, plant personnel observed a leak on the 'A' Reactor Recirculation Pump suction pipe elbow taps. The observed leak was producing a 3-4' spray with the reactor vessel pressure at approximately 300-400 psig.

   The condition was entered into the corrective action program and a root cause evaluation was performed. The leak was located where a 1" pipe is welded to the 28" suction line of the “A” recirculation pump. After the pipe insulation was removed at the failure location, it was determined that the failure occurred at a socket weld fitting. The visible through wall crack extended for approximately 180 degrees about the circumference. The visual examination did not show any evidence of external corrosion degradation such as pitting on the base metal or weld and determined that a single circumferential through wall crack was confined to the weld. Radiographic examination indicated that there was a gap at the bottom of the socket weld fitting, as expected, in addition to showing the single through wall crack. No other significant indications were noted in the failed fillet weld.

   The Root Cause investigation found that the crack was attributed to a fatigue failure at the toe of the socket weld. The weld crack was at a location typical to promote fatigue failure in a highly susceptible system. The crack was most likely caused by the second natural frequency of the piping combined with the additional accelerometer weight, being resonant with the five-vane passing, running frequency of the “A” Recirc pump. Corrective action consisted of repair of the cracked weld using a 2 X 1 weld profile and the removal of the accelerometers on both the “A” and “B” recirculation lines. In addition, an extent of condition evaluation was performed that resulted in a walk down of all recirculation sample lines for similar conditions as well as the performance of dye-penetrant examination of all other susceptible welds.

   The effectiveness of the corrective actions was confirmed by inspections on other lines (lines originating at the outside radius of the elbow, used for flow indication) to confirm no further cracking was occurring. Volumetric examinations were performed during refueling outages R11 and R12 with no flaws detected. A penetrant exam was performed during the R13 refueling outage, with no flaws detected. The inspection frequency has now been increased to 72 months.

This OE provides objective evidence that the walkdown and inspection programs are effective in detecting incipient cracks in the small-bore piping. It also demonstrates the effectiveness of the corrective action process in determining the cause and the development and implementation of effective corrective actions to prevent recurrence of an adverse condition.

3. Hope Creek was taken off line the weekend of March 26, 2005, to investigate the source of unidentified drywell leakage, which had been increasing over the prior few weeks. The source of the leak was determined to be a crack in a weld on a 4 inch NPS portion of the B Reactor Recirculation system decontamination assembly.

   The condition was entered into the plant corrective action program and a root cause investigation was performed. The cause of the crack was determined to be a direct result of fatigue initiation and propagation due to the configuration of the 4 inch NPS portion of the B Reactor Recirculation system decontamination connection assembly.

   Corrective action consisted of removing the cracked weld and replacing the weld. This action was completed prior to restart from the outage. Corrective action to prevent future fatigue cracking of the decontamination connections was to shorten the length of the 4 inch decontamination connection pipe to increase its natural frequency to be non-coincident with the normal recirculation pump vane passing frequencies. This was performed on both the A and B Loop decontamination connections. This action was also completed prior to restart from the outage. The extent of condition (EOC) evaluation resulted in inspections on similar piping connections in the reactor recirculation system but did not identify any additional cracking. These inspections included penetrant testing (PT), ultrasonic testing (UT), and radiographic testing (RT) exams. In addition, EOC analyses and calculation reviews did not identify other similar design vulnerabilities.

   The effectiveness of the corrective actions was confirmed through follow-up visual surface and UT inspections of the Recirc system decontamination assemblies during the following outage.

   This OE provides objective evidence that the walkdown and inspection programs are effective in detecting incipient cracks in the small-bore piping. This OE also demonstrates the effectiveness of the corrective action process in determining the cause and developing and implementing effective corrective actions to prevent recurrence of an adverse condition.

4. In May 2003 during the RF11 outage, a VT-2 inservice leak test was performed on Class 1 systems. During the inspections the following discrepancies were noted and entered into the corrective action process for

appropriate corrective action. Numerous valve packing leaks were discovered, a small through seat leak was noted on a solenoid valve, and seven leaks were identified ranging from 5 to 50 drops per minute from control rod drive flange joints. All of the above identified leaks were repaired or dispositioned appropriately utilizing the corrective action process.

Although none of the issues identified above constituted a loss or degradation of the Class 1 pressure boundary, the inspection techniques and sensitivity to reporting these types of leaks demonstrates a high level of assurance that the program provides appropriate guidance for inspections and evaluations, deficiencies are entered into the corrective action process, and appropriate action is taken as necessary to ensure effective condition monitoring of piping and components within the scope of license renewal.

The above examples provide objective evidence that existing Class 1 ISI inspections supplemented with the new Small-Bore Class 1 Piping Inspection aging management program are capable of both monitoring and detecting the aging effects of cracking.

The operating experience related to the Small-Bore Class 1 Piping Inspection program did not show any adverse trend in performance. Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence as required per applicable investigations. There is sufficient confidence that the implementation of the Small-Bore Class 1 Piping Inspection program will effectively identify degradation prior to failure or loss of intended function. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of the Small-Bore Class 1 Piping Inspection program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Exceptions to NUREG-1800

None.

Enhancements

None.

Conclusion

The new Small-Bore Class 1 Piping Inspection aging management program will provide reasonable assurance that the aging effects of cracking will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.3 NUREG-1801 Chapter X Aging Management Programs

This section provides summaries of the NUREG-1801 Chapter X programs credited for managing the effects of aging.

B.3.1.1 Metal Fatigue of Reactor Coolant Pressure Boundary

Program Description

The Metal Fatigue of Reactor Coolant Pressure Boundary Program is an existing program that manages cumulative fatigue damage in the selected reactor coolant components subject to the reactor coolant and treated water environments.

The Metal Fatigue of Reactor Coolant Pressure Boundary Program is a preventive program that monitors and tracks the number of critical thermal and pressure transients to ensure that the cumulative usage factors for selected reactor coolant pressure boundary components remain less than 1.00 through the period of extended operation. The program determines the number of transients that occur and updates the 60-year projections as required on an annual basis. A software program, FatiguePro, computes cumulative usage factors for select locations.

The effect of the reactor coolant environment on fatigue usage, known as environmental fatigue, has been evaluated for the period of extended operation using the formulae contained in NUREG/CR-6583 for carbon and low-alloy steels and NUREG/CR-5704 for austenitic stainless steels. The fatigue usage associated with the effects of the reactor coolant environment will be included into the ongoing monitoring program.

The program requires the generation of a periodic fatigue monitoring report, including a listing of transient events, cycle summary event details, cumulative usage factors, a detailed fatigue analysis report, and a cycle projection report. If the fatigue usage for any location has had an unanticipated increase based on cycle accumulation trends or if the number of cycles is approaching their limit, the corrective action program is used to evaluate the condition and determine the corrective action. Acceptable corrective actions include repair of the component, replacement of the component, and a more rigorous analysis of the component to demonstrate that the design code limit will not be exceeded during the period of extended operation. Corrective actions include a review of additional affected reactor coolant pressure boundary locations.

The continued implementation of the Metal Fatigue of Reactor Coolant Pressure Boundary aging management program provides reasonable assurance that fatigue of reactor coolant pressure boundary components will be managed so that the intended functions of the components within the scope of License Renewal will be maintained during the period of extended operation.

The preventive activities employed by the program are effective in preventing cumulative fatigue damage and are adequate to prevent significant degradation.

NUREG-1801 Consistency

The Metal Fatigue of Reactor Coolant Pressure Boundary program is consistent with the ten elements of aging management program X.M1, “Metal Fatigue of Reactor Coolant Pressure Boundary”, specified in NUREG-1801.

Exceptions to NUREG-1801

None.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

1. The Metal Fatigue of Reactor Coolant Pressure Boundary program will be enhanced to include additional transients beyond those defined in the Technical Specifications and the UFSAR, and expanding the fatigue monitoring program to encompass other components identified to have fatigue as an analyzed aging effect, which require monitoring. **Program Elements Affected: Parameters Monitored or Inspected (Element 3)**
2. The Metal Fatigue of Reactor Coolant Pressure Boundary program will be enhanced to use a software program to automatically count transients and calculate cumulative usage on select components. **Program Elements Affected: Scope of Program (Element 1), Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Monitoring and Trending (Element 5) and Acceptance Criteria (Element 6)**
3. The Metal Fatigue of Reactor Coolant Pressure Boundary program will be enhanced to address the effects of the reactor coolant environment on component fatigue life by assessing the impact of the reactor coolant environment on a sample of critical components for the plant identified in NUREG/CR-6260. **Program Elements Affected: Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Monitoring and Trending (Element 5) and Acceptance Criteria (Element 6)**
4. The Metal Fatigue of Reactor Coolant Pressure Boundary program will be enhanced to require a review of additional reactor coolant pressure boundary locations if the usage factor for one of the environmental fatigue sample locations approaches its design limit. **Program Elements Affected: Corrective Actions (Element 7)**

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the Metal Fatigue of Reactor Coolant Pressure Boundary program will be effective in assuring that intended function(s) would be maintained consistent with the CLB for the period of extended operation:

1. Hope Creek experienced an Emergency Core Cooling System (ECCS) actuation on May 29, 2007. As a result, there was a High Pressure Coolant Injection (HPCI) injection through the Core Spray nozzle. The corrective action program was invoked to update the fatigue usage analysis for the Core Spray nozzle. The analysis consisted of the latest information from the Metal Fatigue of Reactor Coolant Pressure Boundary program, and confirmed that the cumulative usage factor was still less than 1.00 for the Core Spray nozzle. Therefore, this example provides objective evidence that the program's confirmation process was successfully used and that the program engineer was able to verify that the design basis was maintained for a reactor pressure boundary component.

2. In October 2004, Hope Creek experienced a High Pressure Coolant Injection (HPCI) event. As a result, the actual cumulative injection cycles exceeded the number of events that was assumed in the Core Spray (CS) nozzle fatigue analysis. The HPCI event is considered an Emergency Core Cooling System (ECCS) injection event, which was not previously monitored in the program. The corrective action program was used to evaluate the condition, resulting in an analysis indicating that the cumulative usage factor was 0.815, which is less than the design limit of 1.0. Another corrective action was implemented to update the cycle counting procedure to specifically include ECCS injections to ensure future ECCS injections are counted. The extent of condition indicated that this condition was an isolated case. Therefore, this example provides objective evidence that the existing Metal Fatigue of Reactor Coolant Pressure Boundary program is capable of evaluating conditions that have exceeded original design limits to ensure that the design basis of the reactor coolant boundary is maintained, and to take corrective action to prevent a recurrence of the condition.

3. The Metal Fatigue of Reactor Coolant Pressure Boundary program tracks component cycles and transients. The program has a corrective action process where if the Ratio of Lifetime Cycles (RLC40) exceeds 1.0 for any cycle limit, a SAP Notification is generated to evaluate the condition for future actions. The 2006 annual review of plant transients indicated that the Heatup and Cooldown transients will exceed the 40-year lifetime ratio if the current trend of transients continues. The evaluation of this condition indicated that there were a large number of heatups and cooldowns early in plant life. From 1986 through 1995 there were 5 transients per year. From 1996 through 2002 the trend was down to 1.6 per year. The current trend (2003 through 2006) is 3.5 transients per year. The 40-year life limit for both categories (heatups and cooldowns) is 120 cycles, or equivalent to an average of 3 transients of each category per year. As of 12/31/2007, the cycle count for these categories is 79, thus there is adequate margin to prevent cracking due to fatigue. The corrective action for this condition is to continue to trend the transients in accordance with the program.

4. To support the TLAAs associated with metal fatigue of the reactor coolant system pressure boundary components, Hope Creek analyzed the projected cumulative usage factor, incorporating the environmental fatigue effects for the six (6) NUREG/CR-6260 locations; Reactor Vessel (CRD

penetrations), Reactor Recirculation Piping (recirculation inlet and outlet nozzles), Reactor Vessel Feedwater Nozzle (nozzle safe end and corner), Core Spray Line Reactor Vessel Nozzle and associated Class 1 Piping (nozzle safe end and corner), Feedwater Line Class 1 Piping (tee), and the RHR Class 1 Piping (RHR supply and return piping). The detailed analyses found the cumulative usage factors, with the environmental factor added, had met the acceptance criteria of < 1.0 for all locations except for the reactor pressure vessel feedwater nozzle safe end. Hope Creek will implement a computer-based program, which will continually monitor plant data and provide current stress-based and cycle-based fatigue calculations for the six NUREG/CR-6260 locations to ensure that the RCS pressure boundary design basis is maintained. Corrective action will be taken prior to exceeding the environmental assisted fatigue CUF value of 1.0. Therefore, this example provides objective evidence that the Metal Fatigue of Reactor Coolant Pressure Boundary program completed the 60-year environmental fatigue assessments required for license renewal, a computer-based program will continue to monitor the fatigue usage at the select locations and that corrective actions will be taken prior to the environmental assisted fatigue cumulative usage factors exceeding the acceptance criteria of 1.0.

Problems identified would not cause significant impact to the safe operation of the plant, and adequate corrective actions were taken to prevent recurrence. There is sufficient confidence that the implementation of Metal Fatigue of Reactor Coolant Pressure Boundary program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found. Assessments of Metal Fatigue of Reactor Coolant Pressure Boundary program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The enhanced Metal Fatigue of Reactor Coolant Pressure Boundary program will provide reasonable assurance that the cumulative fatigue damage aging effects will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained consistent with the current licensing basis during the period of extended operation.

B.3.1.2 Environmental Qualification (EQ) of Electric Components

Program Description

The Environmental Qualification (EQ) of Electric Components program is an existing program that manages components' thermal, radiation, and cyclical aging through the use of aging evaluations in adverse localized environments. The Environmental Qualification (EQ) of Electric Components program implements preventive activities to ensure that the qualified life of components within the scope of the program is maintained through the period of extended operation.

The Environmental Qualification (EQ) of Electric Components program implements the requirements of 10 CFR 50.49, NUREG-0588, NRC Regulatory Guide 1.89, Rev. 1, DOR Guidelines, and Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors.

The Environmental Qualification (EQ) of Electric Components program is an existing program implemented through station procedures and preventive maintenance tasks. The Environmental Qualification (EQ) of Electric Components program complies with 10 CFR 50.49, "Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants." The program provides for maintenance of the qualified life for electrical equipment within the scope of the Environmental Qualification (EQ) of Electric Components program. Program activities establish, demonstrate, and document the level of qualification, qualified configuration, maintenance, surveillance and replacement requirements necessary to meet 10 CFR 50.49. Reanalysis addresses attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, corrective actions if acceptance criteria are not met, and the period of time prior to the end of qualified life when the reanalysis will be completed. Qualified life is determined for equipment within the scope of the Environmental Qualification (EQ) of Electric Components program and appropriate actions such as replacement or refurbishment, or reanalysis, are taken prior to or at the end of the qualified life of the equipment so that the aging limit is not exceeded.

NUREG-1801 Consistency

The Environmental Qualification (EQ) of Electric Components aging management program is consistent with the ten elements of aging management program X.E1, "Environmental Qualification (EQ) of Electric Components," specified in NUREG 1801.

Exceptions to NUREG-1801

None.

Enhancements

None.

Operating Experience

Demonstration that the effects of aging are effectively managed is achieved through objective evidence that shows that aging effects and mechanisms are being adequately managed. The following examples of operating experience provide objective evidence that the Environmental Qualification (EQ) of Electric Components program will be effective in assuring that intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation:

1. In September 2001, the Hope Creek collected actual temperature data in the High Pressure Coolant Injection (HPCI) Room 4111 due to active steam leaks. The temperature information was provided to the EQ engineer to evaluate the impact on EQ for the HPCI pump motor. The EQ engineer concluded that the pump motor had a qualified life of 7.75 years and required a replacement on 12/24/01. The motor was replaced during the 2001 outage. This example provides objective evidence that the existing Environmental Qualification (EQ) of Electric Components program is capable of addressing changing plant conditions and re-evaluating the technical basis for EQ life, making recommendations, and including recommendations implementation.

2. As part of implementing corrective action from a Level 1 Root Cause Analysis, the Environmental Qualification (EQ) of Electric Components program was revised to direct the EQ engineer to look ahead two (2) years for EQ orders to ensure they are properly launched and planned for work, since there may be long lead times for parts, or the work would have to be scheduled into outages, etc. In January 2009, the EQ engineer performed the 2-Year look ahead and found several missing EQ orders for components that would have otherwise missed their dates for maintenance work. The planned EQ work was listed in the SAP files, but the work orders had not been generated from this data. The missing EQ order information was provided from the EQ engineer to the work planners for incorporation into the maintenance plans. This example provides objective evidence that the existing Environmental Qualification (EQ) of Electric Components program has incorporated corrective actions to prevent recurrence, and found opportunities at the site to improve the EQ program.

3. Hope Creek initiated an effort to re-evaluate all EQ maintenance frequencies while converting the EQ binders into an electronic format in 2007. The re-evaluation updated all of the EQ calculations, and resulted in extending the EQ maintenance of several component types, providing a significant cost savings to the company. This example provides objective evidence that the Environmental Qualification (EQ) of Electric Components program allows for improvements such as re-evaluations of components for EQ maintenance frequencies with technical justification.

There is sufficient confidence that the implementation of the Environmental Qualification (EQ) of Electric Components program will effectively identify degradation prior to failure. Appropriate guidance for re-evaluation, repair, or replacement is provided for locations where degradation is found.

Assessments of the Environmental Qualification (EQ) of Electrical Components program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Conclusion

The existing Environmental Qualification (EQ) of Electric Components program provides reasonable assurance that aging effects are adequately managed so that the intended functions of components within the scope of 10 CFR 50.49 will be maintained consistent with the current licensing basis during the period of extended operation.

APPENDIX C

RESPONSE TO BWRVIP APPLICANT ACTION ITEMS

Of the BWRVIP reports credited for Hope Creek license renewal, the following NRC safety evaluation reports (SERs) for license renewal have licensee action items:

- BWRVIP-18-A BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines
- BWRVIP-25 BWR Core Plate Inspection and Flaw Evaluation Guidelines
- BWRVIP-26-A BWR Top Guide Inspection and Flaw Evaluation Guidelines
- BWRVIP-38 BWR Shroud Support Inspection and Flaw Evaluation Guidelines
- BWRVIP-41 BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines (Revision 1)
- BWRVIP-42-A BWR LPCI Coupling Inspection and Flaw Evaluation Guidelines
- BWRVIP-47-A BWR Lower Plenum Inspection and Flaw Evaluation Guidelines
- BWRVIP-48-A BWR Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines
- BWRVIP-49-A BWR Instrument Penetration Inspection and Flaw Evaluation Guidelines
- BWRVIP-74-A BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines

License renewal applicant action items (AAIs) identified in the corresponding SERs for each of the above BWRVIP reports are addressed in the following tables. BWRVIP-76 is not included because the SER has not yet been issued. BWRVIP-27-A is not included because the Hope Creek Standby Liquid Control system does not inject through the Core DP penetration. BWRVIP reports without SERs for license renewal have no AAIs and are therefore not included in the tables.

It is recognized that the first three AAIs from each of the license renewal SERs applicable to the above BWRVIP reports are fundamentally identical. For that reason they are combined in the table and addressed together.

Action Item Description	HCGS Response
Common Action Items from BWRVIP-18-A, -25, -26-A, -38, -41, 42-A, -47A, -48-A, -49-A, -74-A	
BWRVIP-All (1) The license renewal applicant is to verify that its plant is bounded by the report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within these BWRVIP reports described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The BWRVIP reports applicable to Hope Creek have been reviewed and verified that Hope Creek is bounded by the reports. Additionally, Hope Creek commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operations. If, upon review of a BWRVIP approved guideline, it is determined that known exceptions to full compliance are warranted, the NRC will be notified of the exception within 45 days of the receipt of NRC final approval of the guideline. Commitments are administratively controlled in accordance with the requirements of 10 CFR 50, Appendix B
BWRVIP-All (2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contains a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAAs for the period of extended operation. Those applicants for license renewal referencing the applicable BWRVIP report shall ensure that the programs and activities specified as necessary in the applicable BWRVIP reports are summarily described in the FSAR supplement.	The FSAR supplements for Hope Creek are included as Appendix A of the LRA and include a summary of the programs and activities specified as necessary for the BWRVIP program.

Action Item Description	HCGS Response
BWRVIP-All (3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. The applicable BWRVIP reports may state that there are no generic changes or additions to technical specifications associated with the report as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the applicable BWRVIP report shall ensure that the inspection strategy described in the reports does not conflict with or result in any changes to their technical specifications. If technical specification changes or additions do result, then the applicant must ensure that those changes are included in its application for license renewal.	There are no technical specification changes identified for Hope Creek based upon the BWRVIP reports.
Additional Action Items	
BWRVIP-18-A Core Spray Internals Inspection and Flaw Evaluation Guidelines	
BWRVIP-18 (4) Applicants referencing the BWRVIP-18 report for license renewal should identify and evaluate any potential TLAA issues which may impact the structural integrity of the subject RPV internal components.	There were no TLAA issues identified for the Hope Creek internal core spray components.

BWRVIP-25 Core Plate Inspection and Flaw Evaluation Guidelines	
BWRVIP-25 (4) Due to susceptibility of the rim hold-down bolts to stress relaxation, applicants referencing the BWRVIP-25 report for license renewal should identify and evaluate the projected stress relaxation as a potential TLAA issue.	Preload of the rim hold-down bolts is required to prevent lateral motion of the core plate for those plants that do not have core plate wedges installed. While a generic study reported in Appendix B of BWRVIP-25 states that the Hope Creek core plate rim hold down bolts will retain at least 81% of their preload, a plant specific analysis is required to determine the amount of preload necessary to prevent core plate motion throughout the period of extended operation. To address this issue, a plant-specific fluence analysis was performed to determine fluence values at the core plate rim hold down bolt locations at various EFPY values up to 56 EFPY. A plant-specific structural analysis was then performed using the new fluence values and it determined that the pre-load of the rim hold down bolts would be sufficient to prevent lateral motion of the core plate until the plant reaches 43.9 EFPY, which will occur after entry into the period of extended operation. Since this analysis will not bound 56 EFPY (60 years), additional actions are required. Prior to the period of extended operation, the plant will install core plate wedges or perform an analysis to demonstrate the component function is maintained.
BWRVIP-25 (5) Until such time as an expanded technical basis for not inspecting the rim hold-down bolts is approved by the staff, applicants referencing the BWRVIP-25 report for license renewal should continue to perform inspections of the rim hold-down bolts.	Hope Creek inspection operating experience associated with the core plate rim hold-down bolts is described in Section B.2.1.9 of the application. Until such time as an expanded technical basis for not inspecting the rim hold-down bolts is approved by the NRC, Hope Creek will continue to perform inspections of the rim hold-down bolts, unless core plate wedges are installed.

BWRVIP-26-A Top Guide Inspection and Flaw Evaluation Guidelines	
BWRVIP-26 (4) Due to IASCC susceptibility of the subject safety-related components, applicants referencing the BWRVIP-26 report for license renewal should identify and evaluate the projected accumulated neutron fluence as a potential TLAA issue.	Hope Creek has determined that the neutron fluence threshold for IASCC susceptibility has been exceeded. No TLAA has been identified. During the period of extended operation, the aging of the top guide will be managed by inspections conducted as part of the Hope Creek BWR Vessel Internals program. The Hope Creek BWR Vessel Internals program now requires that at least 10% of the grid beam cells containing control rod drives/blades will be inspected every twelve years with at least one-half of the inspections being performed within the first six years of each twelve-year interval. The top guide locations to be inspected are those subject to neutron fluence levels that exceed the IASCC threshold of 5.0E+20 n/cm2. The inspections are performed using the enhanced visual inspection technique, EVT-1. Hope Creek will continue to perform inspections on at least 10% of the top guide locations every twelve years during the period of extended operation.
BWRVIP-42-A BWR LPCI Coupling Inspection and Flaw Evaluation Guidelines.	
BWRVIP-42 (4) Applicants referencing the BWRVIP-42 report for license renewal should identify and valuate any potential TLAA issues which may impact the structural integrity of the subject RPV internal components	There is no TLAA identified for the LPCI coupling.
BWRVIP-42 (5) The BWRVIP committed to address development of the technology to inspect inaccessible welds and to have the individual LR applicant notify the NRC of actions planned. Applicants referencing BWRVIP-42 report for license renewal should identify the action as open and to be addressed once the BWRVIP's response to this issue has been reviewed and accepted by the staff.	Hope Creek inspects the LPCI coupling in accordance with guidelines described in BWRVIP-42-A, except for one inaccessible location. HCGS recognizes the inspection of inaccessible welds is a generic open action. HCGS will address this issue once the BWRVIP's response to this issue has been reviewed and accepted by the NRC.
BWRVIP-47-A, BWR Lower Plenum Inspection and Flaw Evaluation Guidelines	
BWRVIP-47 (4) Due to fatigue of the subject safety-related components, applicants referencing the BWRVIP-47 report for LR should identify and evaluate the projected CUF as a potential TLAA issue.	Fatigue usage is considered a TLAA for lower plenum components. This is addressed in Section 4.3.1 of the LRA.

BWRVIP-74-A , BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines	
BWRVIP-74-A (4) The staff is concerned that leakage around the reactor vessel seal rings could accumulate in the VFLD lines, cause an increase in the concentration of contaminants and cause cracking in the VFLD line. The BWRVIP-74 report does not identify this component as within the scope of the report. However, since the VFLD line is attached to the RPV and provides a pressure boundary function, LR applicants should identify an AMP for the VFLD line.	The Hope Creek vessel flange leak detection line (VFLD) is included in the scope of scope of license renewal. Aging of the vessel flange leak detection line is managed by the Water Chemistry and One-Time Inspection programs. .
BWRVIP-74-A (5) LR applicants shall describe how each plant-specific aging management program addresses the following elements: (1) scope of program, (2) preventative actions, (3) parameters monitored and inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.	There is no plant-specific aging management program credited for managing aging of the Hope Creek reactor vessel. Descriptions of the Hope Creek aging management programs credited for managing the reactor pressure vessel are described in Appendix B. These descriptions include any program element that deviates from the NUREG-1801 program element.
BWRVIP-74-A (6) The staff believes inspection by itself is not sufficient to manage cracking. Cracking can be managed by a program that includes inspection and water chemistry. BWRVIP-29 describes a water chemistry program that contains monitoring and control guidelines for BWR water that is acceptable to the staff. BWRVIP-29 is not discussed in the BWRVIP-74 report. Therefore, in addition to the previously discussed BWRVIP reports, LR applicants shall contain water chemistry programs based on monitoring and control guidelines for reactor water chemistry that are contained in BWRVIP-29.	As discussed in Appendix B, the Hope Creek Water Chemistry Control program meets the requirements of the latest BWRVIP Water Chemistry guidelines (BWRVIP-130) to help ensure the long-term integrity of the reactor vessel and internals. As described in the Water Chemistry program, BWRVIP-130 replaced BWRVIP-29 as the BWR water chemistry standard. Revisions later than BWRVIP-29 are permitted by Chapter XI.M2 of NUREG-1801. Several aging management programs credit the Water Chemistry program to mitigate cracking of reactor vessel components, including the BWR Stress Corrosion Cracking Program and the BWR Internals program.
BWRVIP-74-A (7) LR applicants shall identify their vessel surveillance program, which is either an ISP or plant-specific-in-vessel surveillance program, applicable to the LR term.	As described in Appendix B, the Reactor Vessel Surveillance program for Hope Creek is an Integrated Surveillance Program (ISP) for the license renewal term.

BWRVIP-74-A (8) LR applicants should verify that the number of cycles assumed in the original fatigue design is conservative to assure that the estimated fatigue usage for 60 years of plant operation is not underestimated. The use of alternative actions for cases where the estimated fatigue usage is projected to exceed 1.0 will require case-by-case staff review and approval. Further, a LR applicant must address environmental fatigue for the components listed in the BWRVIP-74 report for the LR period.	Metal fatigue (including discussions of cycles, projected cumulative usage factors, environmental factors, etc.) is evaluated as a TLAA in Chapter 4.3 of the LRA. Environmental fatigue for those components described in NUREG/CR-6260 is addressed in Section 4.3 of the LRA.
BWRVIP-74-A (9) Appendix A to the BWRVIP-74 report indicates that a set of P-T curves should be developed for the heat-up and cool-down operating conditions in the plant at a given EFPY in the LR period.	The development of P-T limit curves for Hope Creek for the period of extended period of operation is described as a TLAA in Section 4.2 of the LRA.
BWRVIP-74-A (10) To demonstrate that the beltline materials meet the Charpy USE criteria specified in Appendix B of the report, the applicant shall demonstrate that the percent reduction in Charpy USE for their beltline materials are less than those specified for the limiting BWR/3-6 plates and the non-Linde 80 submerged arc welds and that the percent reduction in Charpy USE for their surveillance weld and plate are less than or equal to the values projected using the methodology in RG 1.99, Revision 2.	The discussion of Charpy upper shelf energy (USE) evaluation for Hope Creek for the LR period is described as a TLAA in Section 4.2 of the LRA.
BWRVIP-74-A (11) To obtain relief from the in-service inspection of the circumferential welds during the LR period, the BWRVIP report indicates each licensee will have to demonstrate that (1) at the end of the renewal period, the circumferential welds will satisfy the limiting conditional failure frequency for circumferential welds in the Appendix E for the staff's July 28, 1998, SER, and (2) that they have implemented operator training and established procedures that limit the frequency of cold overpressure events to the amount specified in the staff's FSER.	The discussion of the relief from the in-service inspection of the circumferential welds for Hope Creek for the LR period is described in Section 4.2 of the LRA.
BWRVIP-74-A (12) As indicated in the staff's March 7, 2000, letter to Carl Terry, a LR applicant shall monitor axial beltline weld embrittlement. One acceptable method is to determine that the mean RT_{NDT} of the limiting axial beltline weld at the end of the period of extended operation is less than the values specified in Table 1 of this FSER.	The unit-specific axial weld probability of failure calculated for Hope Creek is less than the failure probabilities calculated by the NRC staff. Refer to the discussion of the Reactor Pressure Vessel Axial Weld Failure Probability TLAA in Section 4.2 of the LRA.

BWRVIP-74-A (13) The Charpy USE, P-T limit, circumferential weld and axial weld RPV integrity evaluations are all dependent upon the neutron fluence. The applicant may perform neutron fluence calculations using staff approved methodology or may submit the methodology for staff review. If the applicant performs the neutron fluence calculation using a methodology previously approved by the staff, the applicant should identify the NRC letter that approved the methodology.	Hope Creek used an NRC approved methodology to determine fluence for the period of extended operation, as discussed in Section 4.2 of the LRA.
BWRVIP-74-A (14) Components that have indications that have been previously analytically evaluated in accordance with sub-section IWB-3600 of Section XI to the ASME Code until the end of the 40-year service period shall be re-evaluated for the 60-year service period corresponding to the LR term.	Hope Creek has not performed flaw evaluations for found indications in accordance with subsection IWB-3600 of ASME Section XI for the 40-year life of the plant. Therefore there are no indications that require re-evaluation for the period of extended operation.

APPENDIX D Technical Specification Changes

(This Appendix is not used).