# LICENSE RENEWAL APPLICATION

RIVER BEND STATION

FACILITY OPERATING LICENSE NPF-47

MAY 2017

# PREFACE

The following describes the information location, layout, and editorial conventions in the River Bend Station (RBS) License Renewal Application (LRA) (hereinafter referred to as "this application" or "the application"). Abbreviated names and acronyms used throughout the application are defined at the end of this preface. Commonly understood terms (such as U.S.) and terms used only in referenced document numbers may not be identified in this table. Regulatory documents such as NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, and 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," may be referred to by the document number, i.e., NUREG-1801 and 10 CFR 54, respectively. References to the USAR are to the RBS Updated Safety Analysis Report, Revision 24.

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

Section 2 describes and justifies the methods used to determine the systems and structures within the scope of license renewal and the structures and components subject to aging management review. The results of the system and structure scoping are provided in Tables 2.2-1 through 2.2-5. Tables 2.2-1, 2.2-3 and 2.2-4 list mechanical systems, electrical and instrumentation and controls (I&C) systems, and structures, respectively, within the scope of license renewal. Tables 2.2-2 and 2.2-5 list the systems and structures, respectively, not within the scope of license renewal. Section 2 also provides descriptions of in-scope systems and structures and their intended functions with tables identifying components and commodities requiring aging management review and their component intended functions. References are provided to the results of the aging management reviews in Section 3. The descriptions of systems in Section 2 identify license renewal drawings that depict the components subject to aging management review for mechanical systems. The drawings are provided in a separate submittal.

Section 3 describes the results of aging management reviews of mechanical, electrical and structural components requiring aging management review. Section 3 is divided into sections that address (1) the reactor vessel, internals, and reactor coolant system, (2) engineered safety features, (3) auxiliary systems, (4) steam and power conversion systems, (5) containments, structures and component supports, and (6) electrical and instrumentation and controls (I&C). The tables in Section 3 provide a summary of information concerning aging effects requiring management and applicable aging management programs for component and commodity groups subject to aging management review. The information presented in the tables is based on the format and content of NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Revision 2, U.S. Nuclear Regulatory Commission (NRC), December 2010. The tables include comparisons with the evaluations documented in NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Revision 2, U.S. NRC, December 2010, as modified by applicable NRC Interim Staff Guidance (ISG) documents for license renewal.

Section 4 addresses time-limited aging analyses, as defined by 10 CFR 54.3. It includes identification of the component or subject and an explanation of the time-dependent aspects of the calculation or analysis. Section 4 demonstrates whether (1) the analyses remain valid for the period of extended operation, (2) the analyses have been projected to the end of the period of extended operation, or (3) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. Section 4 also documents the determination that no plant-specific exemptions granted pursuant to 10 CFR 50.12 that are based on time-limited aging analyses as defined in 10 CFR 54.3 will remain in effect.

Appendix A, Updated Safety Analysis Report Supplement, provides a summary description of programs and activities for managing the effects of aging for the period of extended operation. A summary description of the evaluation of time-limited aging analyses for the period of extended operation is also included. Following issuance of the renewed license, the material contained in this appendix will be incorporated into the USAR. The information in Appendix A fulfills the requirements in 10 CFR 54.21(d). Table 3.0-1, "USAR Supplement for Aging Management of Applicable Systems," from Revision 2 of NUREG-1800 was used as guidance for the content of the applicable aging management program summaries. Section A.4 is the license renewal commitment list, which contains the RBS commitments to implement new programs and enhance existing programs.

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

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

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

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

# ABBREVIATIONS AND ACRONYMS

| Abbreviation or Acronym | Description |
|---|---|
| AC (or ac) | alternating current |
| ACAR | aluminum conductor, alloy reinforced |
| ACI | American Concrete Institute |
| ACSR | aluminum conductor, steel reinforced |
| ADAMS | [NRC] Agencywide Documents Access and Management System |
| ADS | automatic depressurization system |
| AEM | aging effect/mechanism |
| AERM | aging effects requiring management |
| Al | aluminum |
| AMP | aging management program |
| AMR | aging management review |
| ANSI | American National Standards Institute |
| APCS | annulus pressure control system |
| APRM | average power range monitor |
| ARI | alternate rod insertion |
| ART | adjusted reference temperature |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| ATWS | anticipated transient without scram |
| | |
| B-10 | Boron-10 |
| B&PV | Boiler and Pressure Vessel |
| BADGER | Boron-10 Areal Density Gage for Evaluating Racks |
| BTP | Branch Technical Position |
| BWR | boiling water reactor |
| BWRVIP | Boiling Water Reactor Vessel and Internals Project |

| Abbreviation or Acronym | Description |
|---|---|
| C | centigrade |
| CASS | cast austenitic stainless steel |
| CB&I | Chicago Bridge and Iron |
| CE | conducts electricity |
| CF | chemistry factor |
| cfm | cubic feet per minute |
| CFR | Code of Federal Regulations |
| CII | containment inservice inspection |
| CLB | current licensing basis |
| CMAA | Crane Manufacturer's Association of America |
| CMS | containment [atmosphere] monitoring system |
| $CO_2$ | carbon dioxide |
| CRD | control rod drive |
| CRDRL | CRD return line |
| CSA | criticality safety analysis |
| CST | condensate storage tank |
| Cu | copper |
| CUF | cumulative usage factor |
| CUI | corrosion under insulation |
| | |
| DBA | design basis accident |
| DC (or dc) | direct current |
| DG | diesel generator |
| $\Delta$P | differential pressure |
| $\Delta$P/SLC | differential pressure/standby liquid control |
| $\Delta$RT | change in reference temperature (nil ductility transition) |
| | |
| EAF | environmentally assisted fatigue |
| ECCS | emergency core cooling system |

| Abbreviation or Acronym | Description |
|---|---|
| EFPY | effective full power years |
| EHC | electrohydraulic control |
| EMA | equivalent margin analysis |
| EN | enclosure, protection |
| EOI | Entergy Operations, Inc. |
| EPRI | Electric Power Research Institute |
| EQ | environmental qualification |
| EQIS | equipment qualification impact summary |
| ESF | engineered safety feature |
| ext | external |
| FAC | flow-accelerated corrosion |
| FB | fire barrier |
| FC | flow control |
| FD | flow distribution |
| $F_{en}$ | environmentally assisted fatigue correction factor |
| FERC | Federal Energy Regulatory Commission |
| FLB | flood barrier |
| FLT | filtration |
| FLV | floodable volume |
| FP-W | fire protection—water |
| ft-lb | foot-pound |
| GALL | Generic Aging Lessons Learned [NUREG-1801 report] |
| GE | General Electric |
| GEH | General Electric Hitachi |
| GL | Generic Letter |
| HCU | hydraulic control unit |

| Abbreviation or Acronym | Description |
|---|---|
| HCS | hydrogen control system |
| HDPE | high density polyethylene |
| HELB | high-energy line break |
| HEPA | high efficiency particulate air |
| HPCS | high pressure core spray |
| HS | heat sink |
| HT | heat transfer |
| HVAC | heating, ventilation, and air conditioning |
| HWC | hydrogen water chemistry |
| I&C | instrumentation and control |
| IAS | instrument air system |
| IASCC | irradiation-assisted stress corrosion cracking |
| ICH | incore housing |
| ID (or I.D.) | inside diameter |
| IGSCC | intergranular stress corrosion cracking |
| ILRT | integrated leakage rate test |
| IN | insulation; [NRC] Information Notice |
| INPO | Institute of Nuclear Power Operations |
| int | internal |
| IRM | intermediate range monitor |
| ISG | Interim Staff Guidance |
| ISI | inservice inspection |
| ISP | Integrated Surveillance Program |
| ksi | kilo-pounds per square inch |
| kV | kilo-volt |
| LLRT | local leakage rate test |

| Abbreviation or Acronym | Description |
|---|---|
| LFMG | low-frequency motor-generator |
| LMS | [containment] leakage monitoring system |
| LOCA | loss-of-coolant accident |
| LPCI | low pressure coolant injection |
| LOP | loss of offsite power |
| LPCS | low pressure core spray |
| LPRM | local power range monitors |
| LR | license renewal |
| LRA | license renewal application |
| LREH | License Renewal Electrical Handbook |
| LTC | limit thermal cycling |
| | |
| M&TE | maintenance and testing equipment |
| MB | missile barrier |
| MCM | thousand circular mils |
| MEB | metal enclosed bus |
| MeV | million electron-volts |
| MIC | microbiologically induced corrosion |
| MS | Mississippi |
| MSIV | main steam isolation valve |
| MS-PLCS | main steam positive leakage control system |
| MSR | moisture separator-reheater |
| mV | millivolt |
| | |
| NA | neutron absorption; not applicable |
| $n/cm^2$ | neutrons per square centimeter |
| NDE | nondestructive examination |
| NEI | Nuclear Energy Institute |
| NESC | National Electrical Safety Code |

| Abbreviation or Acronym | Description |
|---|---|
| NFPA | National Fire Protection Association |
| Ni | nickel |
| NPS | nominal pipe size |
| NRC | Nuclear Regulatory Commission |
| NSSS | nuclear steam supply system |
| nvt | neutron density (*n*) multiplied by neutron velocity (*v*), multiplied by time (*t*) |
| OBE | operating basis earthquake |
| OE | operating experience |
| OVHLL | Overhead Heavy Load and Light Load |
| P&ID | piping and instrument diagram |
| PB | pressure boundary |
| PGCC | power generation control complex |
| pH | potential of hydrogen |
| PH | precipitation-hardened |
| PM | preventive maintenance |
| PSPM | periodic surveillance and preventive maintenance |
| P-T | pressure-temperature |
| PVC | polyvinyl chloride |
| PVLCS | penetration valve leakage control system |
| PWR | pressurized water reactor |
| QA | quality assurance |
| QP | augmented quality |
| RBS | River Bend Station |
| RCIC | reactor core isolation cooling |
| RCPB | reactor coolant pressure boundary |

| Abbreviation or Acronym | Description |
|---|---|
| RCS | reactor coolant system |
| RG | Regulatory Guide |
| RHR | residual heat removal |
| RI-ISI | risk-informed inservice inspection |
| RPCCW | reactor plant component cooling water |
| rpm | revolutions per minute |
| RPS | reactor protection system |
| RPV | reactor pressure vessel (synonymous with reactor vessel) |
| $RT_{NDT}$ | reference temperature (nil-ductility transition) |
| RWCU | reactor water cleanup |
| RVI | reactor vessel internals |
| RVIM | Reactor Vessel Internals Management |
| | |
| S&PC | steam and power conversion |
| S&W | Stone & Webster |
| SAS | service air system |
| SBO | station blackout |
| SC | structure or component |
| SCBA | self-contained breathing apparatus |
| SCC | stress corrosion cracking |
| SCV | steel containment vessel |
| SDC | system design criteria |
| SDG | standby diesel generator |
| SER | Safety Evaluation Report |
| SGTS | standby gas treatment system |
| SIL | Service Information Letter |
| SLC | standby liquid control |
| SMAW | shielded-metal arch weld |
| SNS | support for Criterion (a)(2) equipment |

| Abbreviation or Acronym | Description |
|---|---|
| $SO_2$ | sulfur dioxide |
| SRE | support for Criterion (a)(3) equipment |
| SRM | source range monitor |
| SRP | [NUREG-1800, License Renewal] Standard Review Plan |
| SRV | safety/relief valve |
| SS | stainless steel |
| SSC | system, structure, or component |
| SSR | support for Criterion (a)(1) equipment |
| SSW | standby service water |
| SWC | service water cooling |
| T&D | transmission and distribution |
| TLAA, TLAAs | time-limited aging analysis, time-limited aging analyses |
| TPCCW | turbine plant component cooling water |
| TRM | Technical Requirements Manual |
| TS | Technical Specification |
| USAR | Updated Safety Analysis Report |
| USE | upper-shelf energy |
| UT | ultrasonic testing |
| V | volt |
| VDC | volts, direct current |
| VFLD | vessel flange leak detection |
| yr | year |
| Zn | zinc |

| Abbreviation or Acronym | Description |
|---|---|
| 0T | inner surface of vessel wall |
| ¼T | one-fourth of the way through the vessel wall measured from the internal surface of the vessel |

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# 1.0 ADMINISTRATIVE INFORMATION

Pursuant to Part 54 of Title 10 of the Code of Federal Regulations (10 CFR Part 54), this application seeks renewal for an additional 20-year term of the facility operating license for River Bend Station (RBS), Unit 1. RBS Unit 2 was canceled on January 5, 1984. The facility operating license for RBS Unit 1 (hereinafter referred to as River Bend Station or RBS) (Docket Number 50-458, License Number NPF-47) expires at midnight on August 29, 2025. The application also applies to renewal of those Nuclear Regulatory Commission (NRC) source material, special nuclear material, and by-product material licenses that are subsumed or combined with the facility operating license.

The application is based on guidance provided by the U.S. Nuclear Regulatory Commission in NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Revision 2, December 2010, and Regulatory Guide (RG) 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," Revision 1, September 2005, and guidance provided by the Nuclear Energy Institute (NEI) in NEI 95-10, *Industry Guidelines for Implementing the Requirements of 10 CFR 54 – The License Renewal Rule*, Revision 6, June 2005.

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

## 1.1 GENERAL INFORMATION

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

### 1.1.1 Name of Applicant

Entergy Operations, Inc.

Entergy Louisiana, LLC

### 1.1.2 Address of Applicant

Entergy Operations, Inc.
1340 Echelon Parkway
Jackson, Mississippi 39213

Entergy Louisiana, LLC
4809 Jefferson Highway
Jefferson, Louisiana 70121

**Address of Nuclear Facility**

River Bend Station
5485 US Highway 61
St. Francisville, LA 70775

### 1.1.3 Description of Business of Applicants

Entergy Louisiana, LLC is the owner of River Bend Station, located in West Feliciana Parish, Louisiana. Entergy Operations, Inc. (EOI) is the licensed operator of River Bend Station. Entergy Louisiana, LLC and EOI are the holders of River Bend Station operating license NPF-47 and for purposes of this application are considered the applicant.

Entergy Utility Holding Company, LLC, a Texas limited liability company, is an intermediary holding company for Entergy Corporation and the direct parent company of Entergy Louisiana, LLC. Entergy Louisiana, LLC is one of Entergy Corporation's five retail electric utility subsidiaries. These companies generate, transmit, distribute and sell electric power to retail and wholesale customers in Arkansas, Louisiana, Mississippi, and Texas.

EOI is engaged principally in the business of operating nuclear power facilities.

Entergy Corporation is an integrated energy company engaged primarily in electric power production and retail distribution operations.

Where this application refers to *Entergy,* its meaning is Entergy Louisiana, LLC and EOI as the applicant.

### 1.1.4 Legal Status and Organization

EOI, a Delaware corporation, is a wholly owned subsidiary of Entergy Corporation. The principal office is located in Jackson, Mississippi. EOI is not owned, controlled or dominated by an alien, a foreign corporation, or foreign government.

The names and addresses for EOI directors and principal officers are listed below. All are U.S. citizens.

| | |
|---|---|
| A. Christopher Bakken III<br>Director<br>President and Chief Executive Officer | Entergy Operations, Inc.<br>1340 Echelon Parkway<br>Jackson, MS 39213 |

| | |
|---|---|
| Donna Jacobs<br>Director<br>Chief Operating Officer—South | Entergy Operations, Inc.<br>1340 Echelon Parkway<br>Jackson, MS 39213 |
| Lawrence M. Coyle<br>Director<br>Chief Operating Officer—West | Entergy Operations, Inc.<br>1340 Echelon Parkway<br>Jackson, MS 39213 |
| John Elnitsky<br>Senior Vice President, Engineering and Technical Services | Entergy Operations, Inc.<br>1340 Echelon Parkway<br>Jackson, MS 39213 |
| Marcus V. Brown<br>Executive Vice President and General Counsel | Entergy Operations, Inc.<br>1340 Echelon Parkway<br>Jackson, MS 39213 |
| Kimberly S. Cook<br>Vice President, Operations Support | Entergy Operations, Inc.<br>1340 Echelon Parkway<br>Jackson, MS 39213 |
| William F. Maguire<br>Vice President, Site (River Bend Station) | Entergy Operations, Inc.<br>1340 Echelon Parkway<br>Jackson, MS 39213 |
| Richard L. Anderson<br>Vice President, Site (Arkansas Nuclear One) | Entergy Operations, Inc.<br>1340 Echelon Parkway<br>Jackson, MS 39213 |
| Michael R. Chisum<br>Vice President, Operations (Waterford 3) | Entergy Operations, Inc.<br>1340 Echelon Parkway<br>Jackson, MS 39213 |
| Vincent Fallacara<br>Vice President, Operations Support<br>Vice President, Site (Grand Gulf) (acting) | Entergy Operations, Inc.<br>1340 Echelon Parkway<br>Jackson, MS 39213 |
| William J. James, Jr.<br>Vice President, Major Fleet Projects | Entergy Operations, Inc.<br>1340 Echelon Parkway<br>Jackson, MS 39213 |
| Steven C. McNeal<br>Vice President and Treasurer | Entergy Operations, Inc.<br>1340 Echelon Parkway<br>Jackson, MS 39213 |

Entergy Louisiana, LLC, a Texas limited liability company, is the owner of River Bend Station. As discussed in Section 1.1.3, Entergy Utility Holding Company, LLC is the direct parent company of Entergy Louisiana, LLC. The principal office of Entergy Louisiana, LLC is located in Jefferson, Louisiana. Entergy Louisiana, LLC is not owned, controlled or dominated by an alien, a foreign corporation, or foreign government.

The names and addresses for Entergy Louisiana, LLC directors and principal officers are listed below. All are U.S. citizens.

| | |
|---|---|
| Phillip R. May<br>Director and Chairman of the Board<br>President and Chief Executive Officer | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |
| Theodore H. Bunting, Jr.<br>Director<br>Group President, Utility Operations | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |
| Paul D. Hinnenkamp<br>Director | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |
| Andrew S. Marsh<br>Director<br>Executive Vice President and Chief Financial Officer | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |
| Marcus V. Brown<br>Executive Vice President and General Counsel | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |
| Joseph T. Henderson<br>Senior Vice President and General Tax Counsel | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |
| A. Christopher Bakken III<br>Executive Vice President and Chief Nuclear Officer | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |
| Joseph T. Henderson<br>Senior Vice President and General Tax Counsel | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |
| Alyson M. Mount<br>Senior Vice President and Chief Accounting Officer | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |

| | |
|---|---|
| Steven C. McNeal<br>Vice President and Treasurer | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |
| Dennis P. Dawsey<br>Vice President, Customer Service | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |
| John P. Hurstell<br>Vice President, System Planning | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |
| Jody Montelaro<br>Vice President, Public Affairs | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |
| Mark D. Kleehammer<br>Vice President, Regulatory and Public Affairs | Entergy Louisiana, LLC<br>4809 Jefferson Highway<br>Jefferson, LA 70121 |

### 1.1.5 Class and Period of License Sought

The applicant requests renewal of the facility operating license for River Bend Station (facility operating license Docket Number 50-458, License Number NPF-47) for a period of 20 years. The license was issued under Section 103 of the Atomic Energy Act of 1954 as amended. License renewal would extend the River Bend Station facility operating license from midnight, August 29, 2025, to midnight, August 29, 2045.

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

### 1.1.6 Alteration Schedule

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

### 1.1.7 Regulatory Agencies with Jurisdiction

Regulatory agencies with jurisdiction over the station are listed below.

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

Department of Environmental Quality
P.O. Box 4313
Baton Rouge, Louisiana 70821-4313

Louisiana Public Service Commission
P.O. Box 91154
Baton Rouge, Louisiana 70821-9154

West Feliciana Parish Council
P.O. Box 1921
St. Francisville, LA 70775

Public Utility Commission of Texas
1701 N. Congress Avenue
PO Box 13326
Austin, TX 78711-3326

### 1.1.8 Local News Publications

*The St. Francisville Democrat*
7290 Blue Bonnet
Baton Rouge, LA 70810

*The Advocate*
10705 Rieger Road
Baton Rouge, LA 70809

### 1.1.9 Conforming Changes to Standard Indemnity Agreement

10 CFR 54.19(b) requires that license renewal applications include "conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." The current Indemnity Agreement (No. B-104) for River Bend Station states in Article VII that the Agreement shall terminate at the time of expiration of the license specified in Item 3 of the Attachment (to the Agreement). Item 3 of the Attachment to the Indemnity Agreement, as revised through Amendment No. 4, lists River Bend Station facility operating license number NPF-47. Entergy has reviewed the original Indemnity Agreement and the Amendments. Neither Article VII nor Item 3 of the Attachment specifies an expiration date for license number NPF-47. Therefore, no changes to the Indemnity Agreement are deemed necessary as part of this application. Should the license number be changed by NRC upon issuance of the renewed license, Entergy requests that NRC amend the Indemnity Agreement to include conforming changes to Item 3 of the Attachment and other affected sections of the Agreement.

### 1.1.10 Restricted Data Agreement

This application does not contain restricted data or national security information, and the applicant does not expect that any activity under the renewed license for River Bend Station will involve such information. However, if such information were to become involved, the applicant agrees to secure such information appropriately and not to permit any individual to have access to, or any facility to possess, such information until the individual or facility has been approved under the provisions of 10 CFR Parts 25 or 95, respectively.

## 1.2 PLANT DESCRIPTION

The River Bend Station site is located in West Feliciana Parish, Louisiana, approximately 3 miles southeast of St. Francisville, Louisiana and approximately 24 miles northwest of the city limits of Baton Rouge, Louisiana. This site, approximately 3,342 acres in size, is just east of the Mississippi River, which is used as the source of the RBS major water requirements.

RBS includes a boiling water reactor nuclear steam supply system (NSSS) and a turbine-generator, both of which were furnished by General Electric Company (GE). The containment internal structures include a reinforced concrete drywell and suppression pool of the GE Mark III design. The balance of the unit, including the containment, its internal structures, and the shield building, was designed and constructed by Stone & Webster Engineering Corporation.

EOI is authorized to operate River Bend Station at reactor core power levels not in excess of 3091 megawatts thermal (100 percent rated power) with a net power output of approximately 967 megawatts electrical.

The principal buildings and structures associated with the unit include the primary containment structure, the shield building, the auxiliary building, the fuel building, the control building, the diesel generator building, auxiliary control building, the radwaste building, the turbine building, the water treatment building, the condensate demineralizer regeneration and offgas building, the makeup water pump structure, the circulating water pump structure, the normal service water cooling towers, the ultimate heat sink, and the instrument air/service air building.

The RBS site was originally intended for the construction of two nuclear units when the operating license applications were docketed on August 25, 1981. The original RBS Unit 2 was abandoned after initial construction activities were terminated, and the unit was cancelled on January 5, 1984. The existence of the Unit 2 excavation site was considered in the hydrological analysis of the site for the Unit 1 USAR, Section 2.4.

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

This chapter describes the process for identification of structures and components subject to aging management review (AMR) in the RBS integrated plant assessment. For those systems, structures, and components (SSCs) within the scope of license renewal, 10 CFR 54.21(a)(1) requires the license renewal applicant to identify and list structures and components subject to AMR. Furthermore, 10 CFR 54.21(a)(2) requires that methods used to identify these structures and components be described and justified. Technical information in this section serves to satisfy these requirements.

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

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

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

**Table 2.0-1**
**Component Intended Functions: Abbreviations and Definitions**

| Abbreviation | Intended Function | Definition |
|---|---|---|
| CE | Conducts electricity | Provide electrical connections to specified sections of an electrical circuit to deliver voltage, current or signals. |
| EN | Enclosure protection | Provide enclosure, shelter or protection for in-scope equipment (including high-energy line break [HELB], radiation shielding, pipe whip restraint, and thermal shielding). |
| FB | Fire barrier | Provide rated fire barrier to confine or retard a fire from spreading between adjacent areas. |
| FC | Flow control | Provide control of flow rate or establish a pattern of spray. |
| FD | Flow distribution | Provide distribution of flow. |
| FLB | Flood barrier | Provide flood protection barrier for internal or external flooding events. |
| FLT | Filtration | Provide removal of unwanted material. |
| FLV | Floodable volume | Maintain boundary of a volume in which the core can be flooded and adequately cooled in the event of a breach in the nuclear system process barrier external to the reactor vessel. |
| HS | Heat sink | Provide heat sink during station blackout (SBO) or design basis accidents (includes source of cooling water for plant shutdown). |
| HT | Heat transfer | Provide ability to transfer heat. |
| IN | Insulation | Insulate and support an electrical conductor (electrical) or provide insulating characteristics to reduce heat transfer (structural). |
| LTC | Limit thermal cycling | Provide protection of reactor vessel internals components from flow-induced temperature variations. |
| MB | Missile barrier | Provide barrier against internally or externally generated missile. |
| NA | Neutron absorption | Absorb neutrons. |

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

| Abbreviation | Intended Function | Definition |
|---|---|---|
| PB | Pressure boundary | Mechanical: Provide pressure boundary integrity such that adequate flow and pressure can be delivered or provide fission product barrier for containment pressure boundary. This function includes maintaining structural integrity and preventing leakage or spray for 10 CFR 54.4(a)(2).<br>Structural: Provide pressure boundary or essentially leak-tight barrier. |
| SNS | Support for Criterion (a)(2) equipment | Provide structural or functional support to nonsafety-related equipment whose failure could prevent satisfactory accomplishment of required safety functions (includes seismic II/I considerations) [10 CFR 54.4(a)(2)]. |
| SRE | Support for Criterion (a)(3) equipment | Provide structural or functional support to equipment required to meet the Commission's regulations for any of the five regulated events in 10 CFR 54.4(a)(3). |
| SSR | Support for Criterion (a)(1) equipment | Provide structural or functional support for safety-related equipment. |
| STR | Structural integrity | Maintain structural integrity of reactor vessel internals components such that loose parts are not introduced into the system. |
| STRSP | Structural support | Provide structural or functional support for reactor coolant system components. |

# 2.1 SCOPING AND SCREENING METHODOLOGY

## 2.1.1 Scoping Methodology

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

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

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

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

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

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

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

NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule* (Ref. 2.1-8), provides industry guidance for determining what SSCs are within the scope of license renewal. The process used to determine the systems and structures within the scope of license renewal for RBS followed the recommendations of NEI 95-10.

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

The RBS equipment database and the site procedure for system and equipment designations were used to identify the system codes in use at the plant. The equipment database is a controlled list of plant components, with each component assigned to one plant system code. The system and equipment designations procedure provides a resource for existing designator descriptions for plant systems, structures and components, including cross-references from the Entergy Operations, Inc. (EOI) numeric system designators to the Stone & Webster (S&W) alpha designators using three letters and the General Electric (GE) alpha-numeric designators using one letter with two numbers. All three of these types of component identifications are found on site piping and instrument diagrams (P&IDs), and S&W and GE codes may be used in more than one EOI system. The list of plant systems for license renewal scoping was then developed based on the plant system codes.

For mechanical system scoping, a system is defined as the collection of mechanical components with that EOI system code in the component database. While some structural commodities, such as racks and panels, are included in the equipment database and assigned system codes, these components are evaluated with the structural bulk commodities.

For the purposes of system level scoping described in this report, plant electrical and instrumentation and control (I&C) systems and electrical and I&C components in mechanical systems are included in the scope of license renewal by default. Intended functions for electrical and I&C systems are not identified since the bounding scoping approach makes it unnecessary to determine if an electrical and I&C system has an intended function. Switchyard equipment, not normally considered part of the plant's electrical and I&C systems, was reviewed for station blackout (SBO) intended functions based on NRC guidance. For further discussion of RBS scoping for SBO, see Section 2.1.1.3.5. See Section 2.5 for additional information on electrical and I&C scoping.

As the starting point for structural scoping, a list of plant structures was developed from a review of the USAR, site plans, plant area drawings, the fire hazards analysis, and structural design requirements documents. Structures performing an intended function in accordance with 10 CFR 54.4(a)(1) were identified first, and then those structures that potentially support plant operations or could adversely impact structures that support plant operations (i.e., seismic II/I, station blackout) were addressed. In addition to buildings and facilities, the identified structures include other components and commodities that support plant operation (e.g., foundations for freestanding tanks and electrical manholes). See Section 2.4 for the results of structural scoping.

Functions for mechanical systems and for structures were identified based on reviews of applicable plant licensing and design documentation. These included the USAR, the post-fire Safe Shutdown Analysis, the site station blackout report, system design criteria documents (SDCs), and system/structural design requirement documents (historical documents), supplemented by system training material and various station drawings.

Each mechanical system and structure function was evaluated against the criteria of 10 CFR 54.4 as described in the following sections. Section 2.1.1.1 discusses the evaluation of the safety-related criteria in 10 CFR 54.4(a)(1). Section 2.1.1.2 discusses the evaluation of the criteria of 10 CFR 54.4(a)(2). Section 2.1.1.3 discusses the evaluation of the criteria in 10 CFR 54.4(a)(3). The results of these evaluations for plant system and structures are presented in Section 2.2.

#### 2.1.1.1 Application of Safety-Related Scoping Criteria

A system or structure is within the scope of license renewal if it performs a safety function during and following a design basis event as defined in 10 CFR 54.4(a)(1). Design basis events are defined in 10 CFR 50.49(b)(1)(ii) as conditions of normal operation, including anticipated operational occurrences, design basis accidents, external events, and natural phenomena for which the plant must be designed to ensure functions identified in 10 CFR 54.4(a)(1)(i) through (iii).

An Entergy corporate procedure and a site engineering standard provide control of component and structure quality classification. These documents define design basis events consistent with 10 CFR 50.49(b)(1) and define the quality assurance classification of “safety-related” as follows:

> Those structures, systems and components that are relied upon to remain functional during and following design basis events to assure:
>
> (1) The integrity of the reactor coolant pressure boundary;
>
> (2) The capability to shut down the reactor and maintain it in a safe shutdown condition; or
>
> (3) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to the applicable guideline exposures set forth in 10 CFR 50.34(a)(1), 10 CFR 50.67, or 10 CFR 100.11.

This is the same definition for safety-related SSC used in 10 CFR 54.4(a)(1), with a slight difference in wording: where Entergy procedures use "the applicable guideline exposures set forth in....," 10 CFR 54.4(a)(1)(iii) uses the phrase, "those referred to in...." The two phrases are equivalent. Certain installation specifications for RBS used a somewhat different definition for Safety Class 3 that referred to "a release of radioactive contamination to the public" rather than citing 10 CFR guideline exposures. This resulted in components that are classified as Safety Class 3 at RBS but do not meet the criteria of 10 CFR 54.4(a)(1). RBS Safety Class 3 components were evaluated to determine if they supported system functions meeting the requirements of 10 CFR 54.4(a)(1). Those that did not were further evaluated for the criteria of 10 CFR 54.4(a)(2) and (a)(3).

With the implementation of License Amendment No. 132, a full-scope application of the alternative source term, RBS adopted 10 CFR 50.67 for design basis accident analyses.

The RBS equipment database maintains the controlled component-level list of quality classifications. Mechanical system safety functions were identified by reviews of the USAR, the SDCs, and the equipment database. Mechanical systems whose only safety-related components are electrical and I&C components or structural components are not included in scope for 10 CFR 54.4(a)(1); however, the electrical and I&C components in the system are included in scope by default, and structural components are included in the structural evaluations.

Structures with safety functions were identified by reviews of the USAR, site plans, plant area drawings, and structural design requirements documents. Structural safety functions include providing containment or isolation to mitigate post-accident off-site doses and providing support or protection to safety-related equipment. Structures with a safety function or that support or protect a safety-related component are included within the scope of license renewal on the basis of 10 CFR 54.4(a)(1). Structures and structural components that provide protection to safety-related equipment from external events and natural phenomena are included in the scope of license renewal on the basis of 10 CFR 54.4(a)(1).

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

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

This review identified nonsafety-related systems and structures containing components whose failure could prevent satisfactory accomplishment of a safety function. The guidance of NEI 95-10 Appendix F is used to define the SSCs included in scope in accordance with 10 CFR 54.4(a)(2). Consideration of hypothetical failures that could result from system interdependencies that are not part of the current licensing basis and that have not been previously experienced is not required.

The impact of nonsafety-related SSC failures on safety functions can be either functional or physical. A functional failure is one where the failure of a nonsafety-related SSC to perform its function impacts a safety function. A physical failure is one where a safety function is impacted by the loss of structural or mechanical integrity of a nonsafety-related SSC in physical proximity to a safety-related SSC.

##### 2.1.1.2.1 Functional Failures of Nonsafety-Related SSCs

At RBS, systems and structures required to perform a function to support a safety function are classified as safety-related and have been included in the scope of license renewal per Section

2.1.1.1, with the exception of the function of the plant drains system to support maintaining suppression pool inventory for use following a LOCA (see Section 2.3.3.16 for further information).

2.1.1.2.2 Physical Failures of Nonsafety-Related SSCs

Some nonsafety-related components could affect safety-related components due to their physical proximity; that is, their physical location can result in interaction between the components should the nonsafety-related component fail. Based on the license renewal rule and the guidance in NEI 95-10 (Ref. 2.1-8), physical failures of nonsafety-related SSCs in scope based on 10 CFR 54.4(a)(2) fit into the following two categories.

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

Certain components and piping outside of the safety class pressure boundary must be structurally sound in order to maintain the pressure boundary integrity of safety class piping. Each mechanical system safety-related to nonsafety-related interface was reviewed to identify the components located between the safety-related/nonsafety-related interface and the structural boundary. For RBS, the *structural boundary* is defined as the portion of a piping system outside the safety class pressure boundary, yet relied upon to provide structural support for the pressure boundary. See Section 2.1.2.1.2 for further discussion of screening these components.

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

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

*(a) Physical Impact or Flooding*

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

Structural components that meet the criterion of 10 CFR 54.4(a)(2) include flood barriers, missile barriers, overhead handling systems, and nonsafety-related supports for non-seismic (including seismic II/I) piping systems and electrical conduit and cable trays with potential for spatial interaction with safety-related equipment. Structural components that protect safety-related equipment are within the scope of license renewal and are evaluated in the structural aging management review for the structure in which they are located or in the bulk commodities aging management review (Section 2.4).

*(b) Pipe Whip, Jet Impingement, or Harsh Environments*

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

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

*(c) Leakage or Spray*

Moderate- and low-energy systems have the potential for spatial interactions of leakage or spray. Nonsafety-related systems and nonsafety-related portions of safety-related systems with the potential for leakage or spray that could prevent safety-related SSCs from performing their required safety function are in the scope of license renewal and subject to aging management review.

Operating experience indicates that nonsafety-related components containing only air or gas have experienced no failures due to aging that could impact the ability of safety-related equipment to perform required safety functions. There are no aging effects for these components when the environment is a dry gas. Therefore, a system containing only air or gas is not in the scope of license renewal based on the potential for spray or leakage.

The review used a spaces approach for scoping of nonsafety-related systems with potential spatial interaction with safety-related SSCs. The spaces approach focuses on the interaction between nonsafety-related and safety-related SSCs that are located in the same space. A "space" is defined as a room or cubicle that is separated from other spaces by substantial objects (such as wall, floors, and ceilings). The space is defined such that potential interaction between nonsafety-related and safety-related SSCs is limited to the space.

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

Equipment that has been retired in place and is no longer functional was included in this evaluation. The retired equipment was evaluated for potential spatial interaction unless the equipment had been drained.

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

#### 2.1.1.3 Application of Criterion for Regulated Events

The scope of license renewal includes those systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48), environmental qualification (10 CFR 50.49), pressurized thermal shock (10 CFR 50.61), anticipated transients without scram (10 CFR 50.62), and station blackout (10 CFR 50.63). This section discusses the approach used to identify the systems and structures within the scope of license renewal based on each criterion. The systems and structures that perform intended functions in support of these regulated events are identified in the descriptions in Sections 2.3, 2.4, and 2.5.

##### 2.1.1.3.1 Commission's Regulations for Fire Protection (10 CFR 50.48)

As stated in RBS USAR Section 9.5.1.1,

> The RBS fire protection program conforms with the requirement of General Design Criteria 3 of Appendix A to 10CFR50. In addition, requirements stated in the following documents were considered in the design and evaluation of the fire protection systems:
>
> 1. Appendix A to NRC Branch Technical Position APCSB 9.5-1 dated August 23, 1976
> 2. Basic Fire Protection for Nuclear Power Plants, April 1976, American Nuclear Insurers
> 3. National Fire Codes, National Fire Protection Association.

USAR Section 9A.2.1 states, "The Fire Protection Program at River Bend Station is required to be in compliance with the positions of Appendix A to Branch Technical Position APCSB 9.5-1. The Fire Protection Program was reviewed and found acceptable by the NRC as stated in NUREG-0989, RBS Safety Evaluation Report, Section 9.5, Fire Protection." However, both

Branch Technical Position (BTP) APCSB 9.5-1 and Appendix R provide the regulatory requirements for the RBS Fire Protection Program. The bases of the Fire Hazards Analysis in USAR Section 9A.2 include the requirements of Appendix A to BTP APCSB 9.5-1 and 10 CFR 50, Appendix R.

Systems and structures within the scope of license renewal for fire protection include those required for RBS compliance with BTP APCSB 9.5-1 and Appendix R. Equipment relied on for fire protection includes SSCs credited with fire prevention, detection, and mitigation in areas containing equipment important to safe operation of the plant as well as systems that contain plant components credited for safe shutdown following a fire. To identify this equipment, USAR Section 9.5.1, Appendix 9A, and Appendix 9B were reviewed as well as the site's post-fire safe shutdown analysis.

USAR Section 9.5.1 describes the fire protection program and fire protection systems for the current licensing basis. Appendix 9A presents the fire hazards analysis in Section 9A.2. A point-by-point comparison of the River Bend Fire Protection Program and the positions of Appendix A to BTP APCSB 9.5-1 can be found in USAR Section 9A.3. A point-by-point comparison of the River Bend Fire Protection Program to the requirements of 10 CFR 50, Appendix R, Sections II and III, is located in USAR Appendix 9B. Section 9A.2.5 provides a fire area-by-fire area analysis of the fire hazards in each area. To provide a defense-in-depth approach to fire protection, the objectives of this fire hazards analysis are as follows:

a. Determine plant areas and consider potential in situ and transient fire hazards in each.

b. Specify measures for fire prevention, fire detection, fire suppression, and fire containment.

c. Determine the consequences of fire in any location in the plant on the ability to safely shut down the reactor or on the ability to minimize and control the release of radioactivity to the environment.

d. Specify measures for alternative shutdown capability as required for each area containing structures, system, and components important to safety in accordance with NRC guidelines and regulations.

The RBS post-fire safe shutdown analysis contains the safe shutdown analysis basis, methodology, shutdown function definitions, safe shutdown systems description, associated circuits of concern, spurious actuation analysis, and safe shutdown compliance assessment by fire area, including the safe shutdown equipment list and logic diagrams.

Based on the review of the RBS current licensing bases for fire protection, the system intended functions performed in support of the fire protection program requirements were determined. Section 2.3 contains the results of the review for the RBS mechanical systems and identifies systems that contain passive mechanical components that are required for fire protection and safe shutdown of the plant following a fire event.

Structures required to provide support, shelter or protection to equipment meeting the criterion of 10 CFR 54.4(a)(3) based on the requirements of 10 CFR 50.48 are considered to be within the scope of license renewal based on 10 CFR 54.4(a)(3). Structural commodities credited as fire barriers are included in the structural aging management reviews. Section 2.4 contains the results of the scoping review for RBS structures.

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

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

Electric equipment important to safety that is required to be environmentally qualified to mitigate certain accidents that result in harsh environmental conditions in the plant is defined in 10 CFR 50.49. The RBS Environmental Qualification (EQ) Program controls the maintenance of the EQ component list, which is contained within the equipment database. The equipment database identifies electrical equipment and components that are required to function during and subsequent to design basis events.

As described in Section 2.1.1, plant electrical and I&C systems are included in the scope of license renewal by default. This includes equipment relied upon to perform a function that demonstrates compliance with the Commission's regulations for environmental qualification.

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

The pressurized thermal shock (PTS) rule, 10 CFR 50.61, "Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events," requires that licensees of pressurized water reactors evaluate the reactor vessel beltline materials against specific criteria to ensure protection from brittle fracture. As a boiling water reactor, RBS is not subject to this regulation.

#### 2.1.1.3.4 Commission's Regulations for Anticipated Transients without Scram (10 CFR 50.62)

An anticipated transient without scram (ATWS) is an anticipated operational occurrence that is accompanied by a failure of the reactor trip system (RTS) to shut down the reactor. The ATWS rule, 10 CFR 50.62, requires specific improvements in the design and operation of commercial nuclear power facilities to reduce the probability of failure to shut down the reactor following anticipated transients and to mitigate the consequences of an ATWS event. The RBS USAR identifies system functional requirements for 10 CFR 50.62.

Based on RBS current licensing bases for ATWS, system intended functions performed in support of 10 CFR 50.62 requirements were determined. Individual system scoping evaluations in Section 2.3 contain the results of the review for RBS mechanical systems.

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

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

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

10 CFR 50.63, "Loss of All Alternating Current Power," requires that each light-water-cooled nuclear power plant be able to withstand and recover from an SBO. As defined by 10 CFR 50.2, an SBO is the loss of offsite power and on-site emergency alternating current (AC) electric power to the essential and non-essential switchgear buses in a nuclear power plant. It does not include the loss of AC power fed from inverters powered by station batteries or by alternate AC sources, nor does it assume a concurrent single failure or design basis accident. The objective of this requirement is to assure that nuclear power plants are capable of withstanding an SBO and maintaining adequate reactor core cooling and appropriate containment integrity for a required duration.

USAR Appendix 15C summarizes the licensing bases for SBO at RBS. RBS has developed a four-hour coping analysis to address the requirements of 10 CFR 50.63. Based on the current licensing bases for SBO, system intended functions performed in support of 10 CFR 50.63 requirements were determined.

Based on NRC guidance in NUREG-1800, Section 2.5.2.1.1 (Ref. 2.1-2), certain switchyard components required to restore offsite power are conservatively included within the scope of license renewal even though those components are not relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for SBO (10 CFR 50.63).

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

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

10 CFR 50.63 is included within the scope of license renewal. Section 2.5 contains the results of the review for electrical and I&C systems.

### 2.1.2 Screening Methodology

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

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

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

(ii) That are not subject to replacement based on a qualified life or specified time period [i.e., long-lived components].

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

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

NEI 95-10 (Ref. 2.1-8) provides industry guidance for screening structures and components to identify the passive, long-lived structures and components that support an intended function. The screening process for RBS followed the recommendations of NEI 95-10.

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

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

### 2.1.2.1 Screening of Mechanical Systems

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

#### 2.1.2.1.1 Identifying Components Subject to Aging Management Review

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

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

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

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

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

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

For systems with a function identified as meeting the criteria for 10 CFR 54.4(a)(2) based on a functional failure, components supporting the function are subject to aging management review.

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

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

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

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

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

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

This is consistent with the guidance in NEI 95-10, Appendix F. All component types required or conservatively considered to provide structural support for safety-related portions of systems are included in aging management reviews. This component intended function of maintaining structural integrity is included in the intended function *Pressure boundary* (Table 2.0-1).

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

*Physical Impact or Flooding*

Walls, curbs, dikes, doors, etc., that provide flood barriers to safety-related SCs are subject to aging management review based on the criteria of 10 CFR 54.4(a)(2) and 54.21(a). Missiles can be generated from internal or external events, such as failure of rotating equipment. Nonsafety-related design features that protect safety-related equipment from missiles require aging management review based on the criteria of 10 CFR 54.4(a)(2) and 54.21(a). Specific components in overhead handling systems are subject to aging management review based on the criteria of 10 CFR 54.4(a)(2) and 54.21(a). These structural components have been included in the evaluation of the structure in which they are located or in the evaluation of structural bulk commodities.

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

Reviews of earthquake experience identified no occurrences of welded steel pipe segments falling due to a strong motion earthquake. Falling of piping segments is extremely rare and only occurs when there is a failure of the supports. This conclusion applies for new and aged pipe. Therefore, as long as the effects of aging on the supports for piping systems are managed, falling of piping sections is not credible except due to flow-accelerated corrosion, and the piping section itself is not within the scope of license renewal based on the criteria of 10 CFR 54.4(a)(2) due to a physical impact hazard (but may be in scope due to the potential for leakage or spray). (Ref. 2.1-8)

*Pipe Whip, Jet Impingement, or Harsh Environments*

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

Many high-energy lines are safety-related components in systems that are already within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(1). During review of RBS systems for 10 CFR 54.4(a)(2), high energy systems were considered. If a HELB analysis assumes that a nonsafety-related piping system does not fail or assumes failure only at specific locations, then that piping system is within the scope of license renewal per 10 CFR 54.4(a)(2). Appropriate components are subject to aging management review to provide reasonable assurance that those analysis assumptions remain valid through the period of extended operation.

Nonsafety-related components in high-energy lines are included in the appropriate system table for the 10 CFR 54.4(a)(2) review (Sections 2.3.1.7, 2.3.2.8, 2.3.3.18 and 2.3.4.2).

*Leakage or Spray*

Screening nonsafety-related components for a potential impact to safety functions due to leakage or spray is performed using three steps:

1. Determine if the components only contain air or gas.

   For these systems, a review of operating experience is performed to confirm that there have been no failures of air/gas systems that could have adversely impacted the ability of equipment to perform required safety functions. The operating experience review performed for RBS confirmed that there have been no failures of air/gas systems that could have adversely impacted the ability of equipment to perform required safety functions. Based on this review, components containing only air or gas do not have a potential impact to safety functions due to leakage or spray and are therefore not subject to aging management review for 10 CFR 54.4(a)(2) for leakage or spray.

2. Using a "spaces" approach, determine if the system has components in a safety-related structure.

   Structures containing safety-related components were identified and systems reviewed to verify the locations of components in the system.

3. Determine if components in safety-related structures have the potential for spatial interaction with a safety-related component from leakage or spray.

   Nonsafety-related components containing water, oil, or steam and located in structures containing safety-related equipment were determined to be subject to aging management review.

The following structures contain safety-related components:

- Auxiliary building
- Control building
- Diesel generator building
- Electrical tunnels and piping tunnels (B/C/D/E/F/G/H/T and main steam tunnel)

- Fuel building
- Manholes, handholes and duct banks
- Reactor building
- Standby service water cooling tower, pumphouse and basin

Abandoned equipment located in spaces with safety-related equipment is included within the scope of license renewal in accordance with 10 CFR 54.4(a)(2). The scope of abandoned equipment was determined from discussions with site personnel and from reviews of the site equipment database and relevant documents, such as design change notices, system and structure scoping results, and piping and instrumentation diagrams that denote abandoned equipment using hash marks and notes.

2.1.2.1.3 Mechanical System Drawings

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

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

### 2.1.2.2 Screening of Structures

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

2.1.2.2.1 Structural Component and Commodity Groups

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

- Steel and other metals
- Bolted connections
- Concrete
- Other materials (e.g., fire barrier material, elastomers)

2.1.2.2.2 Evaluation Boundaries

Structural evaluation boundaries were established as described below.

*ASME and Non-ASME Component Supports—Mechanical Components*

The evaluation boundaries for mechanical component supports were established in accordance with rules governing inspection of component supports (i.e., American Society of Mechanical Engineers (ASME) Section XI, Subsection IWF). Component support examination boundaries for integral and non-integral (i.e., mechanically attached) supports are defined in Article IWF-1300, Figure IWF-1300-1. In general, the support boundary extends to the surface of the building structure, but does not include the building structure. Furthermore, the support boundary extends to include non-integral attachments to piping and equipment, but does not include integral attachments to the same.

*Component Supports—Electrical Components*

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

*Other Structural Members*

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

2.1.2.2.3 Intended Functions

Structural components and commodities were evaluated to determine intended functions as they relate to license renewal. NEI 95-10 (Ref. 2.1-8) provides guidelines for determining the intended functions of structures, structural components and commodities.

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

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

### 2.1.2.3 Electrical and Instrumentation and Control Systems

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

2.1.2.3.1 Passive Screening

NEI 95-10, Appendix B, "Typical Structure, Component and Commodity Groupings and Active/ Passive Determinations for the Integrated Plant Assessment," identifies electrical commodities considered to be passive. RBS electrical commodity groups were compared to the NEI 95-10, Appendix B electrical and I&C commodity groups. RBS passive electrical commodity groups correspond to Items 77 and 87 of the NEI 95-10 passive electrical and I&C commodity groups. Items 77 and 87 of NEI 95-10, Appendix B meet the 10 CFR 54.21(a)(1)(i) criterion (i.e., components that perform an intended function without moving parts or without a change in configuration). Appendix B of NEI 95-10 defines the Item 77 commodity group as follows:

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

The 230 kV switchyard commodities are not included in the RBS equipment database because Transmission and Distribution is responsible for their maintenance. However, the following additional switchyard commodities meet the 10 CFR 54.21(a)(1)(i) screening criterion:

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

These commodity groups were subdivided as shown in Table 2.5-1. Other RBS electrical and I&C commodity groups are active and are not subject to aging management review.

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

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

2.1.2.3.2 Long-Lived Screening

Electrical components and electrical and I&C penetration assemblies included in the EQ program per 10 CFR 50.49 are subject to replacement based on their qualified life. Therefore, in accordance with 10 CFR 54.21(a)(1)(ii), EQ electrical and I&C components are not subject to aging management review. EQ electrical and I&C components are qualified by analyses or calculations that may be time-limited aging analyses (TLAAs) as defined in 10 CFR 54.3. Only components that are not in the EQ program are subject to aging management review. The RBS equipment database identifies components included in the EQ program.

### 2.1.2.4 Consumables

Consumables include such items as packing, gaskets, component seals, O-rings, structural sealants, oil, grease, component filters, system filters, fire extinguishers, fire hoses, and air packs. Consumables have been evaluated consistent with the information presented in Table 2.1-3 of NUREG-1800 (Ref. 2.1-2). Consumables have been divided into the following four categories for the purpose of license renewal: (a) packing, gaskets, component seals, and

O-rings; (b) structural sealants; (c) oil, grease, and component filters; and (d) system filters, fire extinguishers, fire hoses, and air packs.

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

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

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

#### 2.1.2.4.2 Structural Sealants

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

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

#### 2.1.2.4.3 Oil, Grease, and Component Filters

Oil, grease, and component filters have been treated as consumables because either (1) they are periodically replaced or (2) they are monitored and replaced based on condition. These consumable items are not subject to aging management review.

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

Components such as system filters, fire hoses, fire extinguishers, self-contained breathing apparatus (SCBA), and SCBA cylinders are considered to be consumables and are routinely tested, inspected, and replaced when necessary. Fire protection at RBS complies with the applicable regulatory guidance as described within USAR Section 9.5.1, USAR Appendix 9A, and USAR Appendix 9B. Performance and condition monitoring programs for these specific components are provided. Fire hoses and fire extinguishers are inspected and hydrostatically tested periodically and must be replaced if they do not pass the test or inspection. SCBA and SCBA cylinders are inspected and periodically tested and must be replaced if they do not pass the test or inspection. Fire protection and radiation protection procedures specify the replacement criterion of these components that are routinely checked by tests or inspections to assure operability. Therefore, while these consumables are in the scope of license renewal, they do not require an aging management review.

### 2.1.3 Interim Staff Guidance Discussion

As discussed in NEI 95-10 (Ref. 2.1-8), the NRC has encouraged applicants for license renewal to address proposed interim staff guidance (ISG) in the LRA. The majority of license renewal-related ISGs have been resolved (Ref. 2.1-9, Ref. 2.1-10) with the issuance of revisions to the license renewal guidance documents NUREG-1800 (Ref. 2.1-2), NUREG-1801 (Ref. 2.1-3), RG 1.188 (Ref. 2.1-4), RG 4.2 (Ref. 2.1-11), and NEI 95-10. The remaining relevant ISGs are addressed as follows.

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

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

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

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

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

This ISG establishes a framework for the consideration of operating experience concerning aging management and age-related degradation during the term of a renewed operating license. The ISG provides interim revisions to NUREG-1800 (Ref. 2.1-2) and NUREG-1801 (Ref. 2.1-3) to present new NRC review criteria for the operating experience review program. The revised guidance is reflected in the description of the process for the review of operating experience presented in Appendix A, Section A.1, Aging Management Programs, and Appendix B, Section B.0.4, Operating Experience.

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

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

*LR-ISG-2012-02 Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion Under Insulation*

This ISG provides guidance on a variety of topics as indicated by the title. The revised guidance has been considered in the integrated plant assessment and is reflected in the aging management results presented in Section 3 and the aging management program descriptions presented in Appendix B.

*LR-ISG-2013-01 Aging Management of Loss of Coating or Lining Integrity for Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks*

This ISG provides guidance related to managing loss of coating integrity. The revised guidance has been considered in the integrated plant assessment and is reflected in the aging management results presented in Section 3 and the aging management program descriptions presented in Appendix B.

*LR-ISG-2015-01 Changes to Buried and Underground Piping and Tank Recommendations*

This ISG provides guidance related to managing loss of material for the external surfaces of buried and underground piping and tanks. The revised guidance has been considered in the integrated plant assessment and is reflected in the aging management results presented in Section 3 and the aging management program descriptions presented in Appendix B.

### 2.1.4 Generic Safety Issues

In accordance with the guidance in NEI 95-10 (Ref. 2.1-8), review of NRC generic safety issues (GSIs) as part of the license renewal process is required to satisfy the finding required by 10 CFR 54.29. GSIs designated as unresolved safety issues (USIs) and High- and Medium-priority issues in NUREG-0933, Appendix B (Ref. 2.1-5), that involve aging effects for structures and components subject to an aging management review or time-limited aging analysis evaluations are to be addressed in the LRA. A review of the version of NUREG-0933 (including the applicable Generic Issue Management Control System Report, Ref. 2.1-6, 2.1-12) current six months prior to the license renewal application submittal, determined that there were no outstanding USIs or High- or Medium-priority GSIs. Two GSIs designated as Active in NUREG-0933, Appendix B, 186 and 193, were reviewed to assure they did not involve aging effects for structures and components subject to an aging management review or time-limited aging analysis evaluations.

Item 186, Potential Risk and Consequences of Heavy Load Drops in Nuclear Power Plants, involves issues related to crane design and operation. Aging effects are not central to these issues. The issue does not involve TLAA evaluations, including typical crane-related TLAAs such as cyclic loading analyses. This issue was closed on January 27, 2012. (Ref. 2.1-7)

Item 193, [Boiling Water Reactor] BWR [Emergency Core Cooling System] ECCS Suction Concerns, addresses the possible failure of low pressure emergency core cooling systems due to unanticipated, large quantities of entrained gas in the suction piping from suppression pools in BWR Mark I, II, and III containments during loss-of-coolant accident (LOCA) conditions following downcomer flow from the drywell into the suppression pool. Aging effects are not relevant to this postulated condition. The issue does not involve TLAAs. This issue was closed in 2016 (Ref. 2.1-6).

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

### 2.1.5 Conclusion

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

### 2.1.6 References

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

2.1-2 NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants,* Revision 2, U.S. Nuclear Regulatory Commission (NRC), December 2010.

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

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

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

2.1-6 Generic Issue Management Control System Report For 3rd Quarter Fiscal Year 2016, NRC Agencywide Documents Access and Management System [ADAMS] Accession number ML16107A497.

2.1-7 Leeds, E. J., Director, NRC Office of Nuclear Reactor Regulation, to R. W. Borchardt, NRC Executive Director for Operations, "Completion of Generic Issue 186, 'Potential Risk and Consequences of Heavy Load Drops in Nuclear Power Plants,'" memorandum dated January 27, 2012, NRC ADAMS Accession number ML113050589.

2.1-8 NEI 95-10, *Industry Guideline on Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule*, Revision 6, Nuclear Energy Institute (NEI), June 2005.

2.1-9 Kuo, P. T. (NRC) to A. Marion (NEI) and D. Lochbaum (Union of Concerned Scientists), Summary of the 2001–2005 Interim Staff Guidance for License Renewal, letter dated February 6, 2007.

2.1-10 NUREG-1950, *Disposition of Public Comments and Technical Bases for Changes in the License Renewal Guidance Documents NUREG-1801 and NUREG-1800,* Table A-8, Summary of Changes to the Updated License Renewal Documents as a Result of License Renewal Interim Staff Guidance (LR-ISG), U.S. NRC, April 2011.

2.1-11 Regulatory Guide 4.2, Supplement 1, "Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications," Revision 1, U.S. NRC, June 2013.

2.1-12 Generic Issue Management Control System Report for 4th Quarter Fiscal Year 2016, ADAMS Accession Number ML16315A006.

## 2.2 PLANT LEVEL SCOPING RESULTS

Tables 2.2-1, 2.2-3, and 2.2-4 list the mechanical systems, electrical and I&C systems, and structures, respectively, that are within the scope of license renewal for RBS. For mechanical systems, a reference is given to the section which describes the system. For electrical systems, no description is necessary since plant electrical systems are in scope by default (see Section 2.5), but a reference to the USAR is provided where applicable. For structures, a reference is given to the section that includes the structure in the evaluation.

Tables 2.2-2 and 2.2-5 list the systems and structures, respectively, that do not meet the criteria specified in 10 CFR 54.4(a) and are therefore excluded from the scope of license renewal. For each item on these lists, the table also provides a reference (if applicable) to the section of the USAR that describes the system or structure. For structures with no USAR reference, a brief description of the building function is given. None of these structures house safety-related equipment nor are they situated such that a failure of the structure would impact a safety function.

Because of the different numbering systems used at RBS during design and construction, components use differing types of system codes: the EOI system codes (3-digit number), the Stone & Webster (S&W) system codes (three alpha characters), and GE system codes (single alpha character followed by two digits). The GE system codes are only used for NSSS system components. The RBS component database and the scoping list of systems are organized using the EOI system codes, but individual component identification numbers may use the S&W or GE system code, as seen on P&IDs. The S&W and GE codes are often used in more than one EOI system designation, but individual components are assigned to a single EOI system. In the system descriptions in Section 2.3, the system codes used in the system review are provided.

The list of systems used in these tables and determination of system boundaries is based on the RBS equipment database. The equipment database is a controlled list of plant systems and components, with each component assigned to one plant system. System intended functions are identified in the section referenced in Table 2.2-1. As needed, system components are grouped functionally for the aging management review. For example, ASME Class 1 components in various systems are evaluated with the ASME Class 1 reactor coolant pressure boundary in Section 2.3.1.2, and containment penetrations from various systems are grouped into one containment penetrations review in Section 2.3.2.7. For each system, the discussion under "Components Subject to Aging Management Review" provides further information.

The LRA section describing the system provides references to relevant sections of the USAR. If the system is described in the USAR with a different system or under a different system name, an explanation is given.

The primary containment system consists of a drywell, a vapor suppression pool, and a primary containment building. The drywell structure houses the reactor system. The freestanding steel primary containment structure encloses the drywell and the suppression pool. The secondary containment consists of the shield building and the auxiliary building. Safety-related piping and valves support the pressure boundaries between the drywell and containment, between the containment and the shield building/auxiliary building (primary containment), and between the shield building/auxiliary building and other areas of the plant (secondary containment). For license renewal, these three barriers are functionally equivalent and are referred to as the "containment pressure boundary." Piping and valves supporting these barriers have an intended function to "support containment pressure boundary."

Nonsafety-related components whose failure could prevent satisfactory accomplishment of safety functions [10 CFR 54.4(a)(2)] due to the potential for a physical interaction (see Section 2.1.1.2) are evaluated together by system in the (a)(2) aging management reviews (AMRs). The (a)(2) AMRs include nonsafety-related components with the potential for spatial interaction with safety-related components as well as components in safety-related systems outside the safety class pressure boundary, such as piping, valves, pumps, and support elements, that are required to be structurally sound in order to maintain the integrity of safety class piping. That is, the system intended function, “Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function” includes the function of components that provide structural/seismic support to directly connected components. The (a)(2) system reviews are presented at the end of the mechanical system sections: Section 2.3.1.7, Reactor Coolant Systems in Scope for 10 CFR 54.4(a)(2); Section 2.3.2.8, ESF Systems in Scope for 10 CFR 54.4(a)(2); Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2); and Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2).

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

The list of plant structures was developed from a review of the USAR, site plans, plant area drawings, the fire hazards analysis, and structural design requirements documents. Structure intended functions are identified in the section referenced in Table 2.2-4. Structural commodities associated with mechanical systems, such as pipe supports and insulation, are evaluated with the structural bulk commodities.

Because of the bounding approach used for scoping electrical and I&C equipment, plant electrical and I&C components contained in electrical and mechanical systems are in scope by default. Descriptions of each electrical system are not provided. In addition to plant electrical systems, certain switchyard components are in scope for support of offsite power recovery following a station blackout. For further information on electrical and I&C systems, see Section 2.5, Scoping and Screening Results: Electrical and Instrumentation and Control Systems.

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

| EOI System Code | S&W System Code | GE System Code | System Name | LRA Section Describing System |
|---|---|---|---|---|
| 050 | RVS | B13 | Reactor Pressure Vessel and Internals | Section 2.3.1.1, Reactor Pressure Vessel and Internals |
| 051/058 | MSS/ISC | B21/A62 | Nuclear Boiler Instrumentation | Section 2.3.1.3, Nuclear Boiler Instrumentation |
| 052/500 | RDC/RDS | C11 | Control Rod Drive Hydraulic | Section 2.3.3.1, Control Rod Drive Hydraulic |
| 053 | RCS | B33 | Reactor Recirculation | Section 2.3.1.4, Reactor Recirculation |
| 055 | FNR/FNS/ FNT/SFT | F42 | Fuel Transfer Equipment | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 106 | CNC/CNS | — | Condensate Makeup, Storage and Transfer | Section 2.3.4.1, Condensate Makeup, Storage and Transfer |
| 107/501 | FWL/FWR/ FWS | C33 | Feedwater | Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) |
| 109 | ISM/MSS/ SVV | B21/T23 | Main Steam | Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) |
| 111/660 | LOS/TMG/ TML/WOS | — | Turbine Lube Oil, Purification and Turning Gear/Waste Oil Disposal | Section 2.3.3.3, Service Water [pressure boundary] |
| 113 | TMB | — | EHC Hydraulic Oil | Section 2.3.3.3, Service Water [pressure boundary] |
| 115 | CCH/CCP | — | Reactor Plant Closed Cooling Water | Section 2.3.3.2, Component Cooling Water |
| 116 | CCS | — | Turbine Plant Closed Cooling Water | Section 2.3.3.3, Service Water [pressure boundary] |
| 118 | SWP | — | Normal Service Water | Section 2.3.3.3, Service Water |
| 121/122/ 710 | SAS/IAS/ JRB | — | Compressed Air | Section 2.3.3.4, Compressed Air |

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

| EOI System Code | S&W System Code | GE System Code | System Name | LRA Section Describing System |
|---|---|---|---|---|
| 123 | GMH | — | Hydrogen and $CO_2$ – Generator | Section 2.3.3.3, Service Water [pressure boundary] |
| 124 | GSN | — | Nitrogen | Section 2.3.3.3, Service Water [pressure boundary] |
| 125 | ARC | — | Main Condenser Air Removal | Section 2.3.3.3, Service Water [pressure boundary] |
| 126 | ABD/ABF/ ABM/ASR/ CNA | — | Auxiliary Condensate | Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) |
| 130 | SWC | — | Service Water Cooling | Section 2.3.3.3, Service Water |
| 200 | RSS | C61 | Remote Shutdown | Section 2.3.1.5, Remote Shutdown |
| 201 | SLS | C41 | Standby Liquid Control | Section 2.3.3.5, Standby Liquid Control |
| 202 | ADS/SVV | B21/T23 | Pressure Relief | Section 2.3.2.1, Pressure Relief |
| 203 | CSH | E22 | High Pressure Core Spray | Section 2.3.2.2, High Pressure Core Spray |
| 204 | RHS | E12 | Residual Heat Removal | Section 2.3.2.3, Residual Heat Removal |
| 205 | CSL | E21 | Low Pressure Core Spray | Section 2.3.2.4, Low Pressure Core Spray |
| 207 | LDS | E31 | Leak Detection | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 208/255 | MSI/LSV | E33 | Main Steam Positive Leakage Control | Section 2.3.3.6, Main Steam Positive Leakage Control |
| 209 | ICS | E51 | Reactor Core Isolation Cooling | Section 2.3.2.5, Reactor Core Isolation Cooling |
| 251 | FOF/FPW | — | Fire Protection – Water | Section 2.3.3.7, Fire Protection – Water |

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

| EOI System Code | S&W System Code | GE System Code | System Name | LRA Section Describing System |
|---|---|---|---|---|
| 253 | FPG | H13D | Fire Protection – Halon | Section 2.3.3.8, Fire Protection – Halon |
| 254 | CPM/CPP/ HCS | — | Hydrogen Mixing, Purge and Recombiner | Section 2.3.3.9, Combustible Gas Control |
| 256 | SWP | — | Standby Service Water | Section 2.3.3.3, Service Water |
| 257 | GTS | — | Standby Gas Treatment | Section 2.3.2.6, Standby Gas Treatment |
| 309 | EGA/EGE/ EGF/EGO/ EGS/EGT/ SYD | — | Standby Diesel Generator | Section 2.3.3.10, Standby Diesel Generator |
| 309/203 | EGA/EGE/ EGF/EGO/ EGS/EGT/ SYD | — | HPCS Diesel Generator | Section 2.3.3.11, HPCS Diesel Generator |
| 402 | HVC | — | HVAC – Control Building | Section 2.3.3.12, Control Building HVAC |
| 403 | HVR | — | HVAC – Containment Cooling | Section 2.3.3.13, Miscellaneous HVAC |
| 405 | HVP | — | HVAC – Diesel Generator | Section 2.3.3.13, Miscellaneous HVAC |
| 408 | HVT | — | HVAC – Turbine Building | Section 2.3.3.13, Miscellaneous HVAC |
| 409 | HVR | — | HVAC – Auxiliary Building | Section 2.3.3.13, Miscellaneous HVAC |
| 410 | HVK/HVN | — | HVAC – Chilled Water | Section 2.3.3.14, Chilled Water |
| 414 | HVO/HVY | — | HVAC – Yard Structures | Section 2.3.3.13, Miscellaneous HVAC |
| 508 | RPS | C71 | Reactor Protection | Section 2.3.1.6, Reactor Protection |

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

| EOI System Code | S&W System Code | GE System Code | System Name | LRA Section Describing System |
|---|---|---|---|---|
| 509 | MSS/TMB | C85 | Electrohydraulic Control and Steam Bypass | Section 2.3.3.3, Service Water [pressure boundary] |
| 511 | RMS | D17 | Radiation Monitoring | Section 2.3.3.12, Control Building HVAC |
| 552 | CMS/LMS | — | Containment Atmosphere and Leakage Monitoring | Section 2.3.3.9, Combustible Gas Control |
| 601 | WCS | G33/G36 | Reactor Water Cleanup | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 602 | SFC | — | Fuel Pool Cooling and Cleanup | Section 2.3.3.15, Fuel Pool Cooling and Cleanup |
| 603 | LWS | — | Radwaste – Liquid | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 607/610/ 611 | SSW/ SSR/SST | D24 | Sampling | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 609 | DED/DER/ DET/DFA/ DFD/DFM/ DFR/DFT/ DFW/ DTM/VTP | — | Drains – Floor and Equipment | Section 2.3.3.16, Plant Drains |
| 655/836 | DWS | — | Domestic Water | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 656 | ZZZ/SPC | — | Suppression Pool Cleanup | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 659/810 | MWS | — | Makeup Water System | Section 2.3.3.7, Fire Protection – Water |

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

| EOI System Code | S&W System Code | GE System Code | System Name | USAR Reference |
|---|---|---|---|---|
| 102/103 | BCS, CWS/VPS/ CWA | — | Circulating Water and Auxiliaries | Section 10.4.1<br>Section 10.4.5 |
| 104/127 | CNM/ HWC | — | Condensate | Section 10.4.7 |
| 108 | CRS/DSM/ DSR/DST/ ESS/HDH/ HDL/HRS/ SVH | — | Heater Feedwater | Section 10.1<br>Section 10.4 |
| 112 | TMS | — | Hood Spray – Turbine | Section 10.4.1.5 |
| 114 | TME | — | Gland Seal and Exhaust | Section 10.4.3 |
| 119 | GMO | — | Seal Oil – Hydrogen | Section 10.2.2 |
| 120 | GMC | — | Stator Cooling | Section 10.2.2 |
| 139 | BDS | — | Berm Drain System | None |
| 252 | FPH | — | Fire Protection – $CO_2$ | Section 9.5.1.2.9 |
| 401 | HVL | — | HVAC – Services Building | Section 12.5.2.1<br>Figure 12.3-5A<br>Figure 12.3-5B |
| 404 | DRS | — | HVAC – Drywell Cooling | Section 9.4.6.2.2 (drywell ventilation system) |
| 406 | HVF | — | HVAC – Fuel Building | Section 9.4.2<br>Section 15.7.4<br>[Discussed in LRA Section 2.3.3.13, Miscellaneous HVAC] |
| 407 | HVW | — | HVAC – Radwaste Building | Section 9.4.3 |
| 411 | GML | — | Isolated Phase Bus Cooling | None |
| 412 | HVJ | — | HVAC – Water Treatment Building | Section 9.4.7.2.4 |

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

| EOI System Code | S&W System Code | GE System Code | System Name | USAR Reference |
|---|---|---|---|---|
| 413 | HVI | — | HVAC – Aux Boiler Building | Section 9.4.7.2.3 |
| 415 | HVS | — | HVAC – Auxiliary Control Building | Section 9.4.7.2.14 |
| 604 | WSS | — | Radwaste – Solid | Section 11.4 |
| 606 | OFG | N64 | Offgas | Section 11.3 |
| 608 | CND | — | Condensate Demineralizer | Section 10.4.6 |
| 651/654 | SRR/<br>SRW/PBS | — | Drains – Storm and Roof;<br>Sanitary Sewage Treatment | Section 2.4.2.3<br>Section 9.3.3 |
| 652 | WTA/WTH | — | Hypochlorination and Chemical Feed | Section 9.2.1.2<br>Section 9.2.5.2<br>Section 9.2.7.2<br>Section 9.2.12.2<br>Section 10.4.5.3 |
| 653/839 | MWS/<br>VPS/WTL | — | Cooling Tower Makeup Water | Section 9.2.11 |
| 657 | WTW | — | Waste Water Treatment | Section 9.2.3 (part of makeup water treatment system) |
| 658 | WTS | — | Makeup Demineralizer Water Treatment | Section 9.2.3 |
| 703 | JAB/JCB/<br>JFB/JNB/<br>JPB/JRB/<br>JTB | — | Elevator/Building Superstructure | None |
| 720 | JPB | — | Auxiliary Building | None |
| FLEX | None | — | FLEX | None |

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

| System Code | S&W System | System Name | USAR Reference |
|---|---|---|---|
| 210 | ZZZ | Core Standby Cooling System Integrated ECCS | Section 14.2.12.1.44 |
| 250 | FPM | Fire Detection Supervisory | Section 13.5.1.2.1.1 |
| 300 | SYL/YWC | 230 kV Electric Distribution | Section 8.2.1.1.1 |
| 301 | NPS | 13.8 kV Electric Distribution | Section 8.3.1.1.3.2 |
| 302 | ENS/NNS | 4.16 kV Electric Distribution | Section 8.3.1.1.3.3 |
| 303 | BTC/EHS/ EJS/MCC/ NHS/NJS | 480 VAC Electric Distribution | Section 8.3.1.1.3.4 |
| 304 | EDA/SCA/ SCI/SCM/ SCV/SPF | 120 VAC Electric Distribution | Section 8.3.1.1.3.5 |
| 305 | BYS/ENB/ IHS/VBN/ VBS/JAB | 125 VDC Electric Distribution and Battery Charger | Section 8.1.5 |
| 306 | BXS/BXY | 48 VDC Electric Distribution | Section 8.3.2 |
| 307 | BWS/BWY | 24 VDC Electric Distribution and Battery Charger | None |
| 308 | PCS | Cathodic Protection | Section 13.5.1.2.1.1 |
| 310 | EXS/GMS/ SPG/SPI/ SPU/SYG | Generator Excitation and Protection | Section 10.2.6.1 |
| 311 | MTX/RTX/ SPL/SPM/ SPR/SPS/ STX/SYS | Transformers – Main and Station | Section 8.3.1.1.3.1 |

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

| System Code | S&W System | System Name | USAR Reference |
|---|---|---|---|
| 312 | ELS/ LAA/LAC/ LAD/LAF/ LAH/LAI/ LAK/LAM/ LAN/LAO/ LAP/LAR/ LAT/LAV/ LAW/LAX/ LAY/POP | Lighting | Section 1.2.2.8.15 |
| 313 | GND | Grounding | Section 8.3.1.1.6.4 |
| 314 | SUM | Supervisory Control and Telemetering | Section 8.3.2.1.6 |
| 503 | NME/NMS | Source Range Monitor | Section 7.6.1.3 |
| 504 | NME/NMI | Intermediate Range Monitor | Section 7.6.1.3 |
| 505 | NME/NMP | Average Power Range Monitor | Section 7.6.1.3 |
| 506 | NME/NMT | Traversing Incore Probe | Section 7.6.1.3 |
| 508 | RPS | Reactor Protection System | Section 7.2 |
| 510 | PPC | Process Computer | Section 7.7.1.6 |
| 511 | RMS | Process and Digital Rad. Monitoring | Section 7.6.1.4 |
| 512 | LCA/MCB | Control Room Panels | None |
| 513 | MCB | Local Racks and Panels [H22] | None |
| 514 | ERF/ERI | Emergency Response Information System | Section 7.7.1.7 |
| 515 | ECN | Emergency Communications Network | Section 1.2.2.8.14 |
| 530 | VMS | Vibration Monitoring System | Section 10.2.6 |
| 550 | ANN | Annunciator System | None |
| 551 | COP/COS/ COT | Communications | Section 1.2.2.8.14 |
| 553 | IHA/IHC/ IHS | Information Handling System | Section 8.3.2 |
| 554 | KTB/MMS | Meteorological Tower | Section 2.3.3.1.2 |
| 557 | ERS | Seismic Monitoring | Section 14.2.12.1.54 |

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

| System Code | S&W System | System Name | USAR Reference |
|---|---|---|---|
| 558 | SCC | Station Control and Bypass/Inop Status | None |
| 559 | CMB/LPM | Loose Parts/Vibration Monitoring | Section 14.2.12.1.69 |
| 560 | N/A | Local Racks and Panels – BOP | None |
| 562 | MOS | Temperature Scanner | None |
| 700 | MDS | Motor-Operated Doors | None |
| 706 | HTS | Heat Trace | Section 9.3.2.6.1 |
| 806 | YWC | Transformer Yard | Section 8.1.4 |
| 830 | YWC | Substation Yard (Fancy Point Switchyard) | Section 8.1.1 |
| 845 | JKB | Electrical Manholes | None |

**Table 2.2-4**
**Structures Within the Scope of License Renewal**

| Structure Name | LRA Section |
|---|---|
| Auxiliary Building | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Auxiliary Control Building | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Circulating Water Switchgear House No. 1 | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Condensate Storage Tank Foundation | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Control Building | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Control House 230kV Switchyard | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Cranes, Trolleys, Monorails and Hoists | Cranes, trolleys, monorails and hoists are evaluated as structural components or commodities of the structure in which they are located. |
| Diesel Generator Building | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Electrical Tunnels and Piping Tunnels | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Fire Protection Storage Tanks Foundation | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Fire Pump House | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Fuel Building | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Manholes, Handholes and Duct Banks | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Motor Generator Building | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Normal Switchgear Building | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |

**Table 2.2-4 (Continued)**
**Structures Within the Scope of License Renewal**

| Structure Name | LRA Section |
|---|---|
| Radioactive Waste Building | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Reactor Building | Section 2.4.1, Reactor Building |
| Service Water Cooling Electrical Switchgear Building and Transformer Foundations | Section 2.4.2, Water Control Structures |
| Service Water Cooling Heat Exchanger Foundation | Section 2.4.2, Water Control Structures |
| Service Water Cooling System Cooling Tower | Section 2.4.2, Water Control Structures |
| Service Water Pumps Foundation | Section 2.4.2, Water Control Structures |
| Service Water Pump Surge Tank and Chemical Injection Foundation | Section 2.4.2, Water Control Structures |
| Standby Service Water Cooling Tower, Pumphouse and Basin | Section 2.4.2, Water Control Structures |
| Transformer and Switchyard Support Structures and Foundations | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |
| Turbine Building Complex | Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures |

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

| Structure Name | Structure Function or USAR Reference |
|---|---|
| Acid Treatment Tanks Foundation | Provides support for two acid treatment tanks and associated equipment. |
| Auxiliary Boiler and Water Treatment Building | Houses equipment for the processing of water and the auxiliary boiler, which produces steam for plant start-up. |
| Circulating Water Cooling Towers and Switchgear Houses | Section 1.2.2.2<br>Section 9A.3.7.17 |
| Circulating Water Flume | Section 2.4.8.1 |
| Circulating Water Pump Structure | Section 1.2.2.2 |
| Clarifiers and Switchgear House | Provides support to the circulating water cooling tower system. |
| Demineralized Water Pump House | Provides space for equipment in support of the demineralized water system. |
| Demineralized Water Storage Tanks Foundation | Provides support for the demineralized water storage tanks. |
| Generation Support Building | Provides space for office and support personnel. The structure does not include any equipment or systems that are part of the power or steam supply systems in the plant. |
| Hydrogen and Carbon Dioxide Storage Pad | Provides support of the hydrogen and carbon dioxide storage tanks. |
| Hypochlorite Tanks Foundation and Switchgear House | Provides support of the hypochlorite storage tanks. |
| Independent Spent Fuel Storage Installation (ISFSI) Cask Storage Pad | Section 9.1.2.5<br>Section 11.4.2.7.2 |
| Instrument Air Diesel Air Compressor Foundation | Provides support for the nonsafety-related diesel air compressor and dryer skid, along with their associated components. |
| Instrument Air/Service Air Building | Section 1.2.2.2<br>Section 9.3.1.2 |
| Low Level Radwaste Storage Facility | Section 11.4.2.7.1 |

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

| Structure Name | Structure Function or USAR Reference |
|---|---|
| Makeup Water Pump House | Section 1.2.2.2 |
| Oil/Water Separator Tank Foundations | Provides support for the associated system equipment. |
| Oil Storage Buildings | Provides storage space for oil, grease and some solvents used at the site. |
| Primary Access Point Building | Provide a structure for the security center for RBS and serve as the facility through which personnel enter and exit the protected area. |
| Radioactive Material Control (RMC) Release Trailer | Serves as a facility for the processing and release of low level radioactive waste. |
| Services Building | Provides office space for site personnel and house the technical support center. The TSC center contains equipment relied upon to support the plant status information system and provides an area for engineering and management support of operations. |
| Service Water Cleaning Chemical Storage Tanks Foundation | Provides support for two chemical waste storage tanks. |
| Warehouse | Provides an enclosure for office space and for storage site personnel. |
| Water Neutralizing Tanks Foundation | Provides support for the waste neutralizing tanks. |
| Well Water Storage Tank Foundation | Section 9.2.3.2 |

## 2.3 SCOPING AND SCREENING RESULTS: MECHANICAL SYSTEMS

### 2.3.1 Reactor Coolant System

The following systems are described in this section:

- Section 2.3.1.1, Reactor Pressure Vessel and Internals
  - Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances
  - Section 2.3.1.1.2, Reactor Vessel Internals
- Section 2.3.1.2, Reactor Coolant Pressure Boundary
- Section 2.3.1.3, Nuclear Boiler Instrumentation
- Section 2.3.1.4, Reactor Recirculation
- Section 2.3.1.5, Remote Shutdown
- Section 2.3.1.6, Reactor Protection
- Section 2.3.1.7, Reactor Coolant Systems in Scope for 10 CFR 54.4(a)(2)

### 2.3.1.1 Reactor Pressure Vessel and Internals

System Description

The reactor pressure vessel (RPV) and internals system (system codes 050, RVS, B13) includes the reactor vessel and reactor vessel internal components such as the core, shroud, steam separator and dryer assemblies, and jet pumps. Also included in this system are the control rods and the control rod drive (CRD) housings and mechanisms.

*RPV and Appurtenances*

The purpose of the RPV and appurtenances is to provide a volume in which the core can be submerged in water for the purpose of moderation, cooling of the fuel, and power generation. The reactor vessel serves as a high integrity barrier against the leakage of radioactive materials to the drywell and provides a floodable volume in which the core can be adequately cooled in the event of a breech in the reactor coolant pressure boundary external to the reactor vessel. The floodable inner volume of the RPV is the volume inside the core shroud up to the level of the jet pump suction inlet. The RPV and appurtenances include the vessel shell, top and bottom heads, nozzles and penetrations, internal and external attachments, and vessel supports.

The RPV is a non-prototype BWR/6 design with a 218-inch diameter vessel. The reactor vessel shell is a cylindrical vessel with a spherical bottom head. The bottom head contains penetrations for the control rod drives, in-core monitors, standby liquid control and differential pressure lines, and drain connections. The vessel shell contains nozzles for recirculation water inlet and outlet piping, feedwater inlets, main steam outlets, core spray inlet piping, and reactor instrumentation. The vessel shell is supported by an integral skirt that is bolted to a concrete pedestal, which is supported by the building foundation.

The cylindrical shell and top and bottom heads of the reactor vessel are fabricated of low alloy steel, the interior of which is clad with stainless steel weld overlay, except for the top head and nozzle and nozzle weld zones. The vessel top head is secured to the reactor vessel by studs, nuts and washers. The vessel flanges are sealed with two concentric metal seal rings designed to permit no detectable leakage through the inner or outer seal at any operating condition. To detect seal failure, a vent tap is located between the two seal rings. A monitor line is attached to the tap to provide an indication of leakage from the inner seal-ring seal.

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

<u>*RPV Internals*</u>

The purpose of the RPV internals (or reactor vessel internals, RVI) is to direct reactor coolant to provide proper coolant distribution, core heat removal, and steam/water separation. The internals provide positioning and support for the fuel assemblies, control rods, and vessel instrumentation. Vessel internals also provide an inner volume containing the core that can be flooded following a break in the reactor coolant pressure boundary external to the reactor vessel.

The RPV internals can be divided into two major groups: components that provide core support and the remaining reactor vessel internals. The core support structures form partitions within the reactor vessel to sustain pressure differentials across the partitions, direct the flow of the coolant water, and laterally locate and support the fuel assemblies. The remaining reactor vessel internal components provide for the operation of the core and the reactor coolant system (RCS).

*Core Support Structures*

- Control rod guide tubes
- Core plate
- CRD housing (only that portion above the first weld that is above the housing-to-pressure vessel weld)
- Grid (Only that portion below the bottom weld in the cylindrical portion is core support structure. The grid is a part of the top guide assembly.)
- Orificed fuel supports (except for the orifices which do not support or restrain the core) and peripheral fuel supports.
- Shroud
- Shroud support cylinder, plate, and legs
- Top guide (hardware studs, nuts, and pins between top guide and shroud)

*Reactor Internals*

- Access hole cover
- Core spray lines and spargers
- Differential pressure and standby liquid control lines
- Feedwater spargers
- Guide rods (for shroud head and steam dryer)
- In-core flux monitor guide tube
- In-core instrument housings (evaluated with the reactor vessel)
- Jet pump assemblies, braces, and instrumentation
- Low pressure core injection (LPCI) piping (including the coupling)
- Shroud head and steam separator assembly
- Steam dryers
- Surveillance sample holders

The vessel head spray function is no longer in use. The vessel vent and head spray nozzle is evaluated with the reactor vessel pressure boundary as a piping component.

Except for the Zircaloy in the reactor core, these reactor internals are stainless steel or other corrosion-resistant alloys. The fuel assemblies (including fuel rods and channel), control blades, incore instrumentation, shroud head and steam separator assembly, and steam dryers are removable when the reactor vessel is opened for refueling or maintenance.

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

*Control Rods, Control Rod Drive Housings, and Control Rod Drives*

The control rods perform dual functions of power distribution shaping and reactivity control. Power distribution in the core is controlled during operation of the reactor by manipulation of selected patterns of rods. The CRD mechanism (drive) used for positioning the control rod in the reactor core is a double-acting, mechanically latched, hydraulic cylinder using water as its operating fluid. The individual drives are mounted on the bottom head of the reactor pressure vessel. The drives are capable of inserting or withdrawing a control rod at a slow, controlled rate, as well as providing rapid insertion when required.

The CRD housings are inserted through the CRD penetrations in the reactor vessel bottom head and are welded to the reactor vessel. Each housing transmits loads to the bottom head of the reactor. These loads include the weights of a control rod, a CRD, a control rod guide tube, a four-lobed fuel support piece, and the four fuel assemblies that rest on the fuel support piece.

The RPV and internals have the following intended functions for 10 CFR 54.4(a)(1).

- Contain the reactor core, reactor internals, and the reactor coolant during all normal and accident modes of plant operation, to ensure structural and pressure boundary integrity.
- Serve as a high integrity barrier against leakage of radioactive materials to the drywell during all normal and accident modes of plant operation.
- Provide a floodable volume in which the reactor core can be adequately cooled in the event of a loss of coolant accident (LOCA).
- Insert all control rods into the core to quickly shut down the reactor in response to a manual or automatic signal.

The RPV and internals have the following intended function for 10 CFR 54.4(a)(2).

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

The RPV and internals have no intended functions for 10 CFR 54.4(a)(3).

USAR References

Section 3.9.5.1B

Section 4.1

Section 5.3

Components Subject to Aging Management Review

The RPV and internals are reviewed as the following subsystems.

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

The control rod housings are reviewed with the RPV and appurtenances. The control rod drive mechanisms and vessel vent and head spray nozzle are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. The control rods are periodically replaced, and as short-lived components, are not subject to aging management review.

License Renewal Drawings

See Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances, for license renewal drawings associated with the RPV and appurtenances. License renewal drawings are not provided for the reactor vessel internals.

#### 2.3.1.1.1 Reactor Pressure Vessel and Appurtenances

Description of Components Subject to Aging Management Review

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

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

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

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

USAR References

Section 3.9.5.1B

Section 4.1

Section 5.3

License Renewal Drawings

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

LRA-PID-03-01A
LRA-PID-06-01B
LRA-PID-25-01A
LRA-PID-25-01C
LRA-PID-26-03A
LRA-PID-27-04A
LRA-PID-27-05A
LRA-PID-27-07A
LRA-PID-27-07B
LRA-PID-27-07C
LRA-PID-27-16A
LRA-PID-32-09B
LRA-PID-36-01C

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

| Component Type | Intended Function |
|---|---|
| *Attachments and Supports and Welds* | |
| Reactor vessel external attachments<br>• Support skirt | Structural support |
| Reactor vessel internal attachments<br>• Steam dryer hold down bracket<br>• Guide rod brackets<br>• Steam dryer support bracket<br>• Core spray brackets and pads<br>• Feedwater sparger brackets<br>• Surveillance specimen brackets and pads<br>• Jet pump riser support pads and pad to riser brackets<br>• Jet pump riser support pads and pad to riser bracket welds<br>• Shroud support leg, baffle and pad | Structural support |
| Welds<br>• Guide rod brackets to vessel<br>• Steam dryer support brackets to vessel<br>• Core spray brackets and pads to vessel<br>• Feedwater sparger brackets to vessel<br>• Surveillance specimen brackets and pads to vessel<br>• Shroud support leg, baffle and pad to vessel | Structural support |
| *Bolting* | |
| In-core housing bolting,<br>CRD flange bolting,<br>Upper head nozzle flange bolting,<br>Vibration instrument flange bolting | Pressure boundary |

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

| Component Type | Intended Function |
|---|---|
| Reactor vessel closure flange bolting<br>• Closure studs, nuts, and washers | Pressure boundary |
| *Penetrations, Nozzles and Welds* | |
| Penetrations<br>• CRD housings<br>• In-core housings<br>• Core differential pressure/standby liquid control (SLC) nozzle (N11, N18)<br>• Core differential pressure stubs | Pressure boundary |
| Nozzles<br>• Recirc outlet (N1)<br>• Recirc inlet (N2)<br>• Steam (N3)<br>• Feedwater (N4-A, B, C, D)<br>• Core spray (N5)<br>• Residual heat removal (RHR)/low pressure coolant injection (LPCI) (N6)<br>• Vent (N7)<br>• Spare head (N8)<br>• Jet pump instrument (N9)<br>• CRD return (N10)<br>• Water level instrumentation (N12, N13, N14)<br>• Drain line (N15)<br>• Vibration instrument (N16)<br>• Seal leak detection (N17) | Pressure boundary |
| *Safe Ends, Thermal Sleeves, Flanges, Caps, and Welds* | |
| CRD return line cap (N10) | Pressure boundary |

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

| Component Type | Intended Function |
|---|---|
| Nozzle flanges<br>• Vent (N7)<br>• Spare head nozzle (N8)<br>• Vibration Instrument (N16) | Pressure boundary |
| Nozzle safe ends or extensions ≥ 4 inches<br>• Recirculation outlets (N1)<br>• Recirculation inlets (N2)<br>• Jet pump instrumentation (N9) | Pressure boundary |
| Nozzle safe ends ≥ 4 inches<br>• Recirculation inlets (N2)<br>• Feedwater (N4-B, -C, -D)<br>• Core spray (N5)<br>• RHR/LPCI (N6) | Pressure boundary |
| Nozzle safe ends or extensions ≥ 4 inches<br>• Steam (N3)<br>• Feedwater (N4-A) safe end<br>• Feedwater (N4-B, -C, -D) extension<br>• Core spray (N5)<br>• RHR/LPCI (N6) | Pressure boundary |
| Nozzle safe ends < 4 inches<br>• Core differential pressure/SLC (N11, N18)<br>• CRD return line (N10) | Pressure boundary |
| Thermal sleeves < 4 inches<br>• CRD return line (N10) | Pressure boundary |

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

| Component Type | Intended Function |
|---|---|
| Thermal sleeves or extensions ≥ 4 inches<br>• Recirculation inlets (N2)<br>• Feedwater (N4-B, -C, -D)<br>• Feedwater (N4-A) thermal sleeve<br>• Core spray (N5)<br>• RHR/LPCI (N6) | Pressure boundary |
| Thermal sleeve extensions ≥ 4 inches<br>• Feedwater (N4-A) extension<br>• Recirculation inlets (N2)<br>• Feedwater (N4-B, -C, -D)<br>• Core spray inlets (N5)<br>• RHR/LPCI (N6) | Pressure boundary |
| Welds ≥ 4 inches (nozzle to safe end)<br>• Recirculation outlet (N1)<br>• Recirculation inlet (N2)<br>• Jet pump instrumentation (N9) | Pressure boundary |
| Welds (nozzle to vessel)<br>• Core differential pressure/SLC (N11, N18)<br>• Water level instrumentation (N12, N13, N14) | Pressure boundary |
| *Shell and Heads* | |
| Reactor pressure vessel<br>• Top head<br>• Top head/closure flange<br>• Non-beltline shell plates/closure flange<br>• Bottom head<br>• Beltline shell plates and connecting welds | Pressure boundary |

#### 2.3.1.1.2 Reactor Vessel Internals

Description of Components Subject to Aging Management Review

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

*Access Hole Cover*

The access hole cover consists of the non-crevice design and is used to cover the access hole in the shroud support plate. This hole is designed to allow access to the lower plenum during the installation of the reactor vessel internals. This component is critical to the assurance of shroud integrity in that it prevents excessive bypass leakage from the shroud during accident conditions, thereby assisting to assure core floodability.

*Control Rod Guide Tubes*

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

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

*Core Plate*

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

BWR-6 plants contain rim holddown bolts and wedge retainers. The holddown bolts prevent the core plate from lifting and the wedge retainers restrict the lateral movement of the core plate. The holddown bolts are tack welded in place to prevent back-off. The wedges are machined parts which are retained in position by keepers; these keepers are retained by bolts also tack welded to prevent back-off.

*Core Spray Lines and Spargers*

The core spray lines are the means for directing flow to the core spray nozzles, which distribute coolant during accident conditions. Two core spray lines enter the reactor vessel through the two core spray reactor vessel nozzles. The lines divide immediately inside the reactor vessel. The two halves are routed to opposite sides of the reactor vessel and are supported by clamps attached to the vessel wall. The lines are then routed downward into the downcomer annulus and pass through the top guide cylinder immediately below the flange. The core spray lines are supported by bolts as they pass through the top guide. The flow divides again as it enters the center of the semicircular sparger, which is routed halfway around the inside of the top guide cylinder. The two spargers are supported by brackets designed to accommodate thermal expansion. The line routing and supports are designed to accommodate differential movement between the top guide and vessel. The other core spray line is identical except that it enters the opposite side of the vessel and the spargers are at a slightly different elevation inside the top guide cylinder. The correct spray distribution pattern is provided by a combination of distribution nozzles and orifices pointed radially inward and downward from the spargers.

Core spray lines and spargers inside the vessel are included in this review. The RPV nozzle, thermal sleeve, and brackets attached to the vessel wall associated with core spray are reviewed in Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances. The remaining Class 1 components of the core spray system are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary.

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

The ΔP/SLC lines (also called liquid control line) enter the vessel through two bottom head penetrations and serve a dual function within the reactor vessel: (1) to sense the differential pressure across the core support plate and (2) to provide a path for the injection of the liquid control solution into the coolant stream. The SLC system injects a sodium pentaborate solution following a design basis LOCA event with no functioning emergency core cooling system injection. The system makes it possible to have an orderly and safe shutdown in the event that not enough control rods can be inserted into the core to accomplish shutdown in the normal fashion. One line terminates near the lower shroud with a perforated length below the core support plate. It is used to sense the pressure below the core support plate during normal operation and to inject liquid control solution if required. This location facilitates good mixing and dispersion. The other line terminates immediately above the core support plate and senses the pressure in the region outside the fuel assemblies.

A reduction in core plate differential pressure indication due to a failure of the ΔP/SLC injection pipe inside the vessel will be indicated in the control room. In the BWR Vessel and Internals Project document BWRVIP-06 safety assessment, there are several components where extensive degradation can be tolerated because of the redundancy provided in the SLC system. A number of these failures are readily detected, but even without detection of cracking, the SLC system would perform its function adequately when initiated as long as the sodium pentaborate is injected into the bottom head. The injection of sodium pentaborate is also credited for post-LOCA control of suppression pool pH. However, this function is similarly dependent only on injection of the sodium pentaborate into the vessel and then into the suppression pool via the break. Therefore, the ΔP/SLC lines inside the reactor vessel do not perform a license renewal intended function and are not subject to aging management review.

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

_Feedwater Spargers_

The feedwater spargers are stainless steel headers in a forged tee design located in the mixing plenum above the downcomer annulus. A separate sparger is fitted to each feedwater nozzle and is shaped to conform to the curve of the vessel wall. Sparger end brackets are pinned to vessel brackets to support the spargers. Feedwater flow enters the center of the spargers and is discharged radially inward to mix the cooler feedwater with the downcomer flow from the steam separators and steam dryer before it contacts the vessel wall. The feedwater also serves to condense the steam in the region above the downcomer annulus and to subcool the water flowing to the jet pumps and recirculation pumps.

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

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

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

*Orificed and Peripheral Fuel Supports*

The fuel supports are of two basic types: peripheral supports and four-lobed orificed fuel supports. The peripheral fuel supports are located at the outer edge of the active core and are not adjacent to control rods. Each peripheral fuel support supports one fuel assembly and contains a single orifice assembly designed to ensure proper coolant flow to the peripheral fuel assembly. The peripheral fuel supports are welded to the core plate.

The four-lobed fuel supports insert into and rest on top of the control rod guide tubes, with lateral alignment and rotational restraint provided by the core plate, and angular alignment provided by alignment pins. Each four-lobed orificed fuel support supports four fuel assemblies and is provided with four orifice plates to ensure proper coolant flow distribution to each fuel assembly. The control rods pass through slots in the center of the four-lobed orificed fuel support. A control rod and the four adjacent fuel assemblies represent a core cell.

The orificed and peripheral fuel supports are safety-related components that provide lateral support, vertical support, and alignment of the fuel bundles. In addition they distribute core flow into the fuel bundles.

*Guide Rods*

The guide rods are used for alignment of the shroud head and steam dryer during assembly and disassembly of reactor vessel internals.

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

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

*In-Core Flux Monitor Guide Tubes, Dry Tubes, and Stabilizers*

The incore guide tubes and dry tubes provide a means of positioning fixed detectors in the core as well as provide a path for calibration monitors (traversing in-core probe [TIP] system). The guide tubes extend from the top of the in-core flux monitor housing in the lower plenum to the top of the core support plate. The dry tubes for the local power range monitoring (LPRM) detectors and the dry tubes for the source range monitoring and intermediate range monitoring (SRM/IRM) detectors are inserted through the guide tubes. The incore guide tube stabilizers (a latticework of clamps, tie bars, and spacers) give lateral support and rigidity to the guide tubes. The bolts and clamps are welded, after assembly, to prevent loosening during reactor operation.

The in-core flux monitoring guide tubes provide the path for and support of neutron monitoring instruments (SRM, IRM and LPRM) and are subject to aging management review. The in-core flux monitoring guide tubes and stabilizers are not classified as a core support structure or safety class component but are subject to aging management review. The dry tubes for SRM/IRM and LRPM detectors are inside the reactor vessel and part of the reactor coolant pressure boundary (RCPB). The dry tubes are inserted into the flux monitoring guide tubes and are evaluated in this review.

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

*Jet Pump Assemblies*

The 20 jet pump assemblies are located in two semicircular groups in the downcomer annulus between the shroud and the reactor vessel wall. Each stainless steel jet pump consists of a riser and riser brace, hold-down beam and bolt assembly, driving nozzles, suction inlet, throat or mixing section, diffuser, and lower ring. The driving nozzles, suction inlet, and throat comprise the inlet mixer assembly, which is removable as a unit.

The diffuser is welded to a lower ring, which is welded to the shroud support plate (also called the shroud support ledge). High pressure water from the recirculation pumps is supplied to each pair of jet pumps through a riser pipe welded to the recirculation inlet nozzle thermal sleeve. A riser brace which provides lateral support for the riser pipe assembly is welded to the riser pipe and to pads on the reactor vessel walls. On the riser for jet pumps 19 and 20, a repair clamp including a repair clamp bolt was installed to provide lateral support. The repair clamp replaces the cracked weld between the riser pipe and the yoke.

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

*Jet Pump Instrumentation*

Jet pump instrument lines are used to measure flow by measuring the differential pressure across each jet pump. Jet pump flows are an indication of jet pump integrity and core flow measurement accuracy, which would be affected by sensing line failure. While this instrumentation is required for operation, it is not required for safe shutdown (when jet pumps are not operating) nor would a sensing line failure cause a failure of other internals components. Therefore, jet pump instrumentation inside the vessel has no license renewal intended function and is not subject to aging management review.

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

*Low Pressure Coolant Injection*

Three LPCI lines penetrate the shroud through separate LPCI nozzles. Each line consists of a nozzle through the reactor vessel wall, thermal sleeve, upper-elbow, set screws, coupling sleeve, threaded collar, lower elbow, strut, elbow extension, shroud attachment ring, thermal shield, and deflector plate. Coolant is discharged inside the shroud, and the flow deflectors prevent horizontal flow impingement upon the core and instrument tubes. The flow deflectors are designed with a conical flow splitter, which redirects the LPCI flow upward, downward and in the two horizontal directions tangential to the core. The flow deflectors are attached to the shroud wall by full penetration welds at the four corners of the deflector plate. The LPCI coupling design incorporates vertically oriented slip fit joints to allow free thermal expansion.

The LPCI line is part of the emergency core cooling system, which performs a safety function. All parts of the LPCI line are subject to aging management review. LPCI components within the reactor vessel are included in this review. The LPCI reactor vessel nozzles and thermal sleeves are evaluated in in Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances, and the lines leading up to the LPCI reactor vessel nozzles are evaluated in Section 2.3.2.3, Residual Heat Removal. Class 1 portions of LPCI are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary.

*Shroud*

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

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

*Shroud Head and Steam Separator Assembly*

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

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

Industry operating experience has shown that loose parts generated by the steam dryers can reach the steam lines. However, any loose parts generated by the steam separators would be captured by the steam dryers, and would not reach the steam lines. The conclusion of BWRVIP-06-A therefore remains valid for the steam separators even considering recent operating experience. Consequently, the steam separators have no license renewal intended function and are not subject to aging management review.

*Shroud Support Assembly*

The shroud support assembly, which includes the shroud support cylinder, shroud support plate, and shroud support legs (or pedestals), is designed to carry the weight of the shroud, shroud head, core support plate, top guide, steam separators, jet pump assembly, and the peripheral fuel assemblies. The shroud support assembly also provides lateral support for the shroud, shroud head, core support plate, top guide, steam separators, jet pump assembly, and the peripheral fuel assemblies. The shroud support provides an annular baffle between the reactor pressure vessel and the shroud. The jet pump discharge diffusers penetrate the shroud support plate to introduce the coolant to the inlet plenum below the core. The shroud is welded to the shroud support cylinder, which is welded to the shroud support plate, which is welded to the shroud support pad, which is welded to the inside of the reactor vessel. The shroud support legs (pedestals) are welded to the bottom of the shroud support cylinder and to the bottom of the inside of the reactor vessel.

The shroud support assembly supports the shroud and core plate and provides a floodable volume, which is a safety function, and thus the assembly is subject to aging management review. The shroud support cylinder and shroud support plate assembly are evaluated in this review. The shroud support leg (pedestal) and pad is welded to the inside of the reactor vessel and evaluated in Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances.

*Steam Dryer*

The steam dryer consists of steam dryer vanes, collecting troughs, and tubes housed in a cylindrical skirt that forms a plenum above the steam separator assembly. The dryer removes moisture from the wet steam leaving the steam separators. The extracted moisture flows down the dryer vanes to the collecting troughs, then flows through tubes into drain channels and then to the downcomer annulus. The drain channels are outside a skirt that extends from the bottom of the dryer vane housing to the steam separator standpipe below the water level. This skirt forms a seal between the wet steam plenum and the dry steam flowing from the top of the dryer to the steam outlet nozzles.

The steam dryer and shroud head are positioned in the vessel during installation with the aid of vertical guide rods. The dryer assembly rests on steam dryer support brackets attached to the reactor vessel wall. Upward movement of the dryer assembly, which may occur under accident conditions, is restricted by steam dryer holddown brackets attached to the reactor vessel top head.

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

*Surveillance Sample Holders*

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

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

*Top Guide Assembly*

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

The top guide assembly, part of the core support structure, performs a safety function of maintaining alignment and spacing at the top of the fuel assemblies and provides lateral support for the upper end of installed in-core guide tubes. The top guide assembly (including hardware such as studs, nuts, and eccentric sleeves) is subject to aging management review and is included in this review.

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

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

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

USAR References

Section 3.9.5.1.1B

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

| Component Type | Intended Function |
| --- | --- |
| RVI connectors<br>• Bolts<br>• Brackets | Structural support |
| Access hole cover | Floodable volume |
| Access hole cover weld | Floodable volume |
| Control rod guide tubes<br>• Tubes<br>• Thermal sleeve | Limit thermal cycling<br>Structural support |
| Control rod guide tubes<br>• Base | Structural support |
| Core support plate and core plate wedge retainers | Structural support |
| Core spray lines, nozzles, orifices and spargers | Flow distribution |
| Fuel supports<br>• Four-lobed<br>• Peripheral | Structural support |
| Fuel supports<br>• Orifices | Flow distribution |
| In-core instrument flux monitoring<br>• Guide tube<br>• Clamps, tie bars, and spacers | Structural support |
| In-core instrument flux monitoring<br>• Dry tube<br>• Stabilizers | Pressure boundary |
| Jet pump assembly<br>• Riser braces<br>• Riser repair clamp<br>• Hold-down beam | Structural support |

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

| Component Type | Intended Function |
|---|---|
| Jet pump assembly<br>• Lower ring<br>• Transition piece<br>• Suction inlet elbow<br>• Suction inlet nozzle<br>• Mixer adapter<br>• Mixer throat (barrel)<br>• Diffuser collar<br>• Diffuser tail pipe | Floodable volume |
| Jet pump assembly<br>• Restrainer bracket<br>• Wedge | Structural support |
| LPCI assembly<br>• Deflector<br>• Extensions<br>• Ring<br>• Collar<br>• Sleeve<br>• Seal rings<br>• Elbows | Flow distribution |
| LPCI assembly<br>• Screw<br>• Strut and pad | Structural support |
| LPCI assembly<br>• Thermal shield | Limit thermal cycling |
| Shroud | Floodable volume |
| Shroud support plate and shroud support cylinder | Floodable volume<br>Structural support |
| Steam dryer | Structural integrity |
| Top guide assembly | Structural support |

### 2.3.1.2 Reactor Coolant Pressure Boundary

Description

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

a. Part of the reactor coolant system, or

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

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

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

    3. The reactor coolant system safety/relief valve piping up to and including the safety/relief valves (SRVs).

Systems and components within the RCPB are classified as Regulatory Guide 1.26 Quality Group A, or ASME Code, Section III Safety Class 1. Code requirements for these components are Class A or Class 1. These components are collectively identified as Class 1, or RCPB components, in this review. Class 2 and Class 3 components directly connected to the Class 1 RCPB components are considered extensions of the RCPB for the purposes of license renewal.

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

| System Code | System Name | LRA Section Describing System |
|---|---|---|
| 051/058 | Nuclear boiler instrumentation | Section 2.3.1.3, Nuclear Boiler Instrumentation |
| 052 | Control rod drive hydraulic | Section 2.3.3.1, Control Rod Drive Hydraulic |
| 053 | Reactor recirculation | Section 2.3.1.4, Reactor Recirculation |
| 107/501 | Feedwater | Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) |
| 109 | Main steam | Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) |
| 200 | Remote shutdown | Section 2.3.1.5, Remote Shutdown |
| 201 | Standby liquid control | Section 2.3.3.5, Standby Liquid Control |
| 202 | Pressure relief | Section 2.3.2.1, Pressure Relief |
| 203 | High pressure core spray (HPCS) | Section 2.3.2.2, High Pressure Core Spray |
| 204 | Residual heat removal–low pressure coolant injection (LPCI) | Section 2.3.2.3, Residual Heat Removal |
| 205 | Low pressure core spray (LPCS) | Section 2.3.2.4, Low Pressure Core Spray |
| 207 | Leak detection | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 208 | Main steam positive leakage control | Section 2.3.3.6, Main Steam Positive Leakage Control |
| 209 | Reactor core isolation cooling (RCIC) | Section 2.3.2.5, Reactor Core Isolation Cooling |
| 508 | Reactor protection | Section 2.3.1.6, Reactor Protection |
| 601 | Reactor water cleanup | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 609 | Floor and equipment drains | Section 2.3.3.16, Plant Drains |
| 610 | Reactor plant sampling | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |

Components of the reactor pressure vessel and internals system (050) that also form part of the RCPB are reviewed in Section 2.3.1.1.1, Reactor Pressure Vessel and Appurtenances and Section 2.3.1.1.2, Reactor Vessel Internals.

This review also includes safety-related RCS components that are outside the RCPB and not addressed in other aging management reviews. This includes equipment such as recirculation pump support components and mechanical instrumentation components (piping, tubing, valves) outside the RCPB.

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

- Maintain reactor coolant pressure boundary. (This function applies to all but the reactor protection system, which has no direct mechanical connection to the Class 1 RCPB or the extended Class 2 or 3 boundary.)
- Support containment pressure boundary. (This function applies to all but the pressure relief, leak detection, main steam positive leakage control, remote shutdown, and reactor protection systems, which have no containment (drywell or primary) penetration components.)
- Maintain pressure boundary of interfacing safety-related systems not connected to the Class 1 RCPB or the extended Class 2 or 3 boundary (nuclear boiler instrumentation, drywell pressure monitoring instrumentation). (This function applies to the reactor protection system.)

Other unique intended functions for 10 CFR 54.4(a)(1) performed by systems addressed only in this review include the following.

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

- Maintain an adequate fuel barrier thermal margin during postulated transients.
- Maintain the ability of the reactor vessel internals to provide a refloodable volume.

The control rod drive hydraulic, standby liquid control, pressure relief, high pressure core spray, residual heat removal-LPCI, low pressure core spray, main steam positive leakage control, reactor core isolation cooling, and floor and equipment drains systems are evaluated in other reviews as stated in the sections referenced in the table above.

The RCS support systems have the following intended function for 10 CFR 54.4(a)(2).

- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function. (This function applies to all but the remote shutdown and reactor protection systems.)

The RCS support systems have the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48). (This function applies to all but the standby liquid control, leak detection, reactor protection, and sampling systems.)
- Perform a function that demonstrates compliance with the Commission's regulations for anticipated transient without scram (ATWS) (10 CFR 50.62). (This function applies to the control rod drive hydraulic and standby liquid control systems.)
- Perform a function that demonstrates compliance with the Commission's regulations for station blackout (10 CFR 50.63). (This function applies to the reactor core isolation cooling system.)

The remote shutdown, leak detection, main steam positive leakage control, reactor protection, and sampling systems have no intended functions for 10 CFR 54.4(a)(3).

USAR References

The reactor coolant pressure boundary is described in USAR Section 5.1 and Section 5.2. USAR Section 3.2.2 discusses system quality group classifications. USAR references for the systems listed above are provided in the listed LRA section.

Components Subject to Aging Management Review

Some safety-related RCS components are included in other reviews. Air operators, air supply lines, and accumulators of the RCS are reviewed in Section 2.3.3.4, Compressed Air, and main steam safety/relief valve discharge line components are reviewed in Section 2.3.2.1, Pressure Relief.

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

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

License Renewal Drawings

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

| System Codes | System | LRA Drawings | |
|---|---|---|---|
| 051/058, MSS/ISC, B21/A62 | Nuclear boiler instrumentation | LRA-PID-25-01A | LRA-PID-25-01G |
| 052, RDC/RDS, C11 | Control rod drive hydraulic | LRA-PID-36-01A | LRA-PID-36-01B |
| 053, RCS, B33 | Reactor recirculation | LRA-PID-25-01A<br>LRA-PID-25-01C<br>LRA-PID-25-01D<br>LRA-PID-25-01E | LRA-PID-25-01F<br>LRA-PID-26-03A<br>LRA-PID-32-09C |
| 107/501, FWL/FWR/ FWS, C33 | Feedwater | LRA-PID-03-01A<br>LRA-PID-25-01A<br>LRA-PID-06-01B | |
| 109, ISM/MSS/ SVV, B21/ T23 | Main steam | LRA-PID-03-01A<br>LRA-PID-03-01B | LRA-PID-03-01C<br>LRA-PID-32-05B |
| 200, RSS, C61 | Remote shutdown | LRA-PID-25-01A | |
| 201 SLS, C41 | Standby liquid control | LRA-PID-03-01A<br>LRA-PID-27-16A | |
| 202, ADS/SVV, B21/T23 | Pressure relief | LRA-PID-03-01B<br>LRA-PID-25-01A | |
| 203, CSH, E22 | High pressure core spray (HPCS) | LRA-PID-27-04A | |
| 204, RHS,E12 | Residual heat removal–low pressure coolant injection (LPCI) | LRA-PID-25-01A<br>LRA-PID-27-07A | LRA-PID-27-07B<br>LRA-PID-27-07C |
| 205, CSL, E21 | Low pressure core spray (LPCS) | LRA-PID-27-05A | |

| System Codes | System | LRA Drawings | |
|---|---|---|---|
| 207, LDS, E31 | Leak detection | LRA-PID-03-01A<br>LRA-PID-26-03A<br>LRA-PID-27-04A | LRA-PID-27-07A<br>LRA-PID-27-07C<br>LRA-PID-32-09B |
| 208/255, MSI/LSV, E33 | Main steam positive leakage control | LRA-PID-03-01A | LRA-PID-27-20A |
| 209, ICS, E51 | Reactor core isolation cooling (RCIC) | LRA-PID-27-06A | |
| 508, RPS, C71 | Reactor protection | LRA-PID-25-01A | |
| 601, WCS, G33/G36 | Reactor water cleanup | LRA-PID-26-03A | |
| 609, DED/DER/ DET/DFA/ DFD/DFM/ DFR/DFT/ DFW/DTM/ VTP | Floor and equipment drains | LRA-PID-32-05B<br>LRA-PID-32-09B | LRA-PID-32-09C<br>LRA-PID-32-09N |
| 610, SSR, D24 | Reactor plant sampling | LRA-PID-21-02B | |

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

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Condensing chamber | Pressure boundary |
| Flange seal leak detection components (non-Class 1)<br>• Flex hose<br>• Orifice<br>• Piping<br>• Valves | Pressure boundary |
| Flex hose (non-Class 1) | Pressure boundary |
| Flow element (main steam flow restrictors) | Flow control |
| Flow element (reactor water cleanup system) | Flow control<br>Pressure boundary |
| Mixing tee (non-Class 1) | Pressure boundary |
| Orifice (non-Class 1) | Pressure boundary |
| Piping (non-Class 1) | Pressure boundary |
| Piping < 4 inches nominal pipe size (NPS) | Pressure boundary |
| Piping ≥ 4 inches NPS | Pressure boundary |
| Recirculation pumps<br>• Pump casing and cover | Pressure boundary |
| Recirculation pumps<br>• Seal injection water heat exchanger inner tube | Pressure boundary |
| Recirculation pumps<br>• Seal injection water heat exchanger outer tube (shell) | Pressure boundary |
| Recirculation system sample probe | Pressure boundary |

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

| Component Type | Intended Function |
|---|---|
| Thermowell | Pressure boundary |
| Tubing (non-Class 1) | Pressure boundary |
| Valve body (non-Class 1) | Pressure boundary |
| Valve body (main steam safety/ relief valves) | Pressure boundary |
| Valve body < 4 inches NPS | Pressure boundary |
| Valve body ≥ 4 inches NPS | Pressure boundary |

### 2.3.1.3 Nuclear Boiler Instrumentation

System Description

The nuclear boiler instrumentation system (system codes 051/058, MSS/ISC, B21/A62) monitors reactor vessel parameters and provides indication and automatic control signals for reactor protection. This system supports instrumentation for systems associated with the reactor pressure vessel and reactor recirculation system and provides input for the reactor protection system and engineered safety system actuations.

The system consists of instrumentation tubing, valves, pressure reducers, transmitters, condensing chambers, and various other support instruments.

Components in this system support the reactor coolant system pressure boundary. Along with containment atmosphere monitoring, nuclear boiler instrumentation is credited for monitoring primary system parameters during safe shutdown for a fire event. The system is credited to provide readings for the following:

- Reactor vessel pressure
- Reactor vessel water level
- Reactor vessel range indication
- Reactor vessel pressure/level recording

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

- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

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

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

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

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

USAR References

Section 1.2.2.6.2.5

Section 4.4.6

Sections 7.5, 7.6, and 7.7 (included in discussions)

Components Subject to Aging Management Review

Components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions not reviewed in other reports are reviewed in Section 2.3.1.7, Reactor Coolant Systems in Scope for 10 CFR 54.4(a)(2).

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

License Renewal Drawings

For additional details for nuclear boiler instrumentation components subject to aging management review, see the LRA drawings listed in the LRA Sections 2.3.1.2 and 2.3.1.7.

### 2.3.1.4 Reactor Recirculation

System Description

The purpose of the reactor recirculation system (system codes 053, RCS, B33) is to provide drive water to the reactor vessel jet pumps. The jet pumps, which are reactor vessel internals, provide for coolant flow through the reactor vessel core to maintain the core at proper operating temperature. The arrangement of the recirculation system routing is such that a piping failure cannot compromise the integrity of the floodable inner volume of the reactor vessel.

The reactor recirculation system consists of two recirculation pump loops external to the reactor vessel. These loops provide the piping path for the driving flow of water to the reactor vessel jet pumps. The recirculation loops are part of the reactor coolant pressure boundary and are located inside the drywell structure. Each loop contains one high-capacity motor-driven recirculation pump, two motor-operated maintenance valves, one hydraulically operated flow control valve, piping, other miscellaneous valves, instrumentation, and controls. The recirculation pump is driven by a constant speed motor with a low-frequency motor-generator (LFMG) set and is equipped with mechanical shaft seal assemblies. The variable position hydraulic flow control valve operates in conjunction with the LFMG set to control reactor power level through the effects of coolant flow rate on moderator void content.

Each recirculation pump motor is a constant speed, vertical, solid shaft, totally enclosed, air-water cooled, induction motor in conjunction with an LFMG set. The combined rotating inertias of the recirculation pump and motor provide a slow coastdown of flow following loss of power to the drive motors so that the core is adequately cooled during the transient.

Saturated water from the steam separators and dryers, which has been cooled by incoming feedwater, passes down the annulus between the reactor vessel wall and the core shroud. A portion of the coolant mixture in the annulus flows from the vessel and is pumped through the two recirculation loops into an external manifold from which individual recirculation inlet lines are routed to the jet pump risers within the reactor vessel. This provides the driving flow for the jet pumps. The remaining coolant in the annulus becomes the driven flow for the jet pumps. This flow enters the jet pumps at the suction inlet and is accelerated by the driving flow provided by the recirculation pumps. The flows, both driving and driven, are mixed in the jet pump throat section.

One recirculation loop provides a tie-in to the RHR system to serve the RHR shutdown cooling mode of operation. The control rod drive hydraulic system supplies seal purge water to the recirculation pumps' seal cavities. The purge water keeps the seals clean by maintaining clean water flowing out of the seal area, along the pump shaft, and into the recirculation system. The component cooling water system (reactor plant closed cooling water) supplies cooling water to the recirculation pumps and motors.

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

- Maintain an adequate fuel barrier thermal margin during postulated transients.
- Maintain the ability of the reactor vessel internals to provide a refloodable volume.
- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

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

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

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

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

<u>USAR References</u>

Section 5.4.1

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

Nonsafety-related components of the system whose failure could prevent satisfactory accomplishment of safety functions not reviewed in other reports are reviewed in Section 2.3.1.7, Reactor Coolant Systems in Scope for 10 CFR 54.4(a)(2). Remaining components of the reactor recirculating system are reviewed in Section 2.3.1.1.2, Reactor Vessel Internals, and Section 2.3.1.2, Reactor Coolant Pressure Boundary.

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

<u>License Renewal Drawings</u>

For additional details for reactor recirculation components subject to aging management review, see the LRA drawings listed in Sections 2.3.1.2 and 2.3.1.7. There are no LRA drawings associated with the reactor vessel internals aging management review.

### 2.3.1.5 Remote Shutdown

System Description

The purpose of the remote shutdown system (system codes 200, RSS, C61) is to support the capability to assure safe shutdown of the reactor in the event the main control room should become uninhabitable. The system consists of the remote shutdown panels, valves, and associated instrumentation and controls. Safety-related valves are associated with instrumentation used during a remote shutdown for RHR pump discharge pressure and the reactor coolant system. RHR pressure instrumentation valves are reviewed with the RHR system. The remaining safety-related valves are reviewed as part of the RCPB.

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

- Maintain reactor coolant system pressure boundary.
- Maintain RHR system pressure boundary.

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

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

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

USAR References

Section 7.4.1.4

Section 7.1.1

Components Subject to Aging Management Review

Components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Components supporting the RHR system pressure boundary are reviewed in Section 2.3.2.3, Residual Heat Removal.

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

License Renewal Drawings

For additional details for remote shutdown components subject to aging management review, see the LRA drawings listed in LRA Sections 2.3.1.2 and 2.3.2.3.

### 2.3.1.6 Reactor Protection

System Description

The purpose of the reactor protection system (system codes 508, RPS, C71) is to prevent the reactor from operating under unsafe, or potentially unsafe, conditions. The system is an electrical alarm and actuating system; however, the 508 system in the component database includes valves associated with drywell pressure instrumentation and high pressure turbine first stage pressure instrumentation. This discussion applies only to the mechanical components of system 508.

Valves associated with drywell pressure instrumentation are safety-related and are reviewed with the nuclear boiler system instrumentation.

Valves associated with high pressure turbine first stage pressure instrumentation are connected to a source that is not safety-related; therefore, these valves are not safety-related. These valves do not support an intended function for license renewal.

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

- Maintain pressure boundary of interfacing safety-related systems.

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

USAR References

Section 7.2.1.1 (Items 5 and 6)

Components Subject to Aging Management Review

Components supporting drywell pressure instrumentation are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary.

For tables that include reactor protection system component types and their component intended functions, see Section 2.3.1.2.

License Renewal Drawings

For additional details for reactor protection components subject to aging management review, see the LRA drawings listed in Section 2.3.1.2.

### 2.3.1.7 Reactor Coolant Systems in Scope for 10 CFR 54.4(a)(2)

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

*Functional Failure*

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

*Physical Failure*

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

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

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

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

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

*Physical Impact or Flooding*

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

*Pipe Whip, Jet Impingement, or Harsh Environments*

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

criterion affected primary systems, those systems are within the scope of license renewal per 10 CFR 54.4(a)(2).

*Leakage or Spray*

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

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

| System Code | System Name | Section Describing System |
|---|---|---|
| 051/058 | Nuclear Boiler Instrumentation | Section 2.3.1.3, Nuclear Boiler Instrumentation |
| 053 | Reactor Recirculation | Section 2.3.1.4, Reactor Recirculation |

System Descriptions

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

Each system listed above has the following intended function for 10 CFR 54.4(a)(2).

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

USAR References

See USAR sections listed in the LRA sections referenced above.

Components Subject to Aging Management Review

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

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

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

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

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

For component types included under 10 CFR 54.4(a)(2), the intended function of *Pressure boundary* includes maintaining structural integrity for nonsafety-related SSCs directly connected to safety-related SSCs.

Series 2.3.1-4-x tables list the component types that require aging management review for 10 CFR 54.4(a)(2) based on potential for physical interactions.

Series 3.1.2-4-x tables provide the results of the aging management review for 10 CFR 54.4(a)(2) based on potential for physical interactions.

| System Code | System Name | Component Types | AMR Results |
|---|---|---|---|
| 051/058 | Nuclear Boiler Instrumentation | Table 2.3.1-4-1 | Table 3.1.2-4-1 |
| 053 | Reactor Recirculation | Table 2.3.1-4-2 | Table 3.1.2-4-2 |

License Renewal Drawings

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

| System Codes | System | LRA Drawings |
|---|---|---|
| 051/058, MSS/ISC, B21/A62 | Nuclear Boiler Instrumentation | LRA-PID-25-01G |
| 053, RCS, B33 | Reactor Recirculation | LRA-PID-25-01C<br>LRA-PID-25-01E<br>LRA-PID-25-01F |

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

| Component Type | Intended Function |
|---|---|
| Filter housing | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

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

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Filter housing | Pressure boundary |
| Flex hose | Pressure boundary |
| Heat exchanger (coil) | Pressure boundary |
| Orifice | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Sight glass | Pressure boundary |
| Strainer housing | Pressure boundary |
| Tank | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.2 Engineered Safety Features

The following Engineered Safety Features (ESF) systems are described in this section.

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

### 2.3.2.1 Pressure Relief

System Description

The purpose of the pressure relief system (system codes 202, ADS/SVV, B21/T23) is to prevent over-pressurization of the nuclear system that could lead to the failure of the reactor coolant pressure boundary (RCPB) for operational transients or accidents. The pressure relief system consists of safety/relief valves (SRVs) mounted on the main steam lines with the associated accumulators, SRV discharge lines, vacuum breakers, and suppression pool diffusers.

SRVs are located upstream of the first main steam isolation valves on horizontal sections of the main steam lines. Each SRV discharges steam through a discharge line to a point below the minimum water level in the suppression pool. Two vacuum breaker valves are provided on each discharge line to prevent water from rising in the line following SRV actuation.

During normal plant operations, the SRVs remain closed to maintain the system pressure boundary. The SRVs are designed to open in either of two modes of operation: automatically using a pneumatic power actuator or by self-actuation in the spring lift mode. Each of the SRVs is equipped with an air accumulator and check valve arrangement.

Seven of the 16 SRVs are actuated by an automatic depressurization system (ADS) as part of the ECCS response. The ADS automatically depressurizes the nuclear system sufficiently to permit low-pressure coolant injection (LPCI) and the low pressure core spray (LPCS) system to operate as a backup for the high pressure core spray (HPCS) system. If the reactor water level cannot be maintained at high pressure, the ADS, which is independent of any other ECCS, reduces the reactor pressure so that flow from LPCI and LPCS enters the reactor vessel in time to cool the core and limit fuel cladding temperature. The accumulators on the SRVs utilized for automatic depressurization assure that the valves can be held open following failure of the air supply to the accumulators.

During normal plant operation, SRV accumulators (including accumulators for the ADS relief valves) are supplied with air from the nonsafety-related main steam system air compressors. System code 202 includes the normal air supply and the accumulators for the SRVs. These compressors are assumed to become unavailable at the start of the accident, and accumulators support SRV operation until makeup air is available from the penetration valve leakage control system (PVLCS) compressors. Air requirements following a loss-of-coolant accident (LOCA) are supplied by the PVLCS compressors. Intermediate and long-term operability of the ADS valves is assured with PVLCS delivering air.

The ADS SRVs are credited for depressurization for 10 CFR 50 Appendix R, including the alternate shutdown cooling path using water flow through the SRVs. A minimum of four SRVs is required for both the alternate shutdown cooling mode of the residual heat removal (RHR) system and plant depressurization to support RHR-LPCI or LPCS system operation.

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

- Prevent over-pressurization of the nuclear system that could lead to the failure of the RCPB.
- Enable functioning of the low pressure ECCS for events involving small breaks in the piping system for which the high pressure injection system cannot maintain reactor water level.
- Maintain reactor coolant pressure boundary.

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

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

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

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

USAR References

Section 5.2.2

Section 6.3

Components Subject to Aging Management Review

Components associated with the Class 1 RCPB are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Components related to the air accumulators are reviewed in Section 2.3.3.4, Compressed Air. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.2.8, ESF Systems in Scope for 10 CFR 54.4(a)(2). Remaining pressure relief system components are reviewed as listed below.

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

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

License Renewal Drawings

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

LRA-PID-03-01B

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

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Diffuser | Flow control<br>Pressure boundary |
| Piping | Pressure boundary |
| Thermowell | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.2.2 High Pressure Core Spray

System Description

The purpose of the high pressure core spray (HPCS) system (system codes 203, CSH, E22) is to maintain reactor vessel coolant inventory after small breaks that do not depressurize the reactor vessel. HPCS also provides spray cooling heat transfer following larger breaks. HPCS cooling, along with other ECCS functions, maintains the fuel cladding temperature limits following a LOCA.

The HPCS system is part of the ECCS that cools the reactor following a LOCA. If the break is small, the HPCS system is designed to maintain coolant inventory as well as vessel level while the reactor coolant system is still pressurized. If the water level is not maintained by the HPCS system, the ADS, LPCI system, and/or the LPCS system are automatically initiated. Following larger pipe breaks, the HPCS system sprays cooling water on the fuel assemblies to remove decay heat. The HPCS system, as well as all the other ECCS system injection/spray subsystems, independently provides long-term cooling following a LOCA.

The HPCS system consists of the HPCS motor-driven pump, the spray sparger in the reactor vessel located above the core, a discharge line fill pump, piping, valves, and instrumentation and controls. The system is designed to operate from normal offsite auxiliary power or from a dedicated diesel generator supply if offsite power is not available (system 309). The principal active HPCS equipment is located outside the primary containment. Suction piping is provided from the condensate storage tank and the suppression pool. System code 203 also includes HPCS diesel generator components, which are reviewed with the diesel generator (Section 2.3.3.11, HPCS Diesel Generator).

Upon initiation, the HPCS system delivers water from the condensate storage tank to the reactor vessel. In the event that the condensate storage water supply becomes exhausted or the suppression pool level is high, the HPCS system automatically takes suction from the suppression pool, assuring a closed cooling water supply for continuous operation of the HPCS system. The suppression pool is the primary safety design source of core spray water. Although use of the condensate storage tank by HPCS is mentioned in the safe shutdown analysis for Appendix R, the credited source is the suppression pool.

The HPCS system serves as a backup to the reactor core isolation cooling (RCIC) system to maintain the reactor water level in the event the reactor becomes isolated from the main condenser during operation and feedwater flow is lost. The RCIC system utilizes HPCS system piping for suction and return of the water from the condensate storage tank.

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

- Maintain, in conjunction with the other ECCS components, the fuel cladding temperature in the event of a breach in the reactor coolant pressure boundary that results in a loss of reactor coolant.
- Backup the RCIC system to maintain the reactor water level in the event the reactor becomes isolated from the main condenser during operation and feedwater flow is lost.
- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

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

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

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

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

USAR References

Section 6.3.2.2.1

Section 6.3.2.2.5

Components Subject to Aging Management Review

Class 1 components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Components associated with the HPCS diesel and diesel fuel oil are reviewed in Section 2.3.3.11, HPCS Diesel Generator, and Section 2.3.3.17, Fuel Oil, respectively. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.2.8, ESF Systems in Scope for 10 CFR 54.4(a)(2). Remaining HPCS system components are reviewed as listed below.

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

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

License Renewal Drawings

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

LRA-PID-27-04A

LRA-PID-32-09K

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

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Cyclone separator | Pressure boundary |
| Flex hose | Pressure boundary |
| Flow element | Pressure boundary |
| Orifice | Flow control<br>Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Strainer | Filtration |
| Strainer housing | Pressure boundary |
| Suction barrel | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.2.3 Residual Heat Removal

System Description

The purpose of the residual heat removal (RHR) system (system codes 204, RHS, E12) is to provide adequate removal of decay and sensible heat from the reactor vessel during normal and accident conditions as well as during refueling operations. The RHR system also provides suppression pool cooling.

The RHR system consists of three independent loops (A, B, and C), which take suction from the suppression pool and discharge back to the reactor vessel through independent injection lines. In addition, loops A and B contain suction piping from the reactor recirculation line and fuel pool and return piping back to the reactor via the feedwater system and the fuel pool cooling and cleanup system. Major RHR components include the three residual heat removal pumps, four heat exchangers (two each in loops A and B), line fill pump, orifices, suction strainers, and associated piping, valves, and instrumentation. RHR heat exchangers are cooled by the normal or standby service water systems. In USAR system descriptions, each pair of RHR heat exchangers is usually referred to as a single heat exchanger for the loop.

The three RHR system loops perform the following functions when configured in the following operating modes:

1. Low Pressure Coolant Injection (LPCI)

Following a LOCA, the RHR system restores and maintains the desired water level in the reactor vessel in order to prevent excessive fuel temperatures. The RHR system performs as an ECCS for this event. Three pumps deliver water from the suppression pool to the bypass region inside the shroud through three separate reactor vessel penetrations to provide inventory makeup following large pipe breaks. Following a small break and ADS initiation, LPCI provides coolant inventory makeup. Following a LOCA, the RHR system may also provide a path for injecting service water into the reactor vessel or suppression pool after all other water sources are exhausted.

2. Suppression Pool Cooling

Prior to and following a blowdown to the suppression pool, the RHR system removes heat from the suppression pool in order to maintain the desired suppression pool water temperature. The RHR system functions as an engineered safety feature in this mode. Water is drawn from the suppression pool, pumped through one or both RHR heat exchangers, and returned to the suppression pool. Water from the service water system is pumped through the heat exchanger tube side to exchange heat with the suppression pool water. Two cooling loops are provided, each being mechanically and electrically separate from the other to achieve redundancy.

3. Shutdown Cooling

After normal cool down using the main condenser, the RHR system provides sensible heat removal from the reactor vessel during cooldown to cold shutdown condition. During refueling operation, the RHR provides additional cooling capacity to the fuel pool cooling and cleanup system (system 602) when required for the upper containment pools. In this alignment, reactor water is pumped from one of the recirculation loops through the RHR system heat exchangers and back to the reactor pressure vessel through the RHR flow distribution spargers located in the upper containment pool.

In the event that the normal shutdown suction line is not available, the alternate shutdown cooling mode provides a backup to the normal shutdown cooling system. This operation is not a separate mode of operation but rather an extension of the LPCI mode. In this mode, water from the suppression pool is pumped by an RHR pump, cooled by the RHR heat exchangers, injected into the vessel through the LPCI nozzles, and returned to the suppression pool via the ADS valve discharge lines.

Each of the three loops has a suction source from the suppression pool and is capable of discharging water to the reactor vessel via a separate nozzle, or back to the suppression pool via a full-flow test line. Loops A and B can also take suction from the reactor recirculation system suction or the fuel pool cooling and cleanup system and can discharge into the reactor via the feedwater line or fuel pool cooling discharge. Loop C can take suction from the reactor recirculation system for testing. Loop C also interfaces with the suppression pool cleanup, cooling, and alternate decay heat removal system (system 656). This interface provides a suction and return path to the suppression pool during normal power operation, and to the reactor during plant shutdowns.

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

- Restore and maintain the desired water level in the reactor vessel in order to prevent excessive fuel temperatures following a LOCA.
- Remove heat from the suppression pool in order to maintain the desired suppression pool water temperature prior to and following a blowdown to the suppression pool.
- Provide sensible heat removal from the reactor vessel during cooldown to cold shutdown condition.
- Provide additional cooling capacity to the fuel pool cooling and cleanup system when required for the upper containment pools.
- Provide a method for the injection of service water into the reactor vessel or the suppression pool if the need should arise.

- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

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

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

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

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

<u>USAR References</u>

Section 5.4.7

Section 6.3

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

Class 1 components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. RHR components that interface with the RCIC system are reviewed in Section 2.3.2.5, Reactor Core Isolation Cooling. Components of the RHR system associated with service water are reviewed in Section 2.3.3.3, Service Water. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.2.8, ESF Systems in Scope for 10 CFR 54.4(a)(2). Remaining RHR system components are reviewed as listed below.

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

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

License Renewal Drawings

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

| | |
|---|---|
| LRA-PID-27-07A | LRA-PID-27-07B |
| LRA-PID-27-07C | LRA- PID-04-03C |
| LRA-PID-09-01B | LRA-PID-09-10F |
| LRA-PID-21-02B | LRA-PID-27-05A |
| LRA-PID-27-06A | LRA-PID-32-09J |
| LRA-PID-32-09K | LRA-PID-26-03A |

**Table 2.3.2-3**
**Residual Heat Removal System**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Cyclone separator | Filtration<br>Pressure boundary |
| Flex hose | Pressure boundary |
| Flow element | Pressure boundary |
| Heat exchanger (channel head) | Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Heat exchanger (tubes) | Heat transfer<br>Pressure boundary |
| Heat exchanger (tubesheet) | Pressure boundary |
| Nozzle | Flow control |
| Orifice | Flow control<br>Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Strainer | Filtration |
| Strainer housing | Pressure boundary |
| Suction barrel | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.2.4 Low Pressure Core Spray

System Description

The purpose of the low pressure core spray (LPCS) system (system codes 205, CSL, E21) is to provide coolant inventory makeup and spray cooling following large breaks. Following a small break and ADS initiation, LPCS provides coolant inventory makeup and spray cooling heat transfer. System operation is automatically initiated in response to reactor vessel low water level or high drywell pressure signals.

The LPCS system is part of the ECCS that removes decay heat from the reactor to prevent fuel cladding damage in the event of a LOCA. For initial cooling of the core, the LPCS operates in conjunction with the HPCS and the LPCI mode of the RHR system for large breaks, and with the ADS and RHR for small breaks. The LPCS can, by itself, provide continuous long-term cooling to the core after an accident.

The LPCS system is a water spray loop consisting of a core spray pump, a sparger ring (separate from the HPCS sparger), spray nozzles, a discharge line fill pump, and the necessary piping, valves and instrumentation for control. The pump takes water from the pressure suppression pool and sprays the water through the sparger ring into the plenum above the core.

The LPCS system includes the following flow paths:

a. A pump suction line from the suppression pool.

b. A pump discharge line into the reactor vessel, terminating in a spray sparger.

c. A minimum flow bypass line from the LPCS pump discharge line to the suppression pool.

d. A test return line from the pump discharge to the suppression pool.

e. A connection from the LPCS pump suction to the RHR pump suction line to the reactor vessel, made by means of a removable spool piece for LPCS system testing during plant shutdown.

f. A standby water leg, fed by the discharge line fill pump, the purpose of which is to keep the LPCS pump discharge line filled with water when the LPCS pump is not running and the LPCS is considered operable.

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

- Provide reactor coolant inventory makeup and spray cooling following a large break LOCA; provide coolant inventory makeup and spray cooling heat transfer following a small break LOCA and ADS initiation.
- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

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

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

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

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

USAR References

Section 6.3

Components Subject to Aging Management Review

Class 1 components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. One LPCS valve (LPCS suction from refueling cavity isolation valve via RHR) is reviewed in Section 2.3.2.3, Residual Heat Removal. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.2.8, ESF Systems in Scope for 10 CFR 54.4(a)(2). Remaining LPCS system components are reviewed as listed below.

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

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

License Renewal Drawings

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

LRA-PID-27-05A

LRA-PID-27-07A

LRA-PID-32-09K

**Table 2.3.2-4**
**Low Pressure Core Spray System**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Flex hose | Pressure boundary |
| Flow element | Flow control<br>Pressure boundary |
| Orifice | Flow control<br>Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Strainer | Filtration |
| Strainer housing | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.2.5 Reactor Core Isolation Cooling

System Description

The purpose of the reactor core isolation cooling (RCIC) system (system codes 209, ICS, E51) is to maintain sufficient reactor water inventory to permit adequate core cooling when the reactor vessel is isolated with no feedwater available. The RCIC system prevents reactor fuel overheating during the following conditions:

a. The vessel is isolated and maintained in the hot standby condition.

b. The vessel is isolated concurrent with a loss of coolant flow from the feedwater system.

c. A complete plant shutdown under conditions of loss of normal feedwater system is started before the reactor is depressurized to a pressure where the RHR system shutdown cooling mode can be placed in operation.

The RCIC system contains the piping from the suction sources in the suppression pool and condensate storage tank to the feedwater line. The system includes a full-capacity steam-driven turbine and associated high-pressure pump, the line fill pump, minimum flow bypass line to the suppression pool, test line to the condensate storage tank, and associated system piping, valves and instrumentation.

The initial source of water for the RCIC system is the condensate storage tank, which is not seismically qualified. The RCIC system initiates an automatic transfer of pump suction from the condensate storage tank to the seismic Category I suppression pool when a low water level condition exists in the condensate storage tank or a high water level in the suppression pool.

The RCIC pump shares a common suction line from the condensate storage tank with the HPCS pump suction line. The RCIC pump discharges into the RHR mixing tee, then through the feedwater line and into the reactor pressure vessel through the feedwater system sparger.

The RCIC turbine receives reactor steam from the A main steam line upstream from the inboard main steam isolation valve (MSIV). The steam from the RCIC turbine exhausts to the suppression pool. The exhaust line is equipped with vacuum breakers to prevent suppression pool water from being drawn into the exhaust line when the steam condenses following turbine operation. The turbine is provided with a gland seal system to prevent turbine shaft and valve stem steam leakage; however, the gland seal leakage control system is not required to accomplish the basic RCIC system function of supplying water to the reactor core during periods of isolation. A turbine lube oil cooler is also provided.

The RCIC system uses differential pressure sensors in the steam supply line to the RCIC turbine to detect and isolate pipe breaks in the system. The RCIC system leak detection portion of the leak detection system (LDS, system 207) is safety-related.

A piping connection to the RHR system was provided in the original design to provide an alternate water supply to the RCIC pump when the RHR heat exchangers were operating in the steam condensing mode. The RHR steam condensing mode of operation is not licensed for use at River Bend and has been permanently disabled. The suction path to the RCIC pump from the RHR heat exchangers has been isolated by removing power from the RHR system motor-operated valves in the suction flow path.

During the 4-hour SBO coping period, the RCIC system assures that sufficient water inventory is maintained in the reactor pressure vessel to permit adequate core cooling to take place. The RCIC system will maintain the unit in the hot standby condition. For the SBO coping period, the RCIC system aligned to the condensate storage tank and the SRVs are the only remote operating systems available for maintaining reactor pressure vessel level and removal of decay heat.

The safety-related portions of the RCIC system are credited for post-fire core cooling following a postulated fire in accordance with Appendix R. The RCIC system is required to maintain sufficient reactor water inventory in the reactor vessel when the vessel is isolated from its primary heat sink and the main condenser and is maintained in the hot standby condition. The credited portion of the RCIC system is the suction alignment from the suppression pool through the injection into the reactor pressure vessel.

The gland seal sub-system for the RCIC turbine is designated as not safety-related. Portions of the suction and return piping connected to the condensate storage tank, which are shared with the HPCS system, are not safety-related.

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

- Maintain sufficient reactor water inventory to permit adequate core cooling when the reactor vessel is isolated with no feedwater available.
- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

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

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

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

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

USAR References

Section 5.4.6

Appendix 15C

Components Subject to Aging Management Review

Class 1 components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. RCIC system components associated with condensate storage tank level instruments are reviewed in Section 2.3.2.2, High Pressure Core Spray. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.2.8, ESF Systems in Scope for 10 CFR 54.4(a)(2). Remaining RCIC system components are reviewed as listed below.

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

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

License Renewal Drawings

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

| | |
|---|---|
| LRA-PID-25-01G | LRA-PID-27-06A |
| LRA-PID-27-07A | LRA-PID-27-07B |
| LRA-PID-32-05B | LRA-PID-32-09J |

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

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Filter housing | Pressure boundary |
| Flex hose | Pressure boundary |
| Flow element | Pressure boundary |
| Heat exchanger (channel head) | Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Heat exchanger (tubes) | Heat transfer<br>Pressure boundary |
| Heat exchanger (tubesheet) | Pressure boundary |
| Orifice | Flow control<br>Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Sight glass | Pressure boundary |
| Strainer | Filtration |
| Strainer housing | Pressure boundary |
| Tank | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Turbine casing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.2.6 Standby Gas Treatment

System Description

The purpose of the standby gas treatment system (SGTS) (system codes 257, GTS) is to limit the release of radioactivity to the environment from the secondary containment under upset, emergency, or accident conditions. During post-accident operation, the primary function of the SGTS is to process exhaust air from the annulus and the auxiliary building.

During normal operation, the annulus pressure control system (APCS) maintains the annulus at negative pressure (see Section 2.3.3.13). Upon receipt of a LOCA, a high-radiation signal (from one of the two radiation monitors located in the annulus), or loss of APCS flow, the annulus air is automatically diverted through the SGTS filter trains, and the exhaust air from the shielded compartments in the auxiliary building is also automatically diverted through SGTS filter trains. On a high-radiation condition in the shielded compartments of the auxiliary building, the SGTS is manually started to process the contaminated air.

With the annulus at a negative pressure, potential leakage is directed inward (away from the shield building). Therefore, if a primary containment design basis accident occurs, airborne radioactivity which exfiltrates the steel primary containment is collected and passed through a filter train of the SGTS before being released.

The SGTS may be manually started for annulus and/or auxiliary building exhaust air purification as needed. The SGTS also serves as a backup to the containment and drywell purge system.

The SGTS consists of two identical, 100-percent capacity, parallel, physically separated, charcoal filter trains with associated ductwork, dampers, controls, and centrifugal exhaust fans. Each train includes a demister, a heating coil, and two banks of high-efficiency particulate air (HEPA) filters separated by a charcoal filter bank, as well as instrumentation tubing and valves. The discharge from the two fans is connected to a common exhaust duct. The air is drawn from the annulus mixing system recirculation ductwork and exhausted or recirculated through the SGTS filters. The decay heat produced post-accident by radioactive materials in the inactive charcoal filter train is removed by a centrifugal fan that takes air from the equipment rooms and exhausts to the main plant exhaust duct.

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

- Limit the release of radioactivity to the environment from the secondary containment under upset, emergency, or accident conditions.
- Support containment pressure boundary.

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

USAR References

Section 6.2.3.2.1

Section 6.5.1

Components Subject to Aging Management Review

Air-operated valves associated with SGTS filters are reviewed in Section 2.3.3.4, Compressed Air. Remaining SGTS components are reviewed as listed below.

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

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

License Renewal Drawings

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

LRA-PID-27-15A

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

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Damper housing | Pressure boundary |
| Ducting | Pressure boundary |
| Fan housing | Pressure boundary |
| Filter housing | Pressure boundary |
| Flex connection | Pressure boundary |
| Flow element | Pressure boundary |
| HEPA filter frames | Pressure boundary |
| Moisture separator | Filtration<br>Pressure boundary |
| Moisture separator housing | Pressure boundary |
| Piping | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.2.7 Containment Penetrations

System Description

The RBS primary containment system consists of a drywell, a vapor suppression pool, and a primary containment building. The drywell structure houses the reactor system. The freestanding steel primary containment structure encloses the drywell and the suppression pool. The secondary containment consists of the shield building and the auxiliary building. Safety-related piping and valves support the pressure boundaries between the drywell and containment, between the containment and the shield building/auxiliary building (primary containment), and between the shield building/auxiliary building and other areas of the plant (secondary containment). For license renewal, these three barriers are functionally equivalent and are referred to as the containment pressure boundary. Piping and valves supporting these barriers have an intended function to support the containment pressure boundary. Additional discussion of the containment structures is provided in Section 2.4.1, Reactor Building.

The containment pressure boundaries contain mechanical penetrations that provide openings for process fluids to pass through the containment boundaries and still maintain containment integrity. The mechanical piping, their associated isolation valves and related design features that are not included in another aging management review are included in this review. The grouping of containment isolation valves from various plant systems into a consolidated review is appropriate for scoping as indicated in NUREG-1800, Section 2.1.3.1. This review includes mechanical components, primarily piping and valves, that provide the pressure boundary intended function associated with the penetrations.

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

| System Code | System Name | Section Describing System |
|---|---|---|
| 055 | Fuel transfer equipment | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 207 | Leak detection | Section 2.3.1.2, Reactor Coolant Pressure Boundary |
| 511 | Radiation monitoring | Section 2.3.3.12, Control Building HVAC |
| 601 | Reactor water cleanup | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |

In addition to its containment penetration components, the RWCU system has components included in this review that are located between a containment penetration and the isolation check valves to the feedwater/RHR system connection to the reactor coolant system. These components support the detection of unbalanced flow to prevent excessive loss of reactor coolant. See the system description in Section 2.3.3.18 for more information.

Each system listed above has the following intended function for 10 CFR 54.4(a)(1), and the fuel transfer equipment system also has this intended function for 10 CFR 54.4(a)(2) for nonsafety-related components that support the fuel transfer tube containment penetrations.

- Support containment pressure boundary.

The RWCU system containment isolation components also have the following intended function for 10 CFR 54.4(a)(1).

- Prevent excessive loss of reactor coolant.

For additional intended functions performed by these systems, see the system descriptions listed in the referenced sections above.

USAR References

Section 1.2.2.4.9

Table 6.2-40

Table 6.2-51

Components Subject to Aging Management Review

Containment penetration mechanical components not included in other aging management reviews are reviewed as listed below.

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

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

License Renewal Drawings

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

| | |
|---|---|
| LRA-PID-26-03A | LRA-PID-33-02B |
| LRA-PID-26-03B | LRA-PID-34-04A |

**Table 2.3.2-7**
**Containment Penetrations**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Flex hose | Pressure boundary |
| Flow element | Pressure boundary |
| Piping | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

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

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

*Functional Failure*

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

*Physical Failures*

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

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

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

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

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

*Physical Impact or Flooding*

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

*Pipe Whip, Jet Impingement, or Harsh Environments*

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

criterion affected ESF systems, those systems are within the scope of license renewal per 10 CFR 54.4(a)(2).

*Leakage or Spray*

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

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

| System Code | System Name | Section Describing System |
|---|---|---|
| 202 | Pressure Relief | Section 2.3.2.1, Pressure Relief |
| 203 | High Pressure Core Spray | Section 2.3.2.2, High Pressure Core Spray |
| 204 | Residual Heat Removal | Section 2.3.2.3, Residual Heat Removal |
| 205 | Low Pressure Core Spray | Section 2.3.2.4, Low Pressure Core Spray |
| 209 | Reactor Core Isolation Cooling | Section 2.3.2.5, Reactor Core Isolation Cooling |

System Descriptions

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

Each system listed above has the following intended function for 10 CFR 54.4(a)(2).

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

USAR References

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

Components Subject to Aging Management Review

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

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

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

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

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

For component types included under 10 CFR 54.4(a)(2), the intended function of *Pressure boundary* includes maintaining structural integrity for nonsafety-related SSCs directly connected to safety-related SSCs.

Series 2.3.2-4-x tables list the component types for ESF systems that require aging management review for 10 CFR 54.4(a)(2) based on potential for physical interactions.

Series 3.2.2-4-x tables provide the results of the aging management review for ESF systems for 10 CFR 54.4(a)(2) based on potential for physical interactions.

| System Name | Component Types | AMR Results |
|---|---|---|
| Pressure Relief | Table 2.3.2-8-1 | Table 3.2.2-8-1 |
| High Pressure Core Spray | Table 2.3.2-8-2 | Table 3.2.2-8-2 |
| Residual Heat Removal | Table 2.3.2-8-3 | Table 3.2.2-8-3 |
| Low Pressure Core Spray | Table 2.3.2-8-4 | Table 3.2.2-8-4 |
| Reactor Core Isolation Cooling | Table 2.3.2-8-5 | Table 3.2.2-8-5 |

License Renewal Drawings

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

| System Codes | System Name | LRA Drawings |
|---|---|---|
| 202,<br>ADS/SVV,<br>B21/T23 | Pressure Relief | LRA-PID-03-01D |
| 203,<br>CSH, E22 | High Pressure Core Spray | LRA-PID-08-09D<br>LRA-PID-27-04A |
| 204,<br>RHS, E12 | Residual Heat Removal | LRA-PID-27-07A<br>LRA-PID-27-07B<br>LRA-PID-27-07C |
| 205,<br>CSL, E21 | Low Pressure Core Spray | LRA-PID-27-05A |
| 209,<br>ICS, E51 | Reactor Core Isolation Cooling | LRA-PID-25-01G<br>LRA-PID-27-06A |

**Table 2.3.2-8-1**
**Pressure Relief System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Filter housing | Pressure boundary |
| Orifice | Pressure boundary |
| Piping | Pressure boundary |
| Trap | Pressure boundary |
| Valve body | Pressure boundary |

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

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.2-8-3**
**Residual Heat Removal System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.2-8-4**
**Low Pressure Core Spray System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.2-8-5**
**Reactor Core Isolation Cooling System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Flex hose | Pressure boundary |
| Piping | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3 Auxiliary Systems

The following systems are described in this section.

- Section 2.3.3.1, Control Rod Drive Hydraulic
- Section 2.3.3.2, Component Cooling Water
- Section 2.3.3.3, Service Water
- Section 2.3.3.4, Compressed Air
- Section 2.3.3.5, Standby Liquid Control
- Section 2.3.3.6, Main Steam Positive Leakage Control
- Section 2.3.3.7, Fire Protection – Water
- Section 2.3.3.8, Fire Protection – Halon
- Section 2.3.3.9, Combustible Gas Control
- Section 2.3.3.10, Standby Diesel Generator
- Section 2.3.3.11, HPCS Diesel Generator
- Section 2.3.3.12, Control Building HVAC
- Section 2.3.3.13, Miscellaneous HVAC
- Section 2.3.3.14, Chilled Water
- Section 2.3.3.15, Fuel Pool Cooling and Cleanup
- Section 2.3.3.16, Plant Drains
- Section 2.3.3.17, Fuel Oil
- Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2)

### 2.3.3.1 Control Rod Drive Hydraulic

System Description

The purpose of the control rod drive (CRD) hydraulic system (system codes 052/500, RDC/RDS, C11) is to provide reactivity control by positioning the control rods to control power generation in the core. The CRD system provides for a sufficiently rapid control rod insertion so that no fuel damage results from any abnormal operating transient. The CRD system includes the control rod drive supporting hydraulics components including pumps, hydraulic control units, accumulators, piping, valves, instruments and controls. The CRD mechanisms are in system 050 and are reviewed in Section 2.3.1.1, Reactor Pressure Vessel and Internals. The individual drives are mounted on the bottom head of the reactor pressure vessel.

The control rod drive used for positioning the control rod in the reactor core is a double-acting, mechanically latched, hydraulic cylinder using water as its operating fluid. The system controls changes in core reactivity by using hydraulic control units (HCUs) to incrementally position neutron-absorbing control rods within the reactor core in response to manual control signals. It also quickly shuts down the reactor (scram) in emergency situations by rapidly inserting all control rods into the core in response to a manual or automatic signal from the reactor protection system (RPS) or the alternate rod insertion (ARI) logic.

The CRD hydraulic system supplies and controls the pressure and flow to and from the drives through the HCUs. One HCU is provided for each of the 145 CRDs. Each HCU furnishes pressurized water for the positioning of its associated CRD. The HCUs contain nitrogen-charged water accumulators, which are used when scramming the CRDs. The water discharged from the drives during a scram flows through the HCUs to the scram discharge volume. The water discharged from a drive during a normal control rod positioning operation flows through the HCU and the exhaust header and is returned to the reactor vessel via the HCUs of the nonmoving drives.

The scram accumulator, part of each HCU, stores sufficient energy to fully insert a control rod at any vessel pressure. The accumulator is a hydraulic cylinder with a free-floating piston. The piston separates the charging water on top from the nitrogen below. A check valve in the accumulator charging line prevents loss of water pressure in the event supply pressure is lost. Accumulator charging pressure is established by charging the nitrogen accumulator to a precisely controlled pressure at known temperature, then applying charging water pressure. During a scram, the scram inlet and outlet valves open and permit the stored energy in the accumulators to discharge into the CRDs.

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

Two 100-percent capacity CRD pumps are provided to supply flow and pressure to the CRD hydraulic system. The supply water to the CRD pumps is taken from either the condensate makeup storage and transfer system or the condensate storage tank. A minimum flow bypass line returns a portion of the discharge to the condensate storage tank to prevent inadvertent overheating of the pump. Cooling water is supplied to the thrust bearing and gear box oil cooler of each pump from the reactor plant component cooling water system (Section 2.3.3.2).

The CRD pumps provide water to the charging water header. The charging water header supplies an individual line to each HCU for charging the scram accumulators. In the discharge header, downstream of the charging header connection, is a flow control station with two 100-percent capacity flow control valves arranged in parallel. These valves maintain a nearly constant flow to the downstream pressure control station. Four drive water headers are connected to the flow control valve outlet piping between the flow control valves and the pressure control station. These headers supply the HCUs with drive water for insertion and withdrawal of the control rods. A separate line is run from the headers to each HCU.

The CRD pumps also supply seal purge water to the reactor recirculation pump seal purge and the reactor water cleanup pump seal purge. Water is also provided for sampling and for the continuous backfill system that supplies the safety-related nuclear boiler instrument reference legs.

The ARI system consists of seven direct current (DC)-powered solenoid operated valves arranged to provide three redundant vent paths for the scram air header and isolation of its air supply. The ARI function is initiated upon receipt of a reactor high dome pressure, reactor low water level 2, or manual signal. The setpoints for ARI initiation are chosen so that an RPS-generated scram should already have been initiated before ARI is initiated. Following any of these initiation signals, the ARI valves will energize to vent air pressure in the header, allowing individual scram inlet and outlet valves to open. The control rod drive units then insert the control rod blades to shut down the reactor.

The hydraulic water pump system is located in the fuel building, and the hydraulic control area is located in the containment. Piping that penetrates the primary containment supports containment isolation.

The control rod drive hydraulic system has the following intended functions for 10 CFR 54.4(a)(1).

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

The control rod drive hydraulic system has the following intended function for 10 CFR 54.4(a)(2).

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

The control rod drive hydraulic system has the following intended functions for 10 CFR 54.4(a)(3).

- Perform a function (reactivity control) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).
- Perform a function (ARI) that demonstrates compliance with the Commission's regulations for anticipated transient without scram (ATWS) (10 CFR 50.62).

USAR References

Section 4.6 (items 5 and 6)

Section 7.2.1.2 (item 7)

Components Subject to Aging Management Review

Class 1 components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. The condensate storage tank supply valve to CRD is reviewed in Section 2.3.4.1, Condensate Makeup, Storage and Transfer. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining CRD system components are reviewed as listed below.

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

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

License Renewal Drawings

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

LRA-PID-36-01A

LRA-PID-36-01C

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

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

### 2.3.3.2 Component Cooling Water

System Description

The purpose of the reactor plant component cooling water (RPCCW) system (system codes 115, CCH/CCP) (also referred to as the closed cooling water–reactor plant system) is to provide cooling water to reactor auxiliary system equipment and accessories during normal plant operation. The system provides a closed cooling water loop between potentially radioactive systems and the service water system used for cooling.

The RPCCW system consists of three pumps, three heat exchangers, a surge tank, redundant headers in that portion of the system which is shared with the standby service water (SSW) system, piping, valves, and instrumentation and controls. During normal operation and accident conditions, two pumps and two heat exchangers provide the required cooling capacity for the heat load of the system with the remaining pump and heat exchanger in standby.

The system includes safety-related equipment and nonsafety-related equipment. The safety-related components of the RPCCW system include redundant piping and associated equipment supplying cooling water to the RHR pumps and fuel pool coolers. The remainder of the RPCCW system, including pumps, heat exchangers, and surge tank, is not safety-related. Remotely actuated valves are provided to isolate the piping which is not safety-related from that which is safety-related.

Cooling water to the RHR pump seal coolers and fuel pool coolers, in addition to being supplied by the RPCCW system, is also supplied by the SSW system, whose operation is initiated by the operator upon low pressure detected in either of the two redundant headers that service safety-related equipment. During a LOCA, with adequate RPCCW pressure, the RPCCW system supplies cooling water to the fuel pool coolers, RHR pump seal coolers, RWCU pump coolers, and CRD pump lube oil coolers. The remaining equipment serviced by the RPCCW system is isolated.

When low water pressure is sensed at either of the RPCCW redundant supply headers, the standby service water pumps are automatically started and the operator is required to manually open the standby service water supply and return valves to the RPCCW system. The RPCCW system is then supplied with standby service water through redundant supply headers. This mode of operation supplies only the fuel pool coolers and the RHR pump seal coolers. The remaining equipment normally serviced by the RPCCW system is automatically isolated in this situation with the exception of the RWCU pumps.

The RPCCW system pumps and heat exchangers do not have a safety function; therefore they are not required to be in operation to ensure the safe shutdown of the reactor.

Nonsafety-related components that are provided cooling from the RPCCW include RWCU pump coolers and heat exchangers, the RCS recirculation pumps, CRD hydraulic pumps, and sampling components.

The safety-related portions of the RPCCW system are credited for post-fire safe shutdown and, in conjunction with the service water system, support achieving and maintaining a safe shutdown following a postulated fire in accordance with Appendix R.

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

- Provide a path for cooling water to the RHR pump seal coolers and the fuel pool coolers.
- Isolate the safety-related portion of the RPCCW system from the nonsafety-related portion on low header pressure.
- Support containment pressure boundary.

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

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

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

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

USAR References

Section 9.2.2

Components Subject to Aging Management Review

Heat exchanger components are reviewed in Section 2.3.3.3, Service Water. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining RPCCW system components are reviewed as listed below.

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

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

License Renewal Drawings

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

LRA-PID-09-01A

LRA-PID-09-01B

LRA-PID-09-10D

**Table 2.3.3-2**
**Component Cooling Water System**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
| --- | --- |
| Bolting | Pressure boundary |
| Flex hose | Pressure boundary |
| Flow element | Flow control<br>Pressure boundary |
| Piping | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3.3 Service Water

System Description

The service water aging management review includes the standby service water system, the normal service water system, and the service water cooling water system. Included in this review are systems with components supporting the service water pressure boundary where this is the only intended function for the system.

*Standby Service Water*

The purpose of the standby service water system (system codes 256, SWP) is to remove heat from those plant components required for the safe shutdown and cooldown of the unit. Using the ultimate heat sink, the system provides all the necessary cooling water to the reactor plant components required to safely bring the reactor to a cold shutdown condition and to maintain it in cold shutdown for a 30-day post-accident period. During normal plant operation, the standby service water system is not in operation, and the normal service water pumps (system 118) use standby service water piping to supply safety-related components.

The standby service water system includes four 50-percent capacity pumps, the standby cooling tower and associated storage basin (which serves as the ultimate heat sink), piping, valves, and instrumentation and controls. The system configuration supports two redundant supply headers of cooling water for safe shutdown components. Two pumps supply each header. All four pumps take suction from a common pump well in the ultimate heat sink water storage basin.

The standby cooling tower is a mechanical-draft, counter-flow cooling tower with four 50-percent capacity cooling cells. Each redundant service water loop is connected to two 50-percent tower cells. The water storage basin is a seismically designed, cylindrical pool sized to hold approximately 6.9 million gallons of water. This volume of water provides a heat sink for the maximum total integrated heat generated during an accident. Makeup water is provided by the normal plant makeup wells.

Standby service water is pumped from the standby cooling tower water storage basin through the discharge line of each pump. All standby service water piping between the standby cooling tower and the reactor complex is routed in Seismic Category I tunnels. Discharge lines from each set of redundant standby service water pumps combine into two equally sized redundant supply headers. The redundant headers are cross-connected in the pipe tunnel by two normally closed redundant motor-operated valves.

Two takeoffs from the header, one from each side of the isolation valve, are routed to the fuel building, auxiliary building, containment, drywell, control building, and diesel generator building to supply standby cooling water to the various components essential to safety. Return lines from the components are collected in redundant headers and returned to the standby cooling tower.

Each supply line is capable of providing sufficient cooling water for all of the following minimum conditions, which are essential to the safe shutdown of the reactor:

- Two residual heat removal pumps operating.
- One standby diesel generator and the HPCS diesel generator operating.
- One of four water chillers which supply cooling water to the main control room air-conditioning system operating.
- Auxiliary building unit coolers operating.
- One of two containment unit coolers operating.

In the auxiliary building, vacuum release air is provided by opening to the ambient building atmosphere. In the containment, instrument air stored in safety-related accumulator tanks is used to prohibit potentially contaminated air from entering the service water system.

The standby service water system via the reactor plant component cooling water (RPCCW) system is available to provide a backup source of makeup water to the spent fuel pool. In the event that the RPCCW system is out of service, standby service water is also supplied to the fuel pool cooling system heat exchangers for cooling the spent fuel pool.

In the event of the most severe earthquake, or earthquakes of less intensity which are characteristic of the region, Seismic Category I standby service water supply is available to manual hose stations located in the auxiliary, control, fuel, and reactor buildings should the fire protection storage tanks become unavailable.

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

- Provide a reliable source of cooling water to plant systems and components required for the safe shutdown and long-term cooling of the plant following a design basis accident.
- Provide a pressure boundary for the normal service water supply to safety-related components.
- Support containment pressure boundary.

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

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

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

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

*Normal Service Water*

The purpose of the normal service water system (system codes 118, SWP) is to provide cooling water to remove heat from turbine and reactor plant auxiliary systems and components during all modes of plant operation. It is cooled by the service water cooling system (system 130). The closed-loop normal service water system operates during normal plant operation; in emergency situations, the safety-related standby service water system operates (system 256). During normal plant operation, the normal service water pumps use standby service water piping to supply safety-related components. (Both systems use SWP in component identification numbers.)

The normal service water system includes three 50-percent capacity pumps, heat exchangers, chemical tanks and a surge tank, piping, valves, and instrumentation and controls. Cooling in the service water system heat exchangers is provided by the service water cooling system.

The pump inlet header is provided by the outlet of the heat exchangers. The normal service water main header from the pump discharge is routed to a point outside the turbine building where the main header branches into two supply headers. One supply header enters the electrical tunnel east of the turbine generator building where it again divides into two redundant 30-inch standby service water headers. These redundant headers supply cooling water to both safety-related and nonsafety-related equipment in the radwaste building, control building, auxiliary building, diesel generator building, and reactor building. The second supply header enters the turbine building and supplies water to the coolers located in that building.

The turbine building branch supply header supplies the three turbine plant component cooling water (TPCCW) heat exchangers, three air-conditioning water chillers, four generator hydrogen coolers, one alternator cooler, two electrohydraulic control (EHC) system coolers, and two turbine lube oil coolers. The return from each of these components is routed to a return header, which returns the service water to the service water system heat exchanger inlet header.

The second branch supply header supplies three radwaste/fuel building chiller condensers; three RPCCW heat exchangers; suppression pool cleanup, cooling, and alternate decay heat removal heat exchanger; auxiliary building unit coolers; four main control room air-conditioning water chillers; four RHR heat exchangers (two heat exchangers in series for Loops A and B); three standby diesel generator jacket water coolers; and six drywell ventilation unit coolers. The return from each of the radwaste building, auxiliary building, drywell, and control building components is routed to a header that returns the service water to the service water system heat exchanger inlet header. In USAR system descriptions, each pair of RHR heat exchangers is usually referred to as a single heat exchanger for the loop. Containment isolation valves are components in the standby service water system (system 256).

The heat exchanger inlet header supplies the eight heat exchangers cooled by the service water cooling system. A surge tank is located between the heat exchangers and the pump suction to allow for thermal expansion. A pressurized nitrogen blanket is provided to minimize oxygen ingression into the water and to minimize the amount of service water piping subjected to a vacuum and the degree of vacuum when no normal service water pumps are running.

Safety-related components in the normal service water system maintain the pressure boundary of the safety-related standby service water system. The nonsafety-related portions of the system isolate automatically upon initiation of the standby service water system.

In the event of a fire in Fire Area PT-1 (E, F, and G Tunnels), the normal service water system will provide the source of cooling water for plant systems and components required for safe shutdown of the reactor.

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

- Maintain pressure boundary of the standby service water system.

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

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

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

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

_Service Water Cooling_

The purpose of the service water cooling system (system codes 130, SWC) is to provide cooling water to remove heat from the normal service water system (system 118) during all modes of plant operation. The service water cooling system provides cooling water to the normal service water system heat exchangers, which cool the normal service water system during normal plant operation and planned unit outages. A cooling tower is provided as the heat sink for the service water cooling system.

The service water cooling system consists of three 50-percent capacity pumps, a cooling tower, piping, valves, and instrumentation and controls. Service water cooling system water is pumped from the cooling tower pump pit. Each pump discharges into the service water cooling system pump discharge header that supplies the heat exchangers in the normal service water system. Flow returns from the heat exchangers to the cooling tower supply header. Risers carry the water to the top of the cooling tower, where it is cooled before recirculating through the system.

The cooling tower is a concrete, rectangular, mechanical-draft cooling tower with five cells. Each of the five cells is cooled by a 32-foot diameter fan. The cell may be operated with the fan turning at full speed, at one-half speed, or with the fan shut down (natural circulation).

In the event of a fire in Fire Area PT-1 (E, F, and G Tunnels), the normal service water system and its support systems will provide the source of cooling water for plant systems and components required for safe shutdown of the reactor. Therefore, the service water cooling system performs an intended function for compliance with 10 CFR 50.48.

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

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

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

*Systems with Components Supporting the Service Water Pressure Boundary*

Several systems support the service water pressure boundary. Those with additional intended functions are described elsewhere in the application. The systems described below have the following intended function as the only intended function for license renewal.

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

*Turbine Lube Oil, Purification and Turning Gear/Waste Oil Disposal*

The purpose of the turbine generator lube oil system (system codes 111/660, LOS/TMG/TML/WOS) is to provide clean, purified and conditioned oil at proper pressure and temperature to the turbine and generator bearings. The oil also removes heat and limits the temperature rise of the bearing material. A bypass stream of turbine lubricating oil flows continuously through an oil conditioner to remove water and other impurities. Lube oil also is provided to various turbine auxiliaries.

Components associated with the turbine lube oil coolers support the pressure boundary of the normal service water system, which is credited for safe shutdown in the event of a fire in Fire Area PT-1.

LRA Drawing: LRA-PID-09-10A

*EHC Hydraulic Oil*

The purpose of the EHC hydraulic oil system (system codes 113, TMB) is to provide the hydraulic oil used to control the turbine-generator unit through an electrohydraulic control (EHC) system capable of controlling the speed, load, and steam flow under steady-state and transient conditions.

Components associated with the EHC hydraulic oil coolers support the pressure boundary of the normal service water system, which is credited for safe shutdown in the event of a fire in Fire Area PT-1.

LRA Drawing: LRA-PID-09-10A

*Closed Cooling Water – Turbine Plant*

The purpose of the turbine building (or turbine plant) closed cooling water (TPCCW) system (system codes 116, CCS) is remove heat from the designated heat exchangers in the turbine building and the radwaste building. The system is an intermediate cooling distribution loop that transfers heat from designated equipment to the station normal service water system.

The TPCCW system is not a safety-related system. System function is not necessary for a safe shutdown of the plant, nor is it required during or after a design-basis LOCA. However, components associated with the TPCCW coolers support the pressure boundary of the normal service water system, which is credited for safe shutdown in the event of a fire in Fire Area PT-1.

LRA Drawing: LRA-PID-09-10A

*Hydrogen and $CO_2$ – Generator*

The purpose of the generator hydrogen and carbon dioxide ($CO_2$) system (system codes 123, GMH) is to provide hydrogen cooling for the main generator and $CO_2$ for purging the generator for maintenance. The generator hydrogen and $CO_2$ system consists of a bulk storage area for hydrogen and $CO_2$, hydrogen coolers, filters, pressure control valves, gas analyzers, isolation valves, and supply, distribution, and vent piping.

Components associated with the main generator hydrogen coolers and main alternator coolers support the pressure boundary of the normal service water system, which is credited for safe shutdown in the event of a fire in Fire Area PT-1.

LRA Drawing: LRA-PID-09-10A

*Nitrogen*

The purpose of the nitrogen system (system codes 124, GSN) is to support the use of bottled nitrogen at the site. Nitrogen cylinders are stored on site for nitrogen blanketing of the closed loop cooling water surge tanks, for supplying nitrogen to the reactor plant sampling system and the total organic carbon analyzer in the radwaste system, and permanent storage of CRD accumulator recharging cylinders. Nitrogen is also used for fuel building and auxiliary building penetrations and for fuel building and reactor building gate seals.

Nitrogen is not required in a post-fire shutdown scenario. However, components associated with the service water surge tank nitrogen supply support the pressure boundary of the normal service water system, which is credited for safe shutdown in the event of a fire in Fire Area PT-1.

LRA Drawing: LRA-PID-14-01B

*Main Condenser Air Removal*

The purpose of the main condenser air removal system (system codes 125, ARC) is to remove air and noncondensible gases from the condenser. The system consists of mechanical vacuum pumps and steam jet air ejector trains. Each air ejector uses two primary steam jets complete with intercondenser, intercooler, and one secondary steam jet for removing the air and noncondensibles.

Cooling water for the intercoolers is service water. Components associated with the intercoolers support the pressure boundary of the normal service water system, which is credited for safe shutdown in the event of a fire in Fire Area PT-1.

LRA Drawing: LRA-PID-05-01A

*Electrohydraulic Control and Steam Bypass*

The purpose of the electrohydraulic control (EHC) and steam bypass system (system codes 509, MSS/TMB, C85) is to control the turbine generator unit under steady-state and transient conditions and to reduce the levels of reactor power surges during system transients.

Components associated with the turbine EHC coolers and steam bypass hydraulic power units support the pressure boundary of the normal service water system, which is credited for safe shutdown in the event of a fire in Fire Area PT-1.

LRA Drawing: LRA-PID-09-10A

USAR References

| *Standby SW* | *Normal SW* | *SW Cooling* |
| --- | --- | --- |
| Section 9.2.5 | Section 9.2.1 | Section 9.2.12 |
| Section 9.2.7 | | |
| Section 9.2.1.2 | | |

Section 9.1.3.2.1 (spent fuel cooling and makeup)

Section 9A.3.2.4 (backup to fire water)

*Turbine Lube Oil, Purification and Turning Gear/Waste Oil Disposal*

Section 10.2.2

*EHC Hydraulic Oil*

Section 10.2.1, Item 4

Section 10.2.2

*Closed Cooling Water – Turbine Plant*

Section 9.2.8

*Hydrogen and $CO_2$ – Generator*

Section 10.2.2

*Nitrogen*

Section 9.5.9.2

*Main Condenser Air Removal*

Section 10.4.2

*EHC and Steam Bypass*

Section 10.2

Section 10.4.4

Components Subject to Aging Management Review

Service water components associated with the standby diesel generator are reviewed in Section 2.3.3.10, Standby Diesel Generator. Service water components associated with the HPCS diesel generator are reviewed in Section 2.3.3.11, HPCS Diesel Generator. SWP system components that interface with HVAC-chilled water (system 410) that have chilled water as the internal environment during normal plant operations are reviewed in Section 2.3.3.14, Chilled Water. Nonsafety-related service water components not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining service water components are reviewed as listed below.

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

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

License Renewal Drawings

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

| | | |
|---|---|---|
| LRA-PID-05-01A | LRA-PID-09-11A | LRA-PID-22-22A |
| LRA-PID-09-01B | LRA-PID-09-11B | LRA-PID-27-07B |
| LRA-PID-09-10A | LRA-PID-09-15A | LRA-PID-27-08A |
| LRA-PID-09-10B | LRA-PID-09-15B | LRA-PID-27-20C |
| LRA-PID-09-10C | LRA-PID-14-01B | LRA-PID-27-20D |
| LRA-PID-09-10D | LRA-PID-22-01C | LRA-PID-32-09P |
| LRA-PID-09-10E | LRA-PID-22-08A | LRA-PID-37-01B |
| LRA-PID-09-10F | LRA-PID-22-14D | |
| LRA-PID-09-10G | LRA-PID-22-14H | |
| LRA-PID-09-10H | LRA-PID-22-14J | |

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

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Coil | Pressure boundary |
| Expansion joint | Pressure boundary |
| Flex hose | Pressure boundary |
| Flow element | Pressure boundary |
| Heat exchanger (channel head) | Pressure boundary |
| Heat exchanger (end cover) | Pressure boundary |
| Heat exchanger (plates) | Heat transfer<br>Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Heat exchanger (tubes) | Heat transfer<br>Pressure boundary |
| Heat exchanger (tubesheet) | Pressure boundary |
| Nozzle | Pressure boundary |
| Orifice | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Sight glass | Pressure boundary |
| Strainer | Filtration |
| Strainer housing | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3.4 Compressed Air

System Description

The compressed air systems are the instrument, service, and breathing air systems (system codes 121/122, SAS/IAS; 710, JRB).

The purpose of the instrument air system (IAS) is to provide clean, dry air for plant instrumentation and controls, and the service air system (SAS) provides clean air for plant services. The breathing air system is a subsystem of the SAS and supplies breathable quality air from the SAS to strategically located service air stations throughout the plant for use by plant personnel. Mechanical components supporting the reactor building penetrations, seals and air locks (system codes 710, JRB) support the containment pressure boundary.

The compressed air supply to the instrument, service, and breathing air systems is provided by six electric-driven, oil-free compressors. Three air compressors serve the instrument air system, and the other three air compressors serve the service air system. The compressed air systems also include accumulators, aftercoolers, dryers, dampers, filters, piping, valves, instrumentation and controls. A diesel-driven air compressor is provided as a backup; however, this diesel is not credited for intended functions for license renewal.

The service air system air compressors will be cross-tied to the instrument air system, so any service air system air compressor can be fed into the instrument air system. Each air compressor is provided with a trim cooler and moisture separator for the discharged compressed air. After passing through the moisture separator, the air is passed through one of two 100-percent capacity pre-filters, one of two 100-percent capacity desiccant-type air dryers, and then filtered through one of two 100-percent capacity after-filters. The instrument air is then distributed to various plant instrument services. Breathing air is taken directly from the service air stations.

Supplementary ASME III Safety Class 3 accumulator tanks are provided to ensure adequate air supply to dampers in the auxiliary building and control building in the case of a loss of offsite power or a LOCA. Eight compressed air bottles are connected to each supplementary accumulator tank in the control building. The additional air reserve capacity of the air bottles supplements the usable air capacity of the accumulator tank. The provision of air bottles ensures continuous availability of the instrument air to the dampers in the control building in the event of a loss of offsite power or a LOCA. Compressed air accumulators are credited in the station blackout analysis.

The fuel building ventilation system (system code 406) is no longer credited to mitigate the consequences of any design basis accident. The fuel building was removed from the definition of secondary containment, and the ventilation system is not credited for a fuel handling accident or for safe shutdown following a fire event. Therefore, air accumulator tanks provided for fuel building ventilation dampers no longer perform a safety function and have no intended function for license renewal.

Safety-related valves and flex hoses associated with the air supply for drywell and reactor building air locks support the containment pressure boundary. This system code (710) also includes safety-related structural components (e.g., seals and penetrations), which are included in the structural review of drywell and containment penetrations.

With the exception of the containment and drywell penetrations (including air locks) and the three independent Safety Class 3 air damper air accumulator systems, the compressed air systems are not safety-related. Control room and standby switchgear heating, ventilation and air conditioning (HVAC) dampers have backup air tanks and associated air bottles to maintain the dampers open in the event of a fire with instrument air unavailable. The original three air compressors that served both IAS and SAS have been abandoned in place.

The compressed air systems have the following intended functions for 10 CFR 54.4(a)(1).

- Ensure adequate air supply to dampers in the auxiliary building and control building in the case of a loss of offsite power or a LOCA.
- Support containment pressure boundary.

The compressed air systems have the following intended function for 10 CFR 54.4(a)(2).

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

The compressed air systems have the following intended functions for 10 CFR 54.4(a)(3).

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

<u>USAR References</u>

Section 9.3.1

Components Subject to Aging Management Review

Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining compressed air system components are reviewed as listed below.

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

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

SCBAs and their backup air bottles used by the control room crew in the event of a toxic gas release are consumables and therefore are not subject to aging management review. See discussion of consumables in Section 2.1.2.4.4.

License Renewal Drawings

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

| | | |
|---|---|---|
| LRA-PID-03-01A | LRA-PID-12-01C | LRA-PID-12-02C |
| LRA-PID-03-01B | LRA-PID-12-01B | |
| LRA-PID-03-01C | LRA-PID-12-01E | |

**Table 2.3.3-4**
**Compressed Air System**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Flex hose | Pressure boundary |
| Orifice | Flow control |
| Piping | Pressure boundary |
| Strainer | Filtration |
| Strainer housing | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3.5 Standby Liquid Control

System Description

The purpose of the standby liquid control (SLC) system (system codes 201, SLS, C41) is to assure reactor shutdown from full power operation to cold sub-critical, without control rod movement, by mixing a neutron absorber with the primary reactor coolant. The system is designed for the condition when no control rods can be remote-manually inserted from the full power setting. The system is designed to disperse neutron absorber within the core zone in sufficient quantity to provide a reasonable margin for leakage or imperfect mixing.

The SLC system consists of a boron solution storage tank; a demineralized water test tank; two positive displacement, full-capacity pumps; two explosive-actuated injection valves; and associated system piping, valves and instrumentation. The portions of the system required for safe shutdown of the reactor are safety-related.

The boron solution storage tank, the test water tank, the two pumps, the two explosive valves, the two motor-operated pump suction valves, and associated local valves and controls are located in the containment. The liquid is piped into the reactor vessel and discharged near the bottom of the core, so it mixes with the cooling water rising through the core.

The SLC system sodium pentaborate solution functions to control suppression pool pH following a design basis LOCA event with no functioning ECCS injection. This function was added to the SLC system in conjunction with the River Bend implementation of alternate source term per Regulatory Guide 1.183.

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

- Provide a backup reactivity control system capable of shutting down the reactor by dispersing a neutron absorber in the reactor core.
- Control suppression pool pH following a design basis LOCA with no functioning ECCS injection.
- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

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

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

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

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

USAR References

Section 9.3.5

Components Subject to Aging Management Review

Class 1 components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining SLC system components are reviewed as listed below.

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

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

License Renewal Drawings

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

LRA-PID-27-16A

**Table 2.3.3-5**
**Standby Liquid Control System**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
| --- | --- |
| Bolting | Pressure boundary |
| Gear box housing | Pressure boundary |
| Heater housing | Pressure boundary |
| Orifice | Flow control<br>Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Sight glass | Pressure boundary |
| Strainer housing | Pressure boundary |
| Tank | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3.6 Main Steam Positive Leakage Control

System Description

The purpose of the main steam (or MSIV) positive leakage control system (MS-PLCS) (system codes 208, MSI/LSV, E33) is to minimize the release of fission products which could bypass the standby gas treatment system (SGTS) after a LOCA. This is accomplished by pressurizing the piping between the inboard and outboard MSIVs and by pressurizing the piping between the seals of the outboard MSIV and the main steam shutoff valve. This pressurized volume eliminates potential radioactive out-leakage by causing leakage to occur inward from the pressurized steam piping into the containment or reactor vessel.

For the purposes of this review, the penetration valve leakage control system (PVLCS, system code 255) is considered as part of the MS-PLCS. The PVLCS provides compressed air to the MS-PLCS. The function of PVLCS associated with controlling the release of fission products to the environment has been removed. However, the PVLCS air compressors were retained as a backup air supply to ADS SRV accumulators (system code 202) and an air supply for MS-PLCS. The PVLCS is capable of performing its safety function following a loss of all offsite power.

Two independent systems (outboard and inboard) are provided to accomplish the leakage control function. The outboard system is connected to each of the main steam shutoff valves, drain lines (inboard and outboard MSIV), and outboard MSIV stem packing leak-off lines. The inboard system is connected to the outboard MSIV body (inlet side) and to the inboard MSIV drain lines located outside the containment.

The inboard and outboard systems are remote-manually initiated in the main control room. Operation of both systems is initiated after it has been ascertained that a design-basis LOCA has occurred (as evidenced by high drywell pressure and low reactor water level indications in the main control room). Either one of the two systems is sufficient to establish the necessary barrier between the containment and the environs.

The MS-PLCS consists of valves, piping (inboard and outboard piping runs), and instrumentation and controls. The air is supplied by the PVLCS compressors. The PVLCS is composed of two independent and redundant systems. Each train includes an air compressor, air accumulator, piping, valves, and instrumentation and controls. The accumulators are sized to accommodate the initial post-accident requirements with the long-term requirements being met with the function of the air compressors. Downstream of the accumulator are two branch lines, one to the MS-PLCS and the other to the main steam ADS SRV accumulators. Each of the systems requires compressed air after an accident.

Backup air to the SRV accumulators that is supplied by the PVLCS compressors supports maintaining the appropriate number of SRVs open for the alternate shutdown cooling mode of RHR for safe shutdown following a fire event.

The compressors are water-sealed and cooled units supplied by normal service water, which is credited in the event of a fire in Fire Area PT-1.

The MS-PLCS has the following intended functions for 10 CFR 54.4(a)(1).

- Prevent the release of fission products through closed MSIVs and main steam drain line valves.
- Provide a backup air supply to ADS accumulators.
- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

The MS-PLCS has the following intended function for 10 CFR 54.4(a)(2).

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

The MS-PLCS has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function (PVLCS compressors supporting operation of SRVs, support service water pressure boundary) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

USAR References

Section 1.2.2.4.17

Section 6.7

Section 9.3.6

Components Subject to Aging Management Review

Class 1 components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Components that support the pressure boundary of the normal service water system are reviewed in Section 2.3.3.3, Service Water. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining MS-PLCS components are reviewed as listed below.

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

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

License Renewal Drawings

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

| | |
|---|---|
| LRA-PID-03-01C | LRA-PID-27-20C |
| LRA-PID-27-20A | LRA-PID-27-20D |
| LRA-PID-27-20B | LRA-PID-32-05B |

**Table 2.3.3-6**
**Main Steam Positive Leakage Control System**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
| --- | --- |
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Compressor housing | Pressure boundary |
| Flex hose | Pressure boundary |
| Flow element | Pressure boundary |
| Heat exchanger (channel head) | Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Heat exchanger (tubes) | Heat transfer<br>Pressure boundary |
| Heat exchanger (tubesheet) | Pressure boundary |
| Orifice | Pressure boundary |
| Piping | Pressure boundary |
| Strainer | Filtration |
| Strainer housing | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3.7 Fire Protection –Water

System Description

The review of the fire protection – water system includes the makeup water system.

*Fire Protection – Water*

The purpose of the fire protection – water (FP-W) system (system codes 251, FOF/FPW) (also referred to as the fire protection – water and engine pump system) is to suppress any fire that occurs. The fire protection system consists of two water-supply tanks, one electrically driven fire pump, two diesel-driven fire pumps, one jockey fire pump, fire water yard mains, hydrants, standpipe hose stations, suppression systems, and system piping and valves as well as the fuel oil supply for the diesel-driven fire pumps.

Fire water supply is from two ground-level steel suction tanks. Each tank has a maximum working capacity of 265,000 gallons with a minimum maintained level of 253,000 gallons, which renders a minimum usable volume of 241,000 gallons. This is sufficient to provide the largest expected flow of 1900 gallons per minute for two hours. The two storage tanks have their discharge piping cross-connected with normally open valves, so that the fire pumps can take suction from either tank. These tanks are filled automatically by the shallow well makeup water pump at a rate of 800 gpm when the water level in the tanks falls 2 feet below the overflow level. At this level, the usable volume is at its minimum of 241,000 gallons. The makeup water pump shuts off automatically when the water level in the tanks reaches the overflow level. Additional makeup water is available from two 150-gpm, manually operated deep well pumps. (See makeup water system description.)

Three half-capacity fire water pumps, one electrically driven and two diesel-driven, deliver water to the yard loop and sprinkler systems. The diesel engines are each supplied by a 500-gallon fuel oil tank with associated filters, piping and valves. Tanks, pumps, and discharge lines to the underground loop are provided with sectionalizing shutoff valves, so no single impairment incapacitates more than one tank or pump.

The system pressure is maintained continuously between 130 and 140 psig by a jockey pump. The fire pumps are started by actuation of pressure switches located on the discharge side of the pumps and stopped manually at the fire pump house. The motor-driven pump starts when system discharge pressure drops to 120 psig. The two diesel-driven pumps start when pressure drops to 110 psig and 100 psig, respectively.

The underground piping forms a continuous loop around the plant. This loop is fed by two headers, which enables water to flow in either direction around the loop. Therefore, a single failure condition will not disable any water sprinkler system. Each sprinkler system has an individual isolation valve for shutting off an actuated sprinkler system, replacing heads, or performing general maintenance. Post indicator sectional valves are provided to isolate portions of the system for maintenance or repair, without shutting off the supply of primary and backup fire suppression systems serving other areas that contain or expose safety-related equipment. Containment isolation valves are provided in the FP-W lines for the reactor building.

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

- Support containment pressure boundary.

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

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

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

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

*Makeup Water*

The purpose of the makeup water system (system codes 659/810, MWS) is to provide well water and demineralized water to systems and equipment throughout the plant which require intermittent quantities of clean water. The makeup water system includes two deepwell pumps, one shallow well pump, a caustic feed tank with pump and mixer, a well water storage tank, three well water transfer pumps, two demineralized water storage tanks, three demineralized water transfer pumps, piping, valves, and instrumentation and controls.

The two deepwell pumps draw water from an aquifer 1700 feet below plant grade and pump this water into the well water storage tank. The shallow well pump draws water from an aquifer 140 feet below plant grade and pumps that water to the two fire protection water storage tanks. Water from the shallow well is neutralized by caustic feed equipment, which injects sodium hydroxide solution into the shallow well pump discharge piping. The deepwell pumps can also be used to provide water to the fire water storage tanks. Deepwell water provides makeup to the standby cooling tower basin.

The well water transfer pumps take suction from the well water storage tank, which also supplies a line to the domestic water system. The discharge of the transfer pumps is sent to a demineralizing treatment system, which is normally provided by a water treatment skid supplied by a contractor. The treated water is stored in two demineralized water storage tanks. This water is distributed through the plant by three demineralized water transfer pumps.

The makeup water system supplies demineralized water to the condensate storage tank, fuel pool cooling and cleanup system, turbine plant component cooling water system (TPCCW), reactor plant component cooling water system (RPCCW), control building chilled water system, ventilation chilled water system, and various other plant systems, including normal service water. Two safety-related valves supply water to the standby diesel generators jacket water standpipe. With this exception, the system is not safety-related.

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

- Support the pressure boundary of the standby diesel generator jacket water system.

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

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

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

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

USAR References

Section 9.5.1

Appendix 9A

Section 9.2.3 (makeup water)

Components Subject to Aging Management Review

Makeup water system components that support the pressure boundary of the normal service water system are reviewed in Section 2.3.3.3, Service Water. Makeup water system components that support the pressure boundary of the standby diesel generator jacket water system are reviewed in Section 2.3.3.10, Standby Diesel Generator. Nonsafety-related components of the systems not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining FP-W and makeup water system components are reviewed as listed below.

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

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

License Renewal Drawings

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

| | |
|---|---|
| LRA-PID-15-01A | LRA-PID-09-15A |
| LRA-PID-15-01B | LRA-PID-22-06A |
| LRA-PID-15-01C | LRA-PID-22-09A |
| LRA-PID-15-01E | LRA-PID-27-15A |

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

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Expansion joint | Pressure boundary |
| Fire hydrant | Pressure boundary |
| Flame arrestor | Pressure boundary |
| Flex hose | Pressure boundary |
| Flow element | Flow control<br>Pressure boundary |
| Heat exchanger (channel head) | Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Heat exchanger (tubes) | Heat transfer<br>Pressure boundary |
| Heater housing | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Silencer | Pressure boundary |
| Sprinkler | Flow control<br>Pressure boundary |
| Strainer | Filtration |
| Strainer housing | Pressure boundary |
| Tank | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |
| Vortex breaker | Flow control |

### 2.3.3.8 Fire Protection –Halon

System Description

The purpose of the fire protection – Halon system (system codes 253, FPG, H13D) is to minimize damage due to cable fires in the underfloor areas of the power generation control complex (PGCC) in the main control room and in other plant areas that do not contain safety-related equipment.

The Halon systems provide a permanently installed automatic means of fire extinguishing for the control room floor modules, associated panels, and termination cabinets as well as other areas of the plant. The system consists of 84 Halon 1301 cylinders (in various separate subsystems), piping, valves, nozzles, and instrumentation and controls.

The cables in the PGCC are protected by detectors and automatically actuated Halon 1301 systems. Each PGCC module is a zone, and flow is alarmed in the main control room.

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

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

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

USAR References

Section 9.5.1.2.10

Section 9A.2.5.2.23

Components Subject to Aging Management Review

Fire protection – Halon system components are reviewed as listed below.

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

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

License Renewal Drawings

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

LRA-PID-15-05A

**Table 2.3.3-8**
**Fire Protection –Halon System**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Nozzle | Flow control<br>Pressure boundary |
| Piping | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3.9 Combustible Gas Control

<u>System Description</u>

The combustible gas control system is composed of the hydrogen mixing, purge and recombiner system (system 254) and the containment atmosphere and leakage monitoring (system 552).

*<u>Hydrogen Mixing, Purge and Recombiner</u>*

The purpose of the hydrogen mixing, purge, and recombiner system (system codes 254, CPM/ CPP/HCS) is to control the concentration of hydrogen that may be released in the drywell and containment as a result of a LOCA. Subsystems are provided for the drywell and containment to mix the atmospheres (hydrogen mixing) and to reduce hydrogen concentrations without relying on purging to the environment (hydrogen recombiners). The system also contains hydrogen igniters, which provide mitigation of degraded core hydrogen generation events that are beyond the design basis. A backup, nonsafety-related, containment hydrogen purge system is provided to aid in long-term, post-LOCA cleanup.

The combustible gas control system described in USAR Section 6.2.5 includes these systems plus the hydrogen analyzer system. The hydrogen analyzers are components in system 552, containment atmosphere and leakage monitoring.

*Hydrogen Mixing*

The hydrogen mixing system operates to mix the drywell atmosphere with the containment atmosphere approximately 30 minutes after the design basis LOCA, so that the hydrogen concentration in the drywell does not reach the 4-percent-by-volume limit in the short term. The hydrogen mixing system consists of two independent, 100-percent capacity trains located in the containment. Each train consists of one hydrogen mixing fan with a capacity of 600 cfm and associated piping, valves, and instrumentation. When the hydrogen mixing system is actuated, air from the primary containment enters the drywell through two openings. These openings are located diametrically opposite each other on the circumference of the drywell, just above the suppression pool. The drywell atmosphere is exhausted into the larger primary containment volume through two penetrations located at the top of the drywell by means of two recirculating fans. Thus, the air from the primary containment, which is relatively free of hydrogen, is mixed with the air in the drywell and dilutes the drywell atmosphere. The hydrogen mixing system is an engineered safety feature and is designed to operate following a LOCA in post-accident environments without loss of function.

*Hydrogen Recombiner*

The hydrogen recombiner system was designed to be initiated approximately 12.5 days after the design basis LOCA to limit the hydrogen concentration in both the drywell and containment to less than 4 volume percent. Hydrogen is removed by combining it with oxygen present in the containment atmosphere to form water vapor. This process is activated by raising the temperature of the gas stream to a temperature at which recombination will occur. The hydrogen recombiner system consists of two 100-percent capacity hydrogen recombiners located on opposite sides of the containment refueling floor. The system is composed primarily of electrical components. However, the electrical recombiner heaters are housed in a stationary ventilation unit that is considered a mechanical component.

License Amendment 142 revised the RBS TS requirements by eliminating the requirements associated with hydrogen recombiners and hydrogen monitoring. Although the two hydrogen recombiners are still classified as safety-related, they no longer meet the criteria of 10 CFR 54.4(a)(1). Because the recombiners are stand-alone, air-handling units located on the refueling floor whose function is not required to support a safety function, they do not meet the criteria of 10 CFR 54.4(a)(2). The recombiners are not relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for the events listed in 10 CFR 54.4(a)(3). Therefore, the hydrogen recombiners do not support a system intended function for license renewal and are not subject to aging management review.

*Hydrogen Purge*

A backup containment hydrogen purge system is provided to aid in long-term, post-LOCA cleanup. The containment hydrogen purge system provides the capability to purge the containment and drywell through the shield building annulus and standby gas treatment system (SGTS) to the atmosphere. The purge air is supplied by the service air system. The purge fan, a 30-cfm capacity fan located in the containment, discharges the purge air through the piping of the containment and drywell purge system (system code 403). From there, the purge air enters the annulus and is treated by the SGTS. The hydrogen purge system is not safety-related with the exception of containment penetration components.

*Hydrogen Igniters*

A hydrogen control system (HCS) using safety-related igniters is distributed throughout the drywell and containment. The design of the HCS is based on the concept of providing distributed ignition sources so that hydrogen combustion is accomplished in a controlled manner. The HCS consists of a total of 104 igniters, which are powered by two physically separate and electrically independent divisions each containing 52 igniters. Each igniter consists of a "glow plug" enclosed in an water-tight sheath with only the tip exposed. A spray hood extends over the glow plug to protect against moisture that would cause a reduction in tip temperature.

The HCS (igniters) system is capable of maintaining the hydrogen concentration at safe levels (i.e., near the lower flammability limit of 4 percent by volume) during an event leading to considerable hydrogen production, more severe than a design basis LOCA. A nonsafety-related backup diesel generator is available to power the hydrogen igniters if necessary during a beyond-design-basis event. The diesel generator supports no intended functions for license renewal.

The hydrogen mixing, purge, and recombiner system has the following intended functions for 10 CFR 54.4(a)(1).

- Mix the drywell atmosphere with the containment atmosphere to control the hydrogen concentration in the drywell following a LOCA.
- Maintain the hydrogen concentration in the drywell and containment at safe levels during a hydrogen generation event more severe than a design basis LOCA.
- Support containment pressure boundary.

The hydrogen mixing, purge, and recombiner system has the following intended function for 10 CFR 54.4(a)(2).

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

The hydrogen mixing, purge, and recombiner system has no intended functions for 10 CFR 54.4(a)(3).

*Containment Atmosphere and Leakage Monitoring*

The containment atmosphere and leakage monitoring system (system codes 552, CMS/LMS) has two subsystems, atmosphere monitoring and leakage monitoring.

*Containment Atmosphere Monitoring*

The purpose of the containment atmosphere monitoring (CMS) system is to provide measurement, indication, recording, and alarm of containment and drywell temperature, pressure, differential pressure, hydrogen concentration, and radiation levels during normal operation, abnormal transients, and accidents. The mechanical components of the system are sample pumps, piping and valves.

The CMS hydrogen analyzers are part of the combustible gas control system described in USAR Section 6.2.5. Hydrogen monitoring determines when the hydrogen control systems (system code 254) should be initiated following a LOCA.

The concentration of hydrogen in the drywell and containment is measured during LOCA conditions using two fully independent hydrogen analyzer trains. For each independent train, samples are derived from one of 12 sources (10 in the containment and 2 in the drywell) and are returned to the drywell. Two manually selected sample sources (any one of 10 in the containment and any one of 2 in the drywell) are automatically monitored by an automatic/ manual sequencer that controls the opening and closing of the respective solenoid-operated valves in the sample lines. The selected sample flows through heat-traced piping and inboard and outboard isolation valves to a hydrogen analyzer. The sample returns through outboard and inboard isolation valves back into containment.

License Amendment 142 revised the RBS TS requirements by eliminating the requirements associated with hydrogen recombiners and hydrogen monitoring. However, as stated in the NRC Safety Evaluation Report (SER) for Amendment 142, the monitors are required to diagnose the course of events beyond design basis accidents (DBAs), and "each licensee should verify that it has, and make a regulatory commitment to maintain, a hydrogen monitoring system capable of diagnosing beyond DBAs." Therefore, the hydrogen analyzers are considered to perform a safety function in accordance with 10 CFR 54.4(a)(1).

The CMS containment and drywell monitors are safety-related and designed to remain functional during and after seismic loading conditions and are qualified to Category 1 standards. To support safe shutdown for a fire event, the system is credited to provide measurement, indication, and recording of suppression pool level and temperature.

*Containment Leakage Monitoring*

The purpose of the containment leakage monitoring (LMS) system is to provide the equipment, instruments, and controls necessary for periodic measurement of the containment integrated leakage rate, as required by 10 CFR 50, Appendix J, and the technical specifications. The LMS system is not safety-related except for piping and valves required for containment isolation.

The containment atmosphere and leakage monitoring system has the following intended functions for 10 CFR 54.4(a)(1).

- Monitor the concentration of hydrogen that may be released in the drywell and containment to diagnose the course of beyond design basis events.
- Support containment pressure boundary.

The containment atmosphere and leakage monitoring system has the following intended function for 10 CFR 54.4(a)(2).

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

The containment atmosphere and leakage monitoring system has the following intended function for 10 CFR 54.4(a)(3).

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

USAR References

*Hydrogen Mixing, Purge, and Recombiner System*

Section 6.2.5

*Containment Atmosphere and Leakage Monitoring System*

Section 6.2.5

Section 6.2.6

Components Subject to Aging Management Review

LMS components associated with an annulus pressure transmitter are reviewed in Section 2.3.3.13, Miscellaneous HVAC. Nonsafety-related components of the CGC system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining CGC system components are reviewed as listed below.

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

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

License Renewal Drawings

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

LRA-PID-21-02B
LRA-PID-22-01B
LRA-PID-27-15A
LRA-PID-27-21A
LRA-PID-33-02A
LRA-PID-33-02B
LRA-PID-33-02C

**Table 2.3.3-9**
**Combustible Gas Control System**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Coil | Heat transfer<br>Pressure boundary |
| Fan housing | Pressure boundary |
| Flex hose | Pressure boundary |
| Orifice | Flow control<br>Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Separator | Pressure boundary |
| Sight glass | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3.10 Standby Diesel Generator

System Description

The purpose of the standby diesel generator (SDG) system (system codes 309, EGA/EGE/EGF/EGO/EGS/EGT/SYD) is to provide emergency power to essential auxiliaries for safe shutdown in the event of a loss of offsite power (LOP) or LOP coincident with a LOCA. Two SDGs are permanently assigned to two of the three electrical system 4.16 kV busses (Division I and II). The third bus is supplied by the HPCS diesel generator (Division III) (Section 2.3.3.11).

In the event of a loss of preferred (offsite) power, the SDG system supplies power to the Division I and II safety-related equipment required for shutting down the reactor safely, maintaining a safe shutdown condition, and operating all auxiliaries required to mitigate the consequences of an accident.

During normal plant operating conditions, the standby diesel generators are operable in a standby readiness status. During the standby mode, power is required from the normal site power to operate the jacket water heater, jacket water circulation pump, lube oil heater, and lube oil keep-warm circulation pump.

The SDG system consists of two diesel engines, engine control system, generators, exciter/voltage regulator system, supporting auxiliary systems, protection devices, instrumentation, and power output up to but not including the diesel generator output breaker.

The following diesel generator auxiliary systems support the operation of the SDG system.

- Fuel oil transfer and engine fuel oil system
- Engine lubrication oil system
- Engine jacket water cooling system
- Starting air system
- Combustion air intake and exhaust system

*Fuel Oil Transfer and Engine Fuel Oil System*

The fuel oil transfer and engine fuel oil system is reviewed in Section 2.3.3.17, Fuel Oil.

*Engine Lubrication System*

The SDG engine lubrication system provides essential lubrication to lubricate and cool the engine's internal moving components (and turbocharger) during engine operation. Upon the start of the diesel generator, the system circulates lubricating oil to all moving parts of the engine and rejects the heat picked up by the lube oil to the cooling water system. The system also circulates heated oil through the engine for prelubrication during engine standby conditions. The system includes lube oil sump tanks, heaters, keep-warm pumps, engine-mounted pumps, lube oil coolers, filters, strainers, piping, valves, and instrumentation and controls.

Each standby diesel engine is provided with two lube oil pumps. One pump is engine-driven, and a second pump is AC motor-driven. During emergency operation, the engine-driven pump provides full oil flow at full engine RPM. The AC motor-driven pump provides keep-warm prelubrication flow whenever the diesel engine is not running.

*Cooling Water System*

The SDG cooling water system provides treated cooling water to the standby diesel generators to remove heat generated by the engine and the turbocharger during operation. The system also circulates heated water through the engine during standby conditions. The system includes jacket water pumps, jacket water coolers, jacket water keep-warm pumps, jacket water heaters (immersion heaters), governor lube oil coolers, intercoolers, piping, valves, and instrumentation and controls. The system is a closed system with an expansion tank (i.e., jacket water stand pipe).

Upon the start of the diesel generator, the system provides cooling water to the diesel engine, lube oil heat exchanger, and turbocharger aftercoolers, and rejects heat to the standby service water system. The cooling water system provides a sufficient heat sink to permit standby diesel engines to continuously operate at full load. The electric immersion heater is thermostatically controlled to maintain the engine jacket cooling water during periods when the diesel is not running using forced circulation of the cooling water.

*Starting Air System*

The SDG starting air system provides compressed air at the proper pressure for startup of the SDGs for emergency and test purposes. The system also provides a supply of air to the engine control system. The system includes starting air compressors, starting air aftercoolers, starting air dryers, air receivers, piping, valves, and instrumentation and controls. An independent diesel generator starting system is provided for each standby diesel generator. A redundant starting system train is provided for each diesel generator to ensure high system reliability. Each redundant train is capable of providing the standby diesel generator with eight starts from two air receivers without recharging the associated air receivers.

*Combustion Air Intake and Exhaust System*

The SDG combustion air intake and exhaust system supplies clean combustion air to each diesel engine and exhausts the products of combustion from the diesel engine to the atmosphere. The system includes intake air filters, intake air silencers, turbocharger aftercooler, exhaust silencers, piping, and expansion joints.

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

- Supply power to the Division I and II safety-related equipment required for shutting down the reactor safely, maintaining a safe shutdown condition, and operating all auxiliaries required to mitigate the consequences of an accident.

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

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

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

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

<u>USAR References</u>

Section 8.3.1.1.3.6.1
Section 9.5.5
Section 9.5.6
Section 9.5.7
Section 9.5.8

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

Components of the standby diesel generator fuel oil system are reviewed in Section 2.3.3.17, Fuel Oil. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining SDG system components are reviewed as listed below.

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

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

License Renewal Drawings

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

LRA-PID-08-09B

LRA-PID-08-09C

LRA-PID-09-10B

LRA-PID-22-07A

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

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Expansion joint | Pressure boundary |
| Filter housing | Pressure boundary |
| Heat exchanger (channel head) | Pressure boundary |
| Heat exchanger (fins) | Heat transfer |
| Heat exchanger (housing) | Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Heat exchanger (tubes) | Heat transfer<br>Pressure boundary |
| Heat exchanger (tubesheet) | Pressure boundary |
| Heater housing | Pressure boundary |
| Orifice | Flow control<br>Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Sight glass | Pressure boundary |
| Silencer | Pressure boundary |
| Strainer | Filtration |
| Strainer housing | Pressure boundary |
| Tank | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Turbocharger | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3.11 HPCS Diesel Generator

System Description

The purpose of the HPCS diesel generator (DG) system (system codes 309/203, EGA/EGE/EGF/EGO/EGS/EGT/SYD) is to restore power quickly to the HPCS bus in the event offsite power is unavailable and to provide all required power for the startup and operation of the HPCS system supply power. The HPCS DG starts automatically on a LOCA signal from the plant protection system or undervoltage on the HPCS 4.16-kV bus and will be automatically connected to the HPCS bus when the plant preferred AC power supply is not available.

During normal plant operating conditions, the HPCS DG is maintained in a standby readiness status. During the standby mode, power is maintained from the normal site power to operate the jacket water immersion heater, lube oil circulating and turbo soak-back pumps, and the system battery charger.

In the event of a loss of offsite power, the HPCS DG system supplies power for the startup and operation of the HPCS system, one standby service water pump, diesel ventilation fans, and miscellaneous auxiliaries.

The following auxiliary systems support operation of the HPCS DG system:

- Fuel oil transfer and engine fuel oil system
- Engine lubrication oil system
- Engine jacket water cooling system
- Starting air system
- Combustion air intake and exhaust system

*Fuel Oil Transfer and Engine Fuel Oil System*

The fuel oil transfer and engine fuel oil system is reviewed in Section 2.3.3.17, Fuel Oil.

*Engine Lubrication System*

The engine lubrication system provides essential lubrication to the engine. Upon the start of the diesel generator, the lubrication system circulates lubricating oil to all moving parts of the engine and rejects the heat picked up by the lube oil to the cooling water system.

The HPCS diesel lubrication system consists of four different lubricating systems: main (pressure) lubricating oil, piston cooling, scavenging, and circulating and soak-back. The circulating and soak-back pumps operate continuously to ensure lubrication of the turbocharger bearings prior to engine start, removal of residual heat from the turbocharger after engine shutdown, and circulation of warm oil to keep the engine ready to start. When the engine is running, the engine-driven main oil and piston cooling pumps supply filtered, cooled oil to most of the engine moving parts and the piston crown and rings, respectively. The engine-driven scavenging pump circulates oil from the sump through the filter and cooler for use by the pressure and piston cooling pumps. For the circulating and soak-back functions, the system includes AC motor-driven pumps and DC (standby) motor-driven pumps. The system also includes a lube oil heat exchanger, filters, strainers, piping, and valves.

The engine-mounted piping and components, from the engine block to the engine interface, are considered part of the engine assembly and are qualified to Seismic Category I requirements as part of the diesel engine package. The lube oil sump for the HPCS diesel is integral with the engine, and lube oil is warmed by heated jacket water in the lube oil heat exchanger during standby. The main lube oil pump and the piston cooling pumps share a common casing.

*Cooling Water System*

The HPCS diesel generator cooling water system provides cooling water to the HPCS diesel generator. The system also circulates heated water through the engine during standby conditions using natural circulation. The system includes two engine-driven water pumps, jacket water cooler, jacket water immersion heater, expansion tank, piping, valves, instrumentation and controls. The system is a closed loop system.

Upon the start of the diesel generator, the system provides cooling water to the diesel engine, lube oil heat exchanger, and turbocharger aftercoolers, and rejects heat to the standby service water (SSW) system. The system provides a sufficient heat sink to permit the engine to start and operate until SSW flow is established (within two minutes) through the jacket water cooler. The electric immersion heater is thermostatically controlled to maintain the engine jacket cooling water during periods when the diesel is not running using natural circulation of the cooling water.

The engine-mounted piping and components, from the engine block to the engine interface, are considered part of the engine assembly.

*Starting Air System*

An independent diesel generator starting system is provided for the HPCS diesel generator consisting of two redundant trains of air start equipment. Each redundant train is equipped with an air receiver capable of providing the diesel with five starts without recharging. The system includes starting air compressors, starting air aftercoolers, starting air membrane air dryers with filters, air receivers, starting air solenoid valves, starter lubricators, starting air motors, and system piping and valves.

The engine air starting system contains two complete sets of starting components, either of which is capable of starting the engine. Both compressors are capable of automatic start and stop and are controlled by pressure switches to maintain required pressure in the air receivers. The two air starting systems are redundant, independent, and arranged so that failure to start in one system will not jeopardize starting of the diesel generator by the other system.

*Combustion Air Intake and Exhaust System*

The diesel combustion air intake and exhaust system supplies clean combustion air to the diesel engine and exhausts the products of combustion from the diesel engine to the atmosphere. The system includes an intake air filter, turbocharger aftercooler, an exhaust silencer, piping, and expansion joints.

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

- In the event of a loss of offsite power, supply power for the startup and operation of the HPCS system and supporting auxiliaries.

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

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

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

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

USAR References

| | |
|---|---|
| Section 8.3.1.1.3.6.2 | Section 9.5.7 |
| Section 9.5.5 | Section 9.5.8 |
| Section 9.5.6 | |

Components Subject to Aging Management Review

Components of the HPCS diesel generator fuel oil system are reviewed in Section 2.3.3.17, Fuel Oil. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining HPCS DG system components are reviewed as listed below.

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

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

License Renewal Drawings

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

LRA-PID-08-09D

LRA-PID-09-10B

LRA-PID-22-07A

**Table 2.3.3-11**
**HPCS Diesel Generator System**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Expansion joint | Pressure boundary |
| Filter housing | Pressure boundary |
| Heat exchanger (channel head) | Pressure boundary |
| Heat exchanger (fins) | Heat transfer |
| Heat exchanger (housing) | Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Heat exchanger (tubes) | Heat transfer<br>Pressure boundary |
| Heat exchanger (tubesheet) | Pressure boundary |
| Heater housing | Pressure boundary |
| Orifice | Flow control<br>Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Sight glass | Pressure boundary |
| Silencer | Pressure boundary |
| Strainer | Filtration |
| Strainer housing | Pressure boundary |
| Tank | Pressure boundary |
| Tubing | Pressure boundary |
| Turbocharger | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3.12 Control Building HVAC

System Description

The review of the control building HVAC system includes the radiation monitoring system, which performs an intended function that supports the control building HVAC.

*Control Building HVAC*

The purpose of the control building HVAC system (system codes 402, HVC) is to provide cooling, heating, ventilation, pressurization, and smoke removal for several areas within the control building. The control building HVAC system is completely independent of all other plant heating, ventilating, and air-conditioning systems.

The control building HVAC system serves the main control room, standby switchgear rooms, battery rooms, HVAC equipment rooms, cable vault, and general areas of the control building. This system operates during normal, shutdown, loss of offsite power, and design basis accident conditions. The system maintains positive pressure above atmospheric pressure to prevent outside air and air from other control building areas from infiltrating into the main control room. The control room HVAC system is designed to reduce the airborne radioactivity in the outside air to the main control room.

The control building HVAC system consists of the following subsystems.

- Main control room air conditioning
- Standby switchgear rooms air conditioning
- Smoke removal
- Chiller equipment room air conditioning

Additionally, an exhaust fan is provided for the elevator equipment room.

The main control room air conditioning subsystem includes redundant full-capacity air handling units. Each control room air-handling unit supplies a mixture of fresh air and recirculated air from control room areas to the air handling units. The supply air to exhaust air ratio is sufficient to maintain a positive pressure above atmospheric pressure which prevents outside air and air from other control building areas from leaking into the main control room. Following a DBA or high outdoor radioactivity, the main control room outside air supply is automatically diverted through one of the emergency charcoal filtration units.

Each control room air-handling unit consists of a filter, chilled water cooling coils, a fan, and electric heating coils. The cooling coils are served by the control building chilled water system (system 410, Section 2.3.3.14). The supply air is distributed throughout the control room area by numerous ducts and manual dampers. This system also provides for the supply air for the kitchen and toilet. The kitchen and toilet are exhausted to atmosphere by separate exhaust fans and exhaust duct systems. The kitchen and toilet exhaust is isolated on LOCA and high outside radioactivity.

Two outside air charcoal filter trains are provided to filter the main control room outside air supply during and after a LOCA. Each charcoal filter train has a capacity of 4000 cfm, 2000 cfm of outside air and 2000 cfm of control room recirculation air. Each charcoal filter unit consists of the following: a demister, electric heating coils, a prefilter, a high efficiency particulate air (HEPA) filter, the charcoal filter bank, and a second HEPA filter.

Each filter assembly has a booster fan (to help provide a driving flow through the bed) and a decay heat removal fan (which starts up automatically after the filter system shuts down). The outside air provides for maintaining the control room pressure envelop.

Remote air intake facilities are provided to accommodate any condition during which the normal intake becomes contaminated. Controls are provided within the main control room so that a change can be made during any event which might introduce contaminants into the room.

The fresh air supply to the main control room from the remote air intake is operable during loss of offsite power and LOCA. The air is filtered and passed through HEPA filters and charcoal adsorbers to prevent contamination of the control room by excessive radioactivity.

Smoke removal from the control room is provided by a separate exhaust system. The smoke removal subsystem consists of an exhaust fan, dedicated ductwork, and a part of the air-conditioning return air ductwork. The subsystem is seismically supported but is not designed to operate during accident conditions.

The standby switchgear room air conditioning subsystem serves the three standby switchgear rooms (1A, B, C), the three battery rooms (1A, B, C), and the cable vaults and chases. The standby switchgear room air conditioning subsystem is a redundant system. During normal plant operation, fresh air is provided from the local or remote outside air intakes, and air is recirculated from the switchgear and cable areas. The air is supplied to various areas through ductwork and dampers. Each switchgear air handling unit has a filter, electric heating coils, chilled water cooling coils, and a supply fan. The cooling coils are supplied with chilled water from the control building chilled water system. A return air fan is also associated with each unit. The system also has a smoke exhaust fan.

The battery rooms are supplied air from the standby switchgear air conditioning unit. Each battery room is provided with redundant full-capacity exhaust fans. The battery room air is not recirculated but is exhausted to the outside by one of two redundant fans from each room to the outside. The exhaust system maintains the hydrogen concentration level in the battery rooms well below the explosive limits.

The chiller equipment room air conditioning subsystem consists of an outside air supply, room exhaust, and redundant safety-related full-capacity air-conditioning unit. Redundant full-capacity air-conditioning units maintain chiller equipment room at or below room design temperatures. Each air conditioning unit consists of a filter, cooling coils and a fan. The cooling coil is supplied with chilled water from the control building chilled water system. The chiller equipment room is provided with outside ventilation air provided by a supply fan. A steady exhaust flow is maintained by the exhaust fan. The exhaust fan is also used for exhausting smoke from the room. The normal exhaust fans are not designed to operate after loss of off-site power.

During normal plant operation the elevator equipment room is ventilated with approximately 800 cfm of outside air. The air is drawn in through an adjustable louver and is exhausted through a fan to the outside.

Standby service water is available to the air handling unit cooling coils to provide cooling sufficient to maintain main control room habitability in the event all chillers and/or all circulation pumps fail.

The control building HVAC system is credited for operation during a post-fire safe shutdown in the Appendix R analysis.

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

- Provide cooling, heating, ventilation, and pressurization for the main control room, standby switchgear rooms, battery rooms, HVAC equipment rooms, cable vault, and general areas of the control building.

The control building HVAC system has no intended functions for 10 CFR 54.4(a)(2).

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

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

*Radiation Monitoring*

The purpose of the radiation monitoring system (system codes 511, RMS, D17) is to monitor and control radioactivity in process and effluent streams and to activate appropriate alarms and controls.

The following radiation monitors are listed in USAR Table 3.2-1 as Safety Class 2; however, not all of these perform a safety function in accordance with 10 CFR 54.4(a)(1).

- Main steam line radiation monitors

- Main plant exhaust
- Fuel building exhaust
- Annulus pressure control system (listed as "Reactor building annulus ventilation")
- Main control room air intakes
- Containment atmosphere
- Drywell atmosphere
- RHR heat exchanger service water
- Containment purge isolation
- Containment post-accident area monitor and drywell post-accident area monitor

The main steam line monitors consist of detectors that are suspended from the ceiling of the steam tunnel. While these area monitors are within the scope of license renewal, they do not have a mechanical license renewal intended function and are therefore not subject to aging management review as mechanical components. The containment and drywell post-accident area monitors do not perform a function meeting the criteria of 10 CFR 54.4(a)(1).

Certain radiation monitors do not perform a safety function meeting the criteria of 10 CFR 54.4(a)(1). The main objective of these radiation monitors is to provide operating personnel with measurement of the content of radioactive material in potentially radioactive effluents and significantly contributing process streams. Some have upgraded capabilities in order to be available following a LOCA. Included in this group of radiation monitors are the main plant exhaust monitors, containment and drywell atmosphere monitoring, RHR heat exchanger service water monitors, and containment purge monitors. The RHR heat exchanger service water monitor mechanical components have an intended function to support the service water system pressure boundary.

Radiation monitors are provided in the fuel building exhaust duct to continuously monitor the radiation level of the discharged air. During normal operation, the fuel building is exhausted through normal exhaust system. However, in the event of a high radiation alarm in the exhaust air, the system is automatically lined up to the charcoal filtration system. With the implementation of Amendment 132, a full-scope implementation of the alternative source term pursuant to 10 CFR 50.67, the charcoal filtration system is no longer credited for mitigation of a release during a fuel handling accident (see Section 2.3.3.13, Miscellaneous HVAC for further description of the fuel building ventilation system). Therefore, the fuel building exhaust monitors do not perform an intended function for license renewal.

The annulus pressure control system maintains the annulus between containment and the shield wall at negative pressure. Radiation levels are monitored by two radiation monitors located in the annulus airstream. On a high radiation signal, the annulus air and air from the shielded compartments in the auxiliary building are automatically diverted through the standby gas treatment system (SGTS) filter train. With the implementation of Amendment 132, the automatic actuation of the SGTS is no longer credited for mitigation of a release during a LOCA as the analysis assumes a manual start for SGTS at 30 minutes into the event. Therefore, the annulus ventilation radiation monitor does not perform an intended function for license renewal. Mechanical components of the radiation monitors are conservatively considered to perform a pressure boundary function in support of the SGTS. This intended function is reviewed in Section 2.3.3.13, Miscellaneous HVAC.

Safety-related radiation monitors in the main control room air intakes serve to protect main control room personnel throughout the course of an accident. Redundant off-line gas monitors are provided at main control room air intakes (local and remote). Radiation monitors in the local outdoor air intake duct detect high radiation in the outdoor air supply. A high radiation signal alarm in the main control room automatically diverts the outdoor air to charcoal filtration units, shuts down and isolates the utility exhaust fan, and starts the emergency charcoal filtration unit trains. Redundant radiation monitors are also provided in the remote air intake duct. The use of remote air intake is by operator action. The main control room ventilation intake monitors enable the operator to choose the least contaminated air intake throughout the course of an accident and provide an indication of airborne radiation levels present in the main control room intake.

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

- Monitor and initiate appropriate manual or automatic protective action to protect main control room personnel throughout the course of an accident.
- Support the pressure boundary of safety-related systems.

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

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

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

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

USAR References

| *Control Building HVAC* | *Radiation Monitoring* | |
|---|---|---|
| Section 6.4 | Section 1.2.2.10 | Section 12.3.3.3.1 |
| Section 9.4.1 | Section 6.2.3.2.1 | Section 12.3.4 |
| Section 9A.3.7.2 | Section 7.6.1.4 | Table 3.2-1 |
| | Section 11.5 | |

Components Subject to Aging Management Review

Control room HVAC Components associated with compressed air are reviewed in Section 2.3.3.4, Compressed Air. Components of the radiation monitoring system are reviewed with the system being monitored: Section 2.3.2.7, Containment Penetrations; Section 2.3.3.3, Service Water; and Section 2.3.3.13, Miscellaneous HVAC. Nonsafety-related components of the radiation monitoring system whose failure could prevent satisfactory accomplishment of safety functions not reviewed in other reports are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining control building HVAC system components, including the associated radiation monitoring system components, are reviewed as listed below.

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

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

License Renewal Drawings

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

| | |
|---|---|
| LRA-PID-22-09A | LRA-PID-22-14H |
| LRA-PID-22-09B | LRA-PID-22-14J |
| LRA-PID-22-09C | LRA-PID-37-01C-22 |

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

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Damper housing | Pressure boundary |
| Demister | Filtration |
| Demister housing | Pressure boundary |
| Ducting | Pressure boundary |
| Expansion joint | Pressure boundary |
| Fan housing | Pressure boundary |
| Filter housing | Pressure boundary |
| Flex connection | Pressure boundary |
| Flex hose | Pressure boundary |
| Heat exchanger (fins) | Heat transfer |
| Heat exchanger (housing) | Pressure boundary |
| Heat exchanger (tubes) | Heat transfer<br>Pressure boundary |
| Heater housing | Pressure boundary |
| Manifold | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Sight glass | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3.13 Miscellaneous HVAC

System Description

The miscellaneous HVAC systems are divided into separate system codes and are therefore discussed in separate subsections. The following HVAC systems are included in this review.

- HVAC – Containment Cooling
- HVAC – Diesel Generator
- HVAC – Turbine Building
- HVAC – Auxiliary Building
- HVAC – Yard Structures

The HVAC – Fuel Building has no intended functions for license renewal; however, because of its original design, its evaluation is also included in this review.

*HVAC – Containment Cooling*

As described in USAR Section 9.4.6, the containment cooling HVAC (system codes 403, HVR) is part of the reactor plant ventilation system. The purpose of reactor plant ventilation is to control building air temperature, humidity, and movement of potential airborne radioactivity, and to maintain a negative pressure in the annulus during all modes of plant operation. The ventilation system provides an environment which ensures the operability of the equipment and safety of plant personnel during all modes of plant operation.

System 403 includes the following systems in reactor plant ventilation:

- Containment Ventilation System
- Annulus Pressure Control System
- Annulus Mixing System (disabled)
- Containment and Drywell Purge System
- Containment Heating System

The drywell ventilation system included as part of the reactor plant ventilation in the USAR description is a separate system code (404) and has no intended functions for license renewal.

*Containment Ventilation System*

The containment ventilation system is an air recirculation cooling system consisting of three 50-percent capacity unit coolers, ductwork, dampers, and controls. Two unit coolers are safety-related; the third is not. During normal plant operation and loss of offsite power, two coolers operate (with the third on standby) to maintain design ambient conditions and to remove heat generated within the containment. Following a LOCA, only one unit cooler is required to operate (with the second on standby) to assist the suppression pool cooling mode (SPCM) of the RHR system.

Each containment unit cooler consists of a fan/motor assembly and cooling coils. Each unit cooler is designed to remove the heat generated within the containment by recirculating the air over the cooling coils, which are supplied with chilled water during normal plant operation and refueling operation. Air is discharged into a common duct, from which a distribution ductwork system distributes the air throughout the reactor containment. The supply air is directly ducted to the shielded compartments within the containment.

The containment unit coolers are automatically initiated on high drywell-to-containment differential pressure with an interlock to delay initiation until 10 minutes after the high drywell pressure signal. Automatic initiation is provided to protect the containment in the event of suppression pool steam bypass leakage. The containment unit coolers are not required to mitigate the effects of a LOCA except in the case of steam bypass. During loss of offsite power and accident conditions, the cooling water is supplied by the standby service water (SSW) system.

The containment cooling HVAC system also includes four nonsafety-related, nonducted recirculation fans located above the polar crane. Their function is to dissipate gases and heat which collect in the volume above the polar crane by providing continued movement of this air.

*Annulus Pressure Control System*

The annulus pressure control system (APCS) maintains the annulus (annular space between the shield building and the primary containment) at negative pressure during normal operation. The APCS consists of two 100-percent capacity exhaust fans with associated ductwork, dampers, and controls. The exhaust fans, one operating and one on standby, exhaust air from the annulus to the plant exhaust duct.

The suction of the two exhaust fans is connected to a common duct which penetrates the shield building to draw the annulus atmosphere. Inside the annulus this duct is connected to a ring duct that is provided with return air openings. Upon receipt of a LOCA or high radiation signal from a radiation monitor, or loss of air flow in the suction of APCS fans, the annulus pressure control system is isolated, and the SGTS is started to maintain negative pressure in the annulus. Redundant radiation monitors are provided in the common duct which penetrates the shield building, and the air is continuously monitored for radioactivity prior to discharge to atmosphere. Upon detection of high airborne radioactivity concentration, the annulus exhaust is diverted to the SGTS automatically. With the implementation of Amendment 132, the automatic actuation of the SGTS is no longer credited for mitigation of a release during a LOCA as the analysis assumes a manual start for SGTS at 30 minutes into the event. Therefore, the automatic APCS isolation does not perform an intended function for license renewal. Mechanical components of the radiation monitors are conservatively considered to perform a pressure boundary function in support of the SGTS and are included in this review.

The APCS does not operate during loss of offsite power. The exhaust fans for the APCS are not safety-related, but the ductwork in the annulus space with isolation dampers is designed to Seismic Category I requirements.

*Annulus Mixing System*

The annulus mixing system fans and associated alarm functions are secured to disable the annulus mixing system. However, the annulus mixing fan housings and ducting support the SGTS pressure boundary.

*Containment and Drywell Purge System*

The containment and drywell purge system is a nonsafety-related system which operates during normal plant operation, shutdown, and refueling outages to reduce airborne radionuclide concentrations.

The containment and drywell purge system consists of an intake structure, air filter, purge supply fans, supply and exhaust distribution ductwork, charcoal filtration unit, a system exhaust fan, isolation valves, and instrumentation and controls. During normal operations, outdoor filtered air is distributed to the general areas of the containment and, during shutdown or refueling, of the drywell. The purge air is exhausted through the containment continuous purge system, which includes a charcoal filtration unit composed of a moisture separator, heating coil, prefilters, HEPA filters, charcoal adsorber bank, and a second HEPA filter bank.

The system has two supply fans with different capacities. The normal system operating fan functions with the charcoal filtration unit. A second manually actuated system with a larger capacity is provided to operate in the event of a mechanical failure of the normal operating system. In this mode, the filtered outside air is distributed into the containment and/or drywell and exhausted through the SGTS to the atmosphere.

Following a LOCA, the containment and drywell purge system is not in operation, and all containment isolation valves are closed. The system may be manually actuated to purge the containment or drywell volumes.

The containment and drywell purge system is classified as nonsafety-related with the exception of the containment and drywell isolation valves. Although the containment and drywell purge system exhaust fan can be manually started for smoke removal in the event of fire in the containment building, the fan is not credited in the Appendix R analysis.

*Containment Heating System*

The nonsafety-related containment heating system consists of an electric heating coil provided in the containment drywell purge supply line to heat the containment/drywell area during a shutdown condition to maintain these areas at their minimum design conditions.

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

- Following a LOCA, maintain the temperature inside the containment building below the post-LOCA maximum long-term bulk air temperature, and reduce the pressure inside the containment by cooling and dehumidifying the containment atmosphere.
- Support SGTS pressure boundary.
- Support containment pressure boundary.

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

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

The containment cooling HVAC system has no intended function for 10 CFR 54.4(a)(3).

*HVAC – Diesel Generator*

The purpose of the diesel generator building ventilation system (system codes 405, HVP) is to provide heating, ventilation, and smoke removal for several areas within the diesel generator building. The diesel generator building houses the Division I and II standby diesel generators and the Division III HPCS diesel generator.

The diesel building ventilation system provides suitable environmental conditions in the diesel generator rooms and diesel generator control room areas. The system operates during diesel generator operation, loss of offsite power, and design basis accident conditions. The ventilation system also maintains suitable environmental conditions during normal plant operation when the diesel generators are not operating. The diesel generator building ventilation system is completely independent of all other plant heating, ventilating, and air-conditioning systems.

Three independent subsystems, one per diesel generator room, are provided for the emergency diesel generator rooms to maintain an indoor design temperature. The diesel generator building ventilation system consists of exhaust fans (normal and standby), control room supply fans, room unit heaters, ductwork, dampers, filters, and instrumentation and controls.

System code 405 also includes components in the combustion air intake and exhaust for the Division I, II and III diesel generators. The diesel generator combustion air intake and exhaust, which supplies clean combustion air to each diesel engine and exhausts the products of combustion from the diesel engine to the atmosphere, consists of intake air filters and silencers and exhaust silencers with associated piping and expansion joints. These components are reviewed with their respective diesel generators (Section 2.3.3.10 and Section 2.3.3.11).

The diesel generator building ventilation system has the following intended function for 10 CFR 54.4(a)(1).

- Support operation of the standby and HPCS Division I, II, and III diesel generators.

The diesel generator building ventilation system has no intended functions for 10 CFR 54.4(a)(2).

The diesel generator building ventilation system has the following intended function for 10 CFR 54.4(a)(3).

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

*HVAC – Turbine Building*

The purpose of the turbine building HVAC system (system codes 408, HVT) is to control the maximum building air temperature and circulation of potential airborne radioactive contaminants. This provides an environment which ensures the operability of the equipment, the safety of plant personnel, and the accessibility of the building and shielded compartments. All components of the turbine building ventilation system are nonsafety-related, not seismically qualified, and not required to operate following a design basis accident.

The turbine building ventilation system consists of the following subsystems:

- Main supply system
- Unit coolers system
- Off-gas area/condensate demineralizer area ventilation system
- Exhaust air system
- Charcoal filtration system
- Sample room air conditioning system

- Heating system
- Steam tunnel air conditioning

The turbine building HVAC system has augmented quality (QP) dampers associated with the turbine building lube oil purifier and storage rooms and with a personnel passageway at el. 123 ft. Although not credited in the Appendix R analysis, these dampers are credited for Appendix A to Branch Technical Position (BTP) ASB 9.5-1 (see USAR Appendix 9A). Therefore, these dampers perform an intended function in accordance with 10 CFR 54.4(a)(3). Also, turbine building HVAC components (sample room condensers) support the pressure boundary of the normal service water system, which is credited in the event of a fire in Fire Area PT-1.

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

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

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

*HVAC – Auxiliary Building*

The purpose of the auxiliary building ventilation system (system codes 409, HVR) is to control the building air temperature and the movement of potential airborne radioactivity contaminants and to maintain a negative pressure within the building. The system provides an environment which ensures the operability of the equipment and the safety of plant personnel during all modes of plant operation, including a DBA, when building ventilation is supported by system 409 unit coolers, isolation dampers, and ducting.

The auxiliary building ventilation system consists of a supply air system, an exhaust air system, and unit coolers provided for removal of heat dissipated from equipment in various auxiliary building areas.

The supply air system consists of two 100-percent capacity fans, a prefilter, high-efficiency filters, an electric duct heater, dampers, and ducting. The supply air flows to areas of progressively higher potential contamination and is exhausted by the exhaust air system. During normal operation, the supply air system operates continuously, providing ventilation air. The supply air system is not in operation during a DBA or when a high radiation level exists within the building. All components of the supply air system are nonsafety-related and not seismically qualified, with the exception of outside air intake and isolation dampers, which are designed to Seismic Category I and Safety Class 3 requirements.

The exhaust system consists of two 100-percent capacity exhaust fans, dampers, and ducting. Ventilation air is induced into cubicles from the general building areas, thus keeping cubicles at a slightly negative pressure and ensuring flow of air from areas of less to progressively greater potential radioactive contamination. The exhaust air to the plant exhaust duct is continuously monitored for radioactivity in the main control room by a radiation monitoring system located in the exhaust duct. In the event that radioactivity approaches a predetermined level, main control room operators can manually shut down the supply fans and reroute the exhaust air through the safety-related SGTS. The HVR system does not provide exhaust filtration.

During the DBA, the supply and exhaust air systems are shut down, and the exhaust air is diverted to the SGTS. The auxiliary building normal exhaust path is provided with redundant, air operated, fail-closed isolation dampers to preclude the possibility of airborne radioactivity bypassing the boundary regions of the SGTS. The auxiliary building ventilation system ducting and isolation dampers in conjunction with the SGTS maintain a negative pressure within the building during DBA conditions, which supports secondary containment.

Unit coolers are provided for removal of heat dissipated from safety-related and nonsafety-related equipment in the auxiliary building. Each unit cooler consists of a housing, throw-away type filters, cooling coils, fan, and ducting. With the exception of one unit cooler that is not required to operate following a postulated DBA or loss of offsite power, the unit coolers are classified as Safety Class 3 and Seismic Category I. During normal operations, cooling water for the safety-related cooling coils is provided by the normal service water system. During loss of offsite power and DBA conditions, normal service water is replaced by standby service water.

The auxiliary building exhaust fans may be used for smoke removal in the event of fire in the auxiliary building during normal plant operation; however, this function is not credited in the Appendix R safe shutdown analysis. Auxiliary building ventilation system unit coolers for safety-related equipment are credited for safe shutdown for Appendix R.

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

- In conjunction with the SGTS, maintain a negative pressure within the auxiliary building during a DBA.
- Support the operability of ECCS equipment by removing heat dissipated from equipment.
- Support containment pressure boundary.

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

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

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

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

*HVAC – Yard Structures*

The purpose of the yard structures HVAC system (system codes 414, HVO/HVY) is to provide suitable environmental conditions for efficient equipment operation and/or personnel comfort. With the exception of the SSW pump house ventilation system and certain fire dampers, the yard structures HVAC systems are designed to nonsafety and nonseismic requirements and are not required for safe shutdown of the plant.

Certain fire dampers are classified as safety-related; however, they do not support a safety function in accordance with 10 CFR 54.4(a)(1). They are subject to aging management review as they support an intended function in accordance with 10 CFR 54.4(a)(3) for fire protection.

The yard structures HVAC includes the SSW pump house ventilation system, a safety-related system that provides ventilation for the SSW cooling tower pump house pump rooms and switchgear rooms. The SSW cooling tower pump house pump rooms ventilation subsystem consists of two 100-percent capacity supply fans for each pump room in two trains utilizing separate ducting, dampers, and controls to maintain the temperature. In the event of failure of both fans in one train, the redundant train will function to meet the single failure criterion. Each pump room ventilation system is connected to the emergency bus which serves the pumps that are being cooled. In this manner, the associated fan is operational when its respective pump is operating, and operation is assured in the event of loss of offsite power and LOCA.

The SSW cooling tower pump house switchgear rooms ventilation subsystem consists of two 100-percent capacity supply fans for each switchgear room in two trains utilizing separate ducting, dampers, and controls to maintain the temperature. In the event of failure of both fans in one train, the redundant train to meet the single failure criterion. Each switchgear room ventilation system is connected to the emergency bus which serves the switchgear that is being cooled. In this manner the associated fan is operational when its respective switchgear is operating, and operation is assured in the event of loss of offsite power and LOCA.

The ventilation air is supplied and exhausted through missile and tornado protected openings. Each room (pump house pump rooms and switchgear rooms) is supplied with an electric unit heater in order to maintain the minimum design temperature of 40°F.

The SSW cooling tower ventilation system includes a remote air intake. The SSW cooling tower remote air intake room ventilation system consists of two 100-percent redundant divisional air supply fans and duct heaters. A controlled environment of temperature and humidity is maintained in the room for the two divisions of radiation monitoring equipment located there.

The normal service water system is credited for safe shutdown in the event of a fire in Fire Area PT-1: E, F, and G Tunnels. Ventilation that supports use of normal service water is also credited for this fire event. Components that interface with normal service water support the service water pressure boundary (suppression pool cleanup equipment room cooler).

Certain electrical and piping tunnel ventilation systems are provided with Seismic Category I supports to maintain the structural integrity of these systems. The supports are reviewed as a structural commodity with the bulk commodities review.

The remainder of the miscellaneous building HVAC systems do not perform an intended function for license renewal with the exception of fire dampers in the following systems:

- Fire pump house heating and ventilation
- Normal switchgear building HVAC
- Makeup water intake structure and switchgear house heating and ventilation
- Electrical and piping tunnels ventilation
- Motor generator building heating and ventilation
- Demineralized water pump house heating and ventilation
- Circulating water pump house and switchgear room heating and ventilation
- Cooling tower switchgear house heating and ventilation
- Clarifier area switchgear house heating and ventilation
- Hypochlorite area switchgear house heating and ventilation
- Blowdown pit heating and ventilation

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

- Provide HVAC services for the SSW cooling tower pump house pump rooms and switchgear rooms.

The yard structures HVAC system has no intended functions for 10 CFR 54.4(a)(2).

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

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

*HVAC – Fuel Building*

The purpose of the fuel building HVAC system (system codes 406, HVF) is to control the building air temperature and the movement of potential airborne radioactivity contaminants within the building. The fuel building ventilation system consists of a supply air system, an exhaust air system, unit coolers, and the charcoal filtration system.

The supply air system provides the building with a filtered source of heated or cooled outside air. The supply air system consists of an air handling unit with an outside air intake louver, inlet air filter, electric heating coil, chilled water cooling coil, two 100-percent capacity supply fans, supply air ductwork, and discharge air openings. Air is supplied to the operating floor, fuel cask area, spent fuel pool area, and to various cubicles within the building before being exhausted by the exhaust air system. The supply air system is not designed to meet safety class or Seismic Category I requirements since it is not required to operate following a postulated DBA.

The exhaust air system is designed to exhaust the ventilation air supplied in the building to the atmosphere through exhaust ventilation ducts located near the spent fuel pool, in general areas, and in various cubicles. During normal operation, exhaust air from all areas is exhausted directly to atmosphere by these exhaust fans. In the event of high airborne radioactivity in the building, and during fuel handling operation, normal exhaust is secured, and exhaust air is routed through the charcoal filtration units, which are provided with separate exhaust fans.

The normal exhaust fans are not designed to meet safety class or Seismic Category I requirements and are not required to operate following a postulated DBA or fuel handling accident. Although the exhaust fans may be used for smoke removal in the event of fire in the fuel building during normal plant operation, the spent fuel pool cooling function is not required for an Appendix R safe shutdown scenario, and the HVF system is not credited in the Appendix R analysis since it is not required for equipment operability.

Individual unit coolers are provided for removal of heat dissipated from equipment for various areas in the fuel building. The unit coolers are not designed to meet safety class or Seismic Category I requirements since these are not required to operate following a postulated DBA.

The charcoal filtration system consists of two 100-percent capacity filtration units with their individual centrifugal exhaust fans, ductwork, and dampers. Each filter unit includes a moisture separator, electric heating coil, prefilter, HEPA filter, charcoal filter, and a second HEPA filter. Exhaust air is routed from the spent fuel pool and fuel cask areas through the charcoal filter units. Although the charcoal filtration units are available to mitigate the consequences of fuel handling accidents, this filtration function is not credited in the fuel handling accident analysis performed for 10 CFR 50.67. Therefore, the charcoal filtration units have no intended function for license renewal.

The fuel building ventilation system is no longer credited to mitigate the consequences of a DBA. The fuel building was removed from the definition of secondary containment, and the ventilation system is not credited for a fuel handling accident or for safe shutdown following a fire event.

The fuel building HVAC system has no intended functions for 10 CFR 54.4(a)(1), (a)(2) or (a)(3).

USAR References

*HVAC – Containment Cooling (403, HVR)*

Section 6.2.2

Section 9.4.6

*HVAC – Diesel Generator (405, HVP)*

Section 9.4.5.2.2

*HVAC – Fuel Building (406, HVF)*

Section 9.4.2

Section 15.7.4

*HVAC – Turbine Building (408, HVT)*

Section 9.4.4

*HVAC – Auxiliary Building (409, HVR)*

Section 9.4.3

*HVAC – Yard Structures (414, HVO/HVY)*

Section 9.4.5.2.3 (SSW pump house)

Section 9.4.7

Components Subject to Aging Management Review

Components using compressed air (systems 403, 409) are reviewed in Section 2.3.3.4, Compressed Air. Combustion air intake and exhaust components for the Div. I, II and III diesel generators are reviewed in Section 2.3.3.10, Standby Diesel Generator, and Section 2.3.3.11, HPCS Diesel Generator. Turbine building HVAC (system 408), chilled water (system 410), and yard structures HVAC (system 414) components that support the pressure boundary of the normal service water system are reviewed in Section 2.3.3.3, Service Water. Because the turbine building HVAC QP dampers are mounted in walls, the aging management for the damper housings is included in Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures.

Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining miscellaneous HVAC systems components are reviewed as listed below.

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

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

License Renewal Drawings

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

*HVAC – Containment Cooling (403, HVR)*

*Containment Building*

LRA-PID-22-01A

LRA-PID-22-01B

LRA-PID-22-01C

LRA-PID-22-01D

LRA-PID-33-02C

*APCS/SGTS Interface*

LRA-PID-27-15A

*APCS/Radiation Monitoring (RMS)*

LRA-PID-37-01C-17

*Chilled Water Cooling Coils for Containment Unit Coolers*

LRA-PID-22-14D

*HVAC – Yard Structures (414, HVY)*

LRA-PID-22-08A

LRA-PID-22-08B

LRA-PID-22-08C

LRA-PID-22-08D

LRA-PID-22-08E

LRA-PID-22-08F

LRA-PID-22-08G

*HVAC – Diesel Generator (405, HVP)*

LRA-PID-22-07A

*HVAC – Aux Building (409, HVR)*

LRA-PID-22-01E

*Service Water Cooling Coils for Auxiliary Building Cooling Units*

LRA-PID-09-10C

LRA-PID-09-10F

**Table 2.3.3-13**
**Miscellaneous HVAC Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Damper housing | Pressure boundary |
| Ducting | Pressure boundary |
| Fan housing | Pressure boundary |
| Filter housing | Pressure boundary |
| Flex connection | Pressure boundary |
| Flex hose | Pressure boundary |
| Heat exchanger (channel head) | Pressure boundary |
| Heat exchanger (fins) | Heat transfer |
| Heat exchanger (housing) | Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Heat exchanger (tubes) | Heat transfer<br>Pressure boundary |
| Heat exchanger (tubesheet) | Pressure boundary |
| Heater housing | Pressure boundary |
| Manifold | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Screen | Filtration |
| Sight glass | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3.14 Chilled Water

System Description

The purpose of the chilled water system (system codes 410, HVK/HVN) is to remove heat generated by plant equipment and personnel to maintain the required environmental conditions.

The chilled water system consists of two separate chilled water systems: the control building chilled water (HVK) and the ventilation chilled water (HVN).

*Control Building Chilled Water*

The control building chilled water system removes heat generated within the control building. The sources of this heat are personnel and equipment in the main control, standby switchgear, and chiller equipment rooms. The control building chilled water system provides a continuous flow of chilled water to the control building HVAC units during normal, shutdown and DBA conditions to maintain required environmental conditions and control room habitability. The system heat loads are ultimately transferred to the service water system.

The control building chilled water system is a closed-loop, cooling water system with two independent trains. Each train includes two 100-percent capacity chillers, two 100-percent capacity chilled water recirculation pumps, two 100-percent capacity condenser cooling water pumps, one chilled water compression tank, and associated piping, valves, instrumentation and controls. The chillers are centrifugal liquid chillers which include an evaporator, condenser, compressor, compressor motor, oil pump, and machine control center. Cooling water is supplied to the condenser by the normal service water system (with offsite power available) or by the standby service water system (with a loss of offsite power or a loss of normal service water system). In the event both chilled water trains fail, partial cooling can be achieved by using a connection to the standby service water instead of the chilled water.

The system provides chilled water to the cooling coils in the main control room air conditioning units, the standby switchgear room air conditioning units, and the chiller equipment room air conditioning units. The control building chillers are credited for safe shutdown in the Appendix R safe shutdown analysis.

Makeup water for the chilled water system is normally supplied by the plant makeup water system. During accident conditions, the makeup water is supplied by the standby service water system.

Chilled water system components support the pressure boundary of the normal service water system, which is credited in the event of a fire in Fire Area PT-1.

Components classified as safety-related that are associated with the nonsafety-related chiller skid pump-down unit and refrigerant storage tanks do not support a safety function.

*Ventilation Chilled Water*

The purpose of the ventilation chilled water system is to remove heat from designated areas and to provide required cooling for equipment located in these areas. The ventilation chilled water system consists of two independent subsystems. One subsystem, located in the turbine building, serves the turbine building, turbine building sample room, condensate demineralizer off-gas building, the auxiliary building, and the containment. The second subsystem, located in the radwaste building, serves the radwaste building and fuel building.

The turbine building chilled water subsystem has three 50-percent capacity centrifugal liquid chillers, three 50-percent capacity chiller condenser cooling water pumps, two 100-percent capacity chilled water recirculation pumps, and a compression tank. The condenser cooling water is provided from the normal service water system. System piping runs to various unit coolers located throughout the turbine building, auxiliary building, and the containment unit coolers located in the reactor building. During normal plant shutdown, the chilled water from this subsystem can be diverted manually to the drywell unit coolers to provide comfortable working conditions in the drywell.

The radwaste building chilled water subsystem has three 50-percent capacity centrifugal liquid chillers, three 50-percent capacity condenser cooling water pumps, two 100-percent capacity chilled water recirculation pumps serving the radwaste building, two 100-percent capacity chilled water recirculation secondary pumps serving the fuel building, and a compression tank. System piping runs to various unit coolers located in the radwaste and fuel buildings.

The ventilation chilled water system is not required for safe shutdown or post-accident mitigation. The ventilation chilled water system has no safety function with the exception of providing containment and drywell isolation for the containment unit cooler piping. Valves and piping to the containment unit coolers interfacing with the standby service water system are also safety-related.

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

- Provide cooling, heating, ventilation, and pressurization for the main control room, standby switchgear rooms, battery rooms, HVAC equipment rooms, cable vault, and general areas of the control building.
- Support containment pressure boundary.

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

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

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

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

USAR References

Section 9.2.9

Section 9.2.10

Components Subject to Aging Management Review

Components supporting the normal service water system are reviewed in Section 2.3.3.3, Service Water. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining chilled water system components are reviewed as listed below.

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

Table 3.3.2-14 provides the results of the aging management review.

License Renewal Drawings

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

LRA-PID-22-14D

LRA-PID-22-14H

LRA-PID-22-14J

LRA-PID-09-10B

LRA-PID-09-10D

**Table 2.3.3-14**
**Chilled Water System**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Air dryer | Filtration<br>Pressure boundary |
| Bolting | Pressure boundary |
| Compressor housing | Pressure boundary |
| Expansion joint | Pressure boundary |
| Filter housing | Pressure boundary |
| Flex hose | Pressure boundary |
| Flow element | Flow control<br>Pressure boundary |
| Heat exchanger (channel head) | Pressure boundary |
| Heat exchanger (fins) | Heat transfer |
| Heat exchanger (shell) | Pressure boundary |
| Heat exchanger (tubes) | Heat transfer<br>Pressure boundary |
| Heat exchanger (tubesheet) | Pressure boundary |
| Orifice | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Separator | Pressure boundary |
| Sight glass | Pressure boundary |
| Strainer | Filtration |
| Strainer housing | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3.15 Fuel Pool Cooling and Cleanup

System Description

The purpose of the fuel pool cooling and cleanup system (system code 602, SFC) is to provide heat removal for spent fuel, to maintain the spent fuel covered with water during all storage conditions, and to maintain required water purity under normal conditions. The system serves the fuel building pools (spent fuel storage pool, cask pool, and lower transfer pool) and the containment pools (refueling cavity, separator storage pool, dryer storage pool, and upper transfer pool).

The fuel pool cooling and cleanup system consists of two separate subsystems: fuel pool cooling and fuel pool purification. The fuel building spent fuel racks (system 054) employ Boraflex, a fixed neutron absorber or poison material for criticality control with the intended function of providing neutron absorption. Boraflex and the spent fuel pool racks are considered to be components in the fuel pool cooling and cleanup system for purposes of aging management review.

*Fuel Pool Cooling*

Fuel pool cooling removes decay heat produced by stored spent fuel assemblies during all anticipated plant operation, refueling, and accident conditions. The fuel pool cooling subsystem also provides makeup water to the fuel building pools and containment pools, maintains the fuel storage racks submerged in water under all conditions, and circulates and cools containment fuel storage pool water through the RHR system.

Fuel pool cooling consists of two 100-percent capacity pumps, two 100-percent capacity coolers, associated piping and valves, and instrumentation and controls.

Normal pool makeup water is taken from the condensate storage tank. A backup source of makeup water is available from the standby service water system via the reactor plant component cooling water system (RPCCW). The RPCCW provides cooling for the fuel pool cooling heat exchangers, with backup cooling provided by the standby service water system.

With one fuel pool cooling pump in service, the other fuel pool cooling pump can be lined up to take suction from the dryer storage pool and return to the same pool. Once the gates are open to connect the reactor cavity, transfer pool, and dryer storage pool, the water can be returned to the reactor cavity or separator storage pool while still taking suction from the dryer storage pool. In this mode of operation, water would be removed from one end of the containment pools and returned at the other end, giving a better cooling distribution to the pools.

During refueling outages when spent fuel is present in the containment pools, the RHR system can be used for cooling the containment pools if one of the fuel pool cooling pumps is unavailable.

Following refueling operations, after the reactor vessel head and the drywell head have been reinstalled, the second fuel pool cooling pump is used to fill the refueling cavity with water from the condensate storage tank.

*Fuel Pool Purification*

Fuel pool purification filters and demineralizes water in the spent fuel pool and containment pools to maintain water quality, removes suspended and dissolved radionuclides to maintain the radiation level above the fuel building pools and at the fuel building operating floor within the zone limits, drains the reactor refueling cavity and the spent fuel cask pool to either the condenser hotwell or the condensate storage tank, and drains the fuel building pools and containment pools for moderate level adjustments to either the condenser hotwell, the condensate storage tank, or the radwaste system. With the exception of containment isolation components, the purification loop is not required to function under accident conditions.

Fuel pool purification consists of two 50-percent capacity pumps, filters, a mixed-bed demineralizer, a strainer, associated piping and valves, and instrumentation and controls.

Prior to refueling operations, one purification pump and one filter are used to transfer water in the refueling cavity of the containment pool to the radwaste system, condensate storage tank, or condenser hotwell.

During refueling outages, one of the fuel pool purification pumps is normally lined up to take suction from the spent fuel pool with the option of also taking suction from the lower transfer pool or the cask pool. The second fuel pool purification pump is lined up to the dryer storage, upper transfer pool, separator storage pool, or the reactor cavity. A supply line from the condensate storage tank is provided to each pump to fill or add makeup water to a pool.

The fuel pool cooling and cleanup system has the following intended functions for 10 CFR 54.4(a)(1).

- Remove decay heat produced by stored spent fuel assemblies located in the spent fuel pool and the containment pools during anticipated operating, refueling, and accident conditions.
- Provide neutron absorption in the spent fuel pool.
- Provide structural support of fuel assemblies in the spent fuel pool.

- Support containment pressure boundary.

The fuel pool cooling and cleanup system has the following intended function for 10 CFR 54.4(a)(2).

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

The fuel pool cooling and cleanup system has no intended functions for 10 CFR 54.4(a)(3).

USAR References

Section 9.1.3

Components Subject to Aging Management Review

Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining fuel pool cooling and cleanup system components are reviewed as listed below.

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

Table 3.3.2-15 provides the results of the aging management review.

License Renewal Drawings

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

| | | |
|---|---|---|
| LRA-PID-09-01B | LRA-PID-27-07B | LRA-PID-34-02A |
| LRA-PID-27-06A | LRA-PID-32-09R | LRA-PID-34-02B |
| LRA-PID-27-07A | LRA-PID-32-09S | LRA-PID-34-04A |

**Table 2.3.3-15**
**Fuel Pool Cooling and Cleanup System**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Flex hose | Pressure boundary |
| Flow element | Flow control<br>Pressure boundary |
| Heat exchanger (channel head) | Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Heat exchanger (tubes) | Heat transfer<br>Pressure boundary |
| Heat exchanger (tubesheet) | Pressure boundary |
| Neutron absorber | Neutron absorption |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Rack | Support for Criterion (a)(1) equipment |
| Strainer housing | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.3.16 Plant Drains

System Description

The purpose of the floor and equipment drains (system codes 609, DED/DER/DET/DFA/DFD/DFM/DFR/DFT/DFW/DTM/VTP) is to collect and transport various fluids to collection points for processing and disposal.

The equipment drainage systems are for the collection of radioactive, potentially radioactive, and nonradioactive fluids from sources not containing oil, such as pump casings, air conditioning condensate drains, valve stem leakoffs, and relief valves. Fluids are sent to either the condenser or to the radioactive liquid waste system. The equipment drain systems also provide open-ended piping between component drains or relief valves and the floor drain system or equipment drain floor hubs.

The equipment drainage systems are organized on an area basis as follows:

- Radwaste building: DED
- Reactor building and fuel building: DER
- Turbine building: DET/DTM

The equipment drain systems (DED, DER, DET and DTM) consist of equipment drain sumps, equipment drain sump pumps, drain receiver tanks, drywell equipment drain cooler, main steam and moisture separator-reheater (MSR) drains, standby diesel generator drains, piping and valves, and instrumentation and controls. Equipment drains systems include containment isolation valves and components that support the operation of safety-related equipment. The DER system includes loop seals that support the secondary containment pressure boundary and components that support the normal service water pressure boundary credited in the event of a fire in Fire Area PT-1. The DER system also contains vents and drains for the RWCU regenerative heat exchanger that are classified as safety-related Class 3. Although many components in the RWCU system are classified as Safety Class 3, the system performs no safety functions other than to support containment isolation and to isolate itself from the RCPB (using containment isolation valves), and these are the only RWCU system functions that meet the criteria of 10 CFR 54.4(a)(1). Therefore, these Class 3 components in the DER system do not perform an intended function in accordance with 10 CFR 54.4(a)(1) or (a)(3).

The equipment vent system (VTP) provides vents to atmosphere, outside the buildings, for tanks associated with generator hydrogen system or to vent the combustion fumes from the diesel generator crankcase and lube oil tank. The VTP system consists of carbon steel piping between the items being vented and the atmosphere outside the building.

The floor drainage systems are for the collection of radioactive, potentially radioactive, and nonradioactive fluids which reach the floor from sources such as maintenance wash-down water, miscellaneous surface spillage, accumulated fire protection water after actuation of fire protection sprinklers, and equipment drainage from sources other than those terminating in segregated equipment drainage sumps. These sumps may be pumped to the liquid radioactive waste system, returned to the suppression pool, or discharged to the storm and waste water system as appropriate for the fluid.

The floor drainage systems are organized in areas as follows:

- Fuel building floor drain: DFA
- Standby diesel generator floor drain: DFD
- Miscellaneous buildings floor drain: DFM
- Reactor and auxiliary buildings floor drain (including suppression pool pumpback connections): DFR
- Turbine building floor drain: DFT
- Radwaste building floor drain: DFW

These systems consist of sump tanks, sump pumps, piping, valves, floor drain hubs, and instrumentation and controls. The discharge piping from each sump pump contains a check valve to prevent backflow from one sump to another.

The radioactive and potentially radioactive floor drainage systems are not safety-related except for the auxiliary building crescent area sump pumps, sump pump discharge piping containment penetrations, and sump pump discharge piping between redundant check valves at wall penetrations from ECCS cubicles in the auxiliary building. Cubicles for the LPCS, RHR (three cubicles), RCIC, and HPCS in the auxiliary building each contain a sump with duplex pumps, which discharge to a common header located outside the cubicle walls. The cubicles are constructed to be watertight. To prevent the transfer of water to other cubicles, should one cubicle flood, an additional spring-loaded check valve is located on each side of the penetrations where the sump pump discharge piping passes through the cubicle walls. The spring-loaded check valves and the penetration piping between them are Safety Class 3. Each cubicle is also provided with a Safety Class 2 level transmitter, wall mounted near the floor, to detect a rising water condition, which annunciates an alarm and provides level indication in the main control room.

The auxiliary building crescent area sumps have the ability to pump to the suppression pool via the HPCS minimum flow line using the associated sump pumps, referred to as suppression pool pumpback. After a LOCA with subsequent passive failure of an ECCS pump or valve seal, water inventory collected by sumps can be directed back to the suppression pool. A normally closed isolation valve aligns the discharge of these sump pumps to the suppression pool, thus helping to maintain suppression pool inventory for use following a LOCA. This function is performed by components that are seismically qualified and powered from Class 1E sources, but not all the components are safety-related.

Floor drains are available for those areas where fixed water fire suppression systems are installed. The drainage system is designed to prevent the spread of fire through drainage piping. Fire area flooding resulting from an inadvertent actuation of a sprinkler system and an assumed loss of the floor drainage system in one fire area does not cause loss of redundant trains of safety-related equipment. The fire hazards analysis does not credit floor drains in its evaluation of flooding from fire system actuations; therefore, the floor drains are not credited for compliance with the Commission's regulations for 10 CFR 50.48.

Analysis of external flooding in USAR Sections 2.4 and 3.4 does not credit plant floor drains for external flood protection. Analysis of internal flooding as described in USAR Section 3C.4.2 does not credit plant drains; however, drain system components that support suppression pool pumpback perform an intended function for license renewal, as do the ECCS cubicle drain line check valves described above.

The floor and equipment drains system has the following intended functions for 10 CFR 54.4(a)(1).

- Contain flooding in the cubicles for LPCS, RHR, RCIC, and HPCS if one cubicle floods.
- Support operation of safety-related equipment.
- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

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

- Support maintaining suppression pool inventory for use following a LOCA (suppression pool pumpback mode).
- Maintain integrity of nonsafety-related components such that no physical interaction with safety-related components could prevent satisfactory accomplishment of a safety function.

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

- Perform a function (support operation of safety-related equipment, support service water pressure boundary) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

USAR References

| | |
|---|---|
| Table 3.9A-10 | Section 9.3.3 |
| Section 9.2.4 | Section 9.3.7 |

Components Subject to Aging Management Review

Components supporting the reactor coolant pressure boundary are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Drain components that interface with the RCIC system are reviewed in Section 2.3.2.5, Reactor Core Isolation Cooling. Drain components associated with service water components are reviewed in Section 2.3.3.3, Service Water. Drain components associated with the standby diesel generator are reviewed in Section 2.3.3.10, Standby Diesel Generator. Drain components associated with HPCS diesel lube oil are reviewed in Section 2.3.3.11, HPCS Diesel Generator. Drain components associated with fuel pool cooling and cleanup are reviewed in Section 2.3.3.15, Fuel Pool Cooling and Cleanup. Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining plant drains system components are reviewed as listed below.

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

Table 3.3.2-16 provides the results of the aging management review.

License Renewal Drawings

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

| | | |
|---|---|---|
| LRA-PID-32-09A | LRA-PID-32-09G | LRA-PID-32-09L |
| LRA-PID-32-09B | LRA-PID-32-09J | LRA-PID-32-09N |
| LRA-PID-32-09F | LRA-PID-32-09K | LRA-PID-32-09P |

**Table 2.3.3-16**
**Plant Drains System**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Orifice | Flow control<br>Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Strainer | Filtration |
| Valve body | Pressure boundary |

### 2.3.3.17 Fuel Oil

System Description

The review of systems with components containing fuel oil includes the standby diesel generators (SDG) (Section 2.3.3.10) and HPCS diesel generator (DG) (Section 2.3.3.11).

*Standby Diesel Generators, Fuel Oil Transfer and Engine Fuel Oil*

The SDG fuel oil transfer and engine fuel oil system (system codes 309, EGF) functions to provide an adequate fuel supply for immediate operation and to supply the correct amount of clean fuel oil at the proper rate to the diesel engine to ensure steady diesel generator operation under all load conditions.

The diesel generator fuel oil transfer and engine fuel oil system includes buried storage tanks, fuel oil transfer pumps, filters, day tanks, strainers, skid-mounted fuel pumps, piping, valves, and instrumentation and controls. Each diesel generator fuel oil storage tank stores sufficient fuel oil for continuous operation at its rated capacity for seven days. Each of the diesel generator fuel oil day tanks stores sufficient capacity for at least one hour of continuous operation of the diesel generator at full load.

Each standby diesel generator is provided with an independent fuel oil system. The fuel oil system transfer pump starts automatically on low level signal from the day tank and transfers fuel oil from the fuel oil storage tank to the fuel oil day tank. Each standby diesel generator is provided with a 100-percent capacity engine-driven fuel oil pump. The pump supplies fuel oil from the day tank to the engine manifolds and provides full flow at full engine speed. A 100-percent capacity DC motor-driven fuel oil booster pump is also provided for use during maintenance or at other times when the engine-driven pump is unavailable.

Fuel oil for the standby diesel generator system supports the following intended function for the standby diesel generators for 10 CFR 54.4(a)(1).

- Supply power to the Division I and II safety-related equipment required for shutting down the reactor safely, maintaining a safe shutdown condition, and operating all auxiliaries required to mitigate the consequences of an accident.

Fuel oil for the standby diesel generator system supports the following intended function for the standby diesel generators for 10 CFR 54.4(a)(2).

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

Fuel oil for the standby diesel generator system supports the following intended function for the standby diesel generators for 10 CFR 54.4(a)(3).

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

*HPCS Diesel Generators, Fuel Oil Transfer and Engine Fuel Oil*

The HPCS fuel oil transfer and engine fuel oil system (system codes 309/203, EGF/CSH) functions to provide an adequate fuel supply for immediate operation and to supply the correct amount of clean fuel oil at the proper rate to the diesel engine to ensure steady diesel generator operation under all load conditions.

The fuel oil transfer and engine fuel oil system includes a buried storage tank, fuel oil transfer pump, filters, day tank, strainers, engine-driven fuel booster pump, DC motor-driven fuel booster pump, piping, valves, and instrumentation and controls. The diesel generator fuel oil storage tank stores sufficient fuel oil for continuous operation at its rated capacity for seven days. The fuel oil day tank stores sufficient capacity for at least one hour of continuous operation of the diesel generator at full load.

The motor-driven transfer pump transfers fuel oil from the fuel oil storage tank to the fuel oil day tank to maintain the minimum required day tank level. Fuel oil flows by gravity from the day tank to the skid-mounted fuel oil system.

The HPCS diesel generator is provided with two positive displacement fuel pumps (one engine-driven and one DC motor-driven) capable of supplying an adequate quantity of fuel to the engine injectors under all operating conditions. The DC motor-driven pump starts automatically when the diesel generator start signal is received and supplies fuel oil from the day tank to the engine injectors. Both pumps operate simultaneously following diesel generator startup. Power for the DC motor-driven pump is supplied by the 125-volt HPCS system battery.

Fuel oil for the HPCS diesel generator system supports the following intended function for the HPCS diesel generator for 10 CFR 54.4(a)(1).

- In the event of a loss of offsite power, supply power for the startup and operation of the HPCS system and supporting auxiliaries.

Fuel oil for the HPCS diesel generator system supports the following intended function for the HPCS diesel generator for 10 CFR 54.4(a)(2).

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

Fuel oil for the HPCS diesel generator system supports the following intended function for the HPCS diesel generator for 10 CFR 54.4(a)(3).

- Perform a function that demonstrates compliance with the Commission's regulations for fire protection.

USAR References

Section 9.5.4

Components Subject to Aging Management Review

Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2). Remaining fuel oil system components are reviewed as listed below.

Table 2.3.3-17 lists the component types that require aging management review.

Table 3.3.2-17 provides the results of the aging management review.

License Renewal Drawings

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

LRA-PID-08-09A

## Table 2.3.3-17
## Fuel Oil Systems
## Components Subject to Aging Management Review

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Filter housing | Pressure boundary |
| Flame arrestor | Pressure boundary |
| Flex hose | Pressure boundary |
| Flow element | Pressure boundary |
| Orifice | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Strainer | Filtration |
| Strainer housing | Pressure boundary |
| Tank | Pressure boundary |
| Tubing | Pressure boundary |
| Valves body | Pressure boundary |

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

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

_Functional Failure_

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

_Physical Failures_

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

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

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

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

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

_Physical Impact or Flooding_

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

_Pipe Whip, Jet Impingement, or Harsh Environments_

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

criterion affected auxiliary systems, those systems are within the scope of license renewal per 10 CFR 54.4(a)(2).

*Leakage or Spray*

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

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

| System Code | System Name | Section Describing System |
|---|---|---|
| 052/500 | Control Rod Drive Hydraulic | Section 2.3.3.1, Control Rod Drive Hydraulic |
| 055 | Fuel Transfer Equipment | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 115 | Reactor Plant Closed Cooling Water | Section 2.3.3.2, Component Cooling Water |
| 118 | Normal Service Water | Section 2.3.3.3, Service Water |
| 121/122/710 | Compressed Air | Section 2.3.3.4, Compressed Air |
| 201 | Standby Liquid Control | Section 2.3.3.5, Standby Liquid Control |
| 207 | Leak Detection | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 208/255 | Main Steam Positive Leakage Control | Section 2.3.3.6, Main Steam Positive Leakage Control |
| 251 | Fire Protection – Water | Section 2.3.3.7, Fire Protection – Water |
| 254 | Hydrogen Mixing, Purge and Recombiner | Section 2.3.3.9, Combustible Gas Control |
| 256 | Standby Service Water | Section 2.3.3.3, Service Water |
| 309 | Standby Diesel Generator | Section 2.3.3.10, Standby Diesel Generator |
| 309/203 | HPCS Diesel Generator | Section 2.3.3.11, HPCS Diesel Generator |
| 403 | HVAC – Containment Cooling | Section 2.3.3.13, Miscellaneous HVAC |

| System Code | System Name | Section Describing System |
|---|---|---|
| 409 | HVAC – Aux Building | Section 2.3.3.13, Miscellaneous HVAC |
| 410 | HVAC – Chilled Water | Section 2.3.3.14, Chilled Water |
| 511 | Radiation Monitoring | Section 2.3.3.12, Control Building HVAC |
| 552 | Containment Atmosphere and Leakage Monitoring | Section 2.3.3.9, Combustible Gas Control |
| 601 | Reactor Water Cleanup | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 602 | Fuel Pool Cooling and Cleanup | Section 2.3.3.15, Fuel Pool Cooling and Cleanup |
| 603 | Radwaste – Liquid | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 607/610/611 | Sampling | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 609 | Drains – Floor and Equipment | Section 2.3.3.16, Plant Drains |
| 655/836 | Domestic Water | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 656 | Suppression Pool Cleanup | Section 2.3.3.18, Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) |
| 659/810 | Makeup Water | Section 2.3.3.7, Fire Protection – Water |

System Descriptions

The following systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) are not described elsewhere in the application. Each system has the following intended function.

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

The systems described below have components that support this intended function. For systems with intended functions that meet additional scoping criteria, the additional intended functions are noted in the descriptions below with a reference to the section where the affected components are evaluated (e.g., Section 2.3.2.7, Containment Penetrations).

*Fuel Transfer Equipment*

The purpose of the fuel transfer equipment system (system codes 055, FNR/FNS/FNT/SFT, F42) is to support the fuel handling system.

The fuel handling system is designed to provide a safe, effective means for transporting and handling fuel from the time it reaches the plant until it leaves the plant after post-irradiation cooling. Fuel movement and reactor servicing operations are performed from platforms which span the refueling, servicing, and storage cavities. The containment building is supplied with a refueling platform for fuel movement and servicing, an auxiliary platform for servicing operations from the refueling floor level, and a vessel platform for reactor servicing from the vessel flange level. The fuel building is supplied with a fuel handling platform for fuel movement and servicing.

The fuel transfer equipment system consists of the refueling platforms and supporting equipment, including hydraulic components. The platforms and cranes are reviewed in the structural aging management reviews. Safety-related pool liners that meet the criteria of 10 CFR 54.4(a)(1) are included in structural reviews.

One safety-related valve supports the pressure boundary of the fuel pool cooling and cleanup system. Other components support containment pressure boundary isolation for the fuel transfer tube, including a safety-related blind flange and a nonsafety-related drain valve.

In addition to the 10 CFR 54.4(a)(2) function described above, the fuel transfer equipment system has the following intended functions for 10 CFR 54.4(a)(1).

- Maintain the pressure boundary of the fuel pool cooling and cleanup system.
- Support containment pressure boundary.

In addition to the 10 CFR 54.4(a)(2) function described above, the fuel transfer equipment system has the following intended function for 10 CFR 54.4(a)(2).

- Support containment pressure boundary.

Components supporting the containment penetration pressure boundary are reviewed in Section 2.3.2.7, Containment Penetrations. The valve supporting the fuel pool cooling and cleanup system pressure boundary is reviewed in Section 2.3.3.15.

*Leak Detection*

The purpose of the leak detection system (system codes 207, LDS, E31) is to detect, annunciate, and in some cases, isolate the RCPB from potential hazardous leaks before predetermined limits are exceeded. The system consists of temperature, pressure, flow, and fission-product sensors with associated instrumentation and alarms. This system detects and annunciates leakage in various systems that interface with the reactor coolant system.

System 207 in the component database includes mechanical components (accumulators, sight glasses, and valves) associated with some of the systems for which leak detection is provided. These components are included in the reviews of their respective systems as components with the intended function of maintaining the systems' pressure boundary.

The system includes instrumentation associated with the reactor water cleanup (RWCU) system flow that supports the containment pressure boundary.

In addition to the 10 CFR 54.4(a)(2) function described above, the leak detection system has the following intended functions for 10 CFR 54.4(a)(1).

- Maintain pressure boundary of interfacing safety-related systems.
- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

Safety-related components in the leak detection system are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary; Section 2.3.2.7, Containment Penetrations; and Section 2.3.2.5, Reactor Core Isolation Cooling.

*Reactor Water Cleanup*

The reactor water cleanup (RWCU) system (system codes 601, WCS, G33/G36) recirculates a portion of reactor coolant through a filter-demineralizer to remove particulate and dissolved impurities from the reactor coolant. It also removes excess coolant from the reactor system under controlled conditions.

The RWCU system consists of two RWCU pumps, regenerative heat exchangers, non-regenerative heat exchangers, two filter-demineralizer units, supporting systems for the demineralizer units (backwash, resin feed and precoat), coolant reject paths to the main condenser and radwaste, associated piping and valves (including five sets of containment isolation valves), and instrumentation and controls.

The RWCU pumps are located outside the containment. RWCU heat exchangers and filter demineralizers are located inside the containment. When operating, the system is in direct communication with the reactor coolant system, taking suction on the recirculation lines inside the drywell (with a small portion from the reactor vessel bottom head drain) and injecting back into the feedwater lines via residual heat removal system piping. The blowdown line from the RWCU system to condensate or liquid radwaste includes a containment penetration as does the discharge of the backwash receiving pumps.

A small part of the RWCU system is part of the reactor coolant pressure boundary (RCPB) up to and including the second isolation valve. The other portions of the system are not part of the RCPB and can be isolated from the reactor coolant system.

The suction line (RCPB portion) of the RWCU system contains two motor-operated isolation valves, which automatically close in response to signals from reactor pressure vessel low-low water level, leak detection system, and actuation of the standby liquid control system (SLCS). This isolation prevents the loss of reactor coolant and release of radioactive material from the reactor and prevents removal of liquid reactivity control material by the cleanup system should the SLCS be in operation.

Although many components in the RWCU system are classified as Safety Class 3, the system performs no safety functions other than to support containment isolation and to isolate itself from the RCPB (using containment isolation valves). High drywell pressure is not an isolation for these valves. The RWCU lines remain in service in order to keep the capability of continuously cleaning the reactor vessel coolant. The RWCU system incorporates break detection logic in conjunction with leak detection systems to automatically isolate on an unbalanced flow or high temperature, which indicate an RWCU line break.

The two containment isolation valves on the RWCU pump suction line are credited in the post-fire safe shutdown analysis for isolating the RCPB so that no inadvertent spurious operation would lead to a fire-induced LOCA.

In addition to the 10 CFR 54.4(a)(2) function described above, the RWCU system has the following intended functions for 10 CFR 54.4(a)(1).

- Prevent excessive loss of reactor coolant.
- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

In addition to the 10 CFR 54.4(a)(2) function described above, the RWCU system has the following intended function for 10 CFR 54.4(a)(3).

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

Components supporting the RCPB are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Two reactor water cleanup return line valves are included in Section 2.3.2.3, Residual Heat Removal. Containment penetrations are reviewed in Section 2.3.2.7, Containment Penetrations. Included in the containment penetrations review are RWCU components from Penetration KJBZ6 to check valves to the feedwater/RHR system (Safety Class 2 flow transmitters for unbalanced flow identification, LRA-PID-26-03A).

*Radwaste – Liquid*

The purpose of the liquid radwaste system (system codes 603, LWS) is to collect, monitor, and process (for reuse or disposal) all potentially radioactive liquid waste produced during normal plant operation and maintenance in a controlled manner. The system collects, processes, stores, monitors, and disposes of all liquid radioactive wastes received from the reactor coolant system or liquids which are potentially contaminated due to contact with liquids from the reactor coolant system.

The waste and floor drain collector subsystem consists of the waste, regenerant and floor drain collector tanks, which receive and store the feed to the subsystem; the radwaste filter, which removes insoluble particles; a radwaste treatment train, which removes the soluble and colloidal ionic material; and the recovery sample tanks, which hold the processed water for testing before it is returned to the condensate system, discharged to the cooling tower blowdown, or transferred back to the waste collector tank inlet header for reprocessing.

The phase separator/backwash tank subsystem provides storage and holdup of filter sludges and spent resins from the reactor water cleanup filter/demineralizers, the condensate polishers, the radwaste treatment vessels, the fuel pool demineralizers, and the radwaste filters.

The collection tanks, process equipment, and sample tank systems are located in the radwaste building. Components of the system (piping, valves) are located in spaces containing safety-related components.

*Sampling*

The purpose of the plant sampling systems (system codes 607/610/611, SSW/SSR/SST, D24), consisting of independent sampling systems in the turbine plant, reactor plant, and radwaste buildings, is to draw liquid and gaseous samples from plant systems. The sample systems condition the samples by pressure and temperature reduction and provide equipment for taking manual grab samples and for continuously monitoring critical plant parameters.

The sampling systems also include the nonsafety-related post-accident sampling system (PASS), a manual grab sampling system designed to provide representative liquid and gaseous samples from inside primary containment for analysis following a LOCA and to provide useful samples under all other operating conditions.

The plant sampling systems consist of large self-contained sample stations located in major buildings into which are run sample lines from the various process systems being monitored. These sample stations are self-contained free-standing sample panels fitted with all necessary tubing valves and instrumentation required to collect and analyze liquid samples. Samples pass through a sample cooler cooled by turbine plant component cooling water. Where additional cooling is required, a secondary sample cooler is provided, cooled by chilled water from the refrigeration chillers. The sample is finally directed to analyzers and a grab sample valve located in the sample sink. Sample effluent is routed to a drain hub. Sampling systems consist of coolers, chilled water pumps, analyzers, piping, valves, and associated instrumentation and controls. Safety-related sampling system components interface with the containment atmosphere, reactor coolant system, residual heat removal system, and condensate and refueling water storage and transfer system.

In addition to the 10 CFR 54.4(a)(2) function described above, the sampling system has the following intended functions for 10 CFR 54.4(a)(1).

- Support the pressure boundary of sampled safety-related systems.
- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

Safety-related reactor coolant system sampling components are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Safety-related components related to sampling RHR flow are reviewed in Section 2.3.2.3, Residual Heat Removal. Safety-related containment atmosphere sampling system components are reviewed in Section 2.3.3.9, Combustible Gas Control. Safety-related components related to sampling condensate are reviewed in Section 2.3.4.1, Condensate Makeup, Storage and Transfer.

*Domestic Water*

The purpose of the domestic water system (system codes 655/836, DWS) is to provide sufficient treated potable (drinking) water from the Consolidated Water District No. 13 Water Supply System to satisfy the quantity and pressure requirements of all installed plumbing fixtures.

Distribution lines are extended underground to the buildings that require domestic water. Domestic hot water is generated by a separate electric hot water heater in each facility containing sanitary facilities.

Components that were originally installed to provide domestic water from deep water wells have been abandoned in place.

*Suppression Pool Cleanup*

The purpose of the suppression pool cleanup system (system codes 656, ZZZ/SPC ) is to provide cleaning and cooling of the water in the suppression pool during normal plant operation and alternate decay heat removal capability during shutdown conditions. The system can provide suppression pool cleanup and cooling during shutdown conditions, in the event the system is not required for alternate decay heat removal.

The suppression pool cleanup system is a nonsafety-related system that performs the following functions, depending on the reactor operating mode and valve alignments:

a. Provide a method to process suppression pool water during plant power operation in order to achieve and maintain suppression pool water clarity and chemistry.

b. Provide a method to routinely remove heat added to the suppression pool as a result of safety relief valve leakage and testing of the reactor core isolation cooling (RCIC) system, as an alternative to using the suppression pool cooling mode of the residual heat removal system.

c. Provide an alternate method of reactor vessel decay heat removal during plant shutdowns.

d. Provide an alternate capability to discharge water to the liquid radwaste system for suppression pool or reactor level reduction.

The suppression pool cleanup system consists of two full-capacity pumps, one full-capacity plate and frame heat exchanger, a filter demineralizer skid, piping, valves, and instrumentation and controls. The suppression pool cleanup system suction and discharge connections with the residual heat removal loop C piping and with the fuel pool cooling and cleanup system piping are equipped with safety-related isolation valves that are components in the connecting systems. The suppression pool cleanup heat exchanger is cooled by normal service water.

The cleanup stream is processed by the filter demineralizer skid. The skid consists of a filter, one mixed bed demineralizer, demineralizer resin strainer, backwash tank, air receiver tank, connecting piping, valves, and instrumentation.

In addition to the 10 CFR 54.4(a)(2) function described above, the suppression pool cleanup system has the following intended function for 10 CFR 54.4(a)(3).

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

Components that support the service water pressure boundary are reviewed in Section 2.3.3.3, Service Water.

<u>USAR References</u>

The following table lists the USAR references for systems described in this section.

| System Code | System | USAR Reference |
|---|---|---|
| 055 | Fuel Transfer Equipment | Section 9.1.4 |
| 207 | Leak Detection | Section 7.6.1.2<br>Section 3.1.2.30 |
| 601 | Reactor Water Cleanup | Section 3C.2.8<br>Section 5.4.8<br>Section 6.2.1.1.3.2.1<br>Section 6.2.4.3.7.1<br>Section 6A.6.3<br>Section 7.3.1.1.2 item 7 |
| 603 | Radwaste – Liquid | Section 11.2 |
| 607/610/611 | Sampling | Section 9.3.2 |
| 655/836 | Domestic Water | Section 9.2.4 |
| 656 | Suppression Pool Cleanup | Section 9.3.8 |

Components Subject to Aging Management Review

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

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

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

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

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

For component types included under 10 CFR 54.4(a)(2), the intended function of *Pressure boundary* includes maintaining structural integrity for nonsafety-related SSCs directly connected to safety-related SSCs.

Series 2.3.3-18-x tables list the component types for auxiliary systems that require aging management review for 10 CFR 54.4(a)(2) based on potential for physical interactions.

Series 3.3.2-18-x tables provide the results of the aging management review for auxiliary systems for 10 CFR 54.4(a)(2) based on potential for physical interactions.

| System Codes | System Name | Component Types | AMR Results |
|---|---|---|---|
| 052/500 | Control Rod Drive Hydraulic | Table 2.3.3-18-1 | Table 3.3.2-18-1 |
| 055 | Fuel Transfer Equipment | Table 2.3.3-18-2 | Table 3.3.2-18-2 |
| 115 | Reactor Plant Closed Cooling Water | Table 2.3.3-18-3 | Table 3.3.2-18-3 |

| System Codes | System Name | Component Types | AMR Results |
|---|---|---|---|
| 118 | Normal Service Water | Table 2.3.3-18-4 | Table 3.3.2-18-4 |
| 121/122/710 | Compressed Air | Table 2.3.3-18-5 | Table 3.3.2-18-5 |
| 201 | Standby Liquid Control | Table 2.3.3-18-6 | Table 3.3.2-18-6 |
| 207 | Leak Detection | Table 2.3.3-18-7 | Table 3.3.2-18-7 |
| 208/255 | Main Steam Positive Leakage Control | Table 2.3.3-18-8 | Table 3.3.2-18-8 |
| 251 | Fire Protection—Water | Table 2.3.3-18-9 | Table 3.3.2-18-9 |
| 254 | Hydrogen Mixing, Purge and Recombiner | Table 2.3.3-18-10 | Table 3.3.2-18-10 |
| 256 | Standby Service Water | Table 2.3.3-18-11 | Table 3.3.2-18-11 |
| 309 | Standby Diesel Generator | Table 2.3.3-18-12 | Table 3.3.2-18-12 |
| 309/203 | HPCS Diesel Generator | Table 2.3.3-18-13 | Table 3.3.2-18-13 |
| 403 | HVAC – Containment Cooling | Table 2.3.3-18-14 | Table 3.3.2-18-14 |
| 409 | HVAC – Aux Building | Table 2.3.3-18-15 | Table 3.3.2-18-15 |
| 410 | HVAC – Chilled Water | Table 2.3.3-18-16 | Table 3.3.2-18-16 |
| 511 | Radiation Monitoring | Table 2.3.3-18-17 | Table 3.3.2-18-17 |
| 552 | Containment Atmosphere and Leakage Monitoring | Table 2.3.3-18-18 | Table 3.3.2-18-18 |
| 601 | Reactor Water Cleanup | Table 2.3.3-18-19 | Table 3.3.2-18-19 |
| 602 | Fuel Pool Cooling and Cleanup | Table 2.3.3-18-20 | Table 3.3.2-18-20 |
| 603 | Radwaste – Liquid | Table 2.3.3-18-21 | Table 3.3.2-18-21 |
| 607/610/611 | Sampling | Table 2.3.3-18-22 | Table 3.3.2-18-22 |
| 609 | Drains – Floor and Equipment | Table 2.3.3-18-23 | Table 3.3.2-18-23 |
| 655/836 | Domestic Water | Table 2.3.3-18-24 | Table 3.3.2-18-24 |
| 656 | Suppression Pool Cleanup | Table 2.3.3-18-25 | Table 3.3.2-18-25 |
| 659/810 | Makeup Water | Table 2.3.3-18-26 | Table 3.3.2-18-26 |

License Renewal Drawings

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

| System Codes | System Name | LRA Drawings |
|---|---|---|
| 052/500, RDC/RDS, C11 | Control Rod Drive Hydraulic | LRA-PID-36-01A LRA-PID-36-01B |
| 055, FNR/FNS/FNT/ SFT, F42 | Fuel Transfer Equipment | LRA-PID-34-04A LRA-PID-34-04B LRA-PID-34-04C |
| 115, CCH/CCP | Reactor Plant Closed Cooling Water | LRA-PID-09-01A LRA-PID-09-01B |
| 118, SWP | Normal Service Water | LRA-PID-09-10A LRA-PID-09-10B |
| 121/122/710, SAS/IAS/JRB | Compressed Air | LRA-PID-12-01B LRA-PID-12-01C LRA-PID-12-01E LRA-PID-12-01F LRA-PID-12-02C |
| 201, SLS, C41 | Standby Liquid Control | LRA-PID-27-16A |
| 207, LDS, E31 | Leak Detection | LRA-PID-32-09B LRA-PID-32-09C LRA-PID-32-09D LRA-PID-32-09E |
| 208/255, MSI/LSV, E33 | Main Steam Positive Leakage Control | LRA-PID-27-20A LRA-PID-27-20B LRA-PID-27-20C LRA-PID-27-20D |
| 251, FOF/FPW | Fire Protection – Water | LRA-PID-15-01C |
| 254, CPM/CPP/HCS | Hydrogen Mixing, Purge and Recombiner | LRA-PID-27-21A |
| 256, SWP | Standby Service Water | None |
| 309, EGA/EGE/EGF/ EGO/EGS/ EGT/SYD | Standby Diesel Generator | LRA-PID-08-09A LRA-PID-08-09B LRA-PID-08-09C |

| System Codes | System Name | LRA Drawings | |
|---|---|---|---|
| 309/203, EGA/ EGE/EGF/ EGO/EGS/ EGT/SYD | HPCS Diesel Generator | LRA-PID-08-09A<br>LRA-PID-08-09D | |
| 403, HVR | HVAC – Containment Cooling | LRA-PID-22-01A<br>LRA-PID-22-01B | LRA-PID-22-01C<br>LRA-PID-22-01D |
| 409, HVR | HVAC – Aux Building | LRA-PID-22-01D | |
| 410, HVK/HVN | HVAC – Chilled Water | LRA-PID-22-14D<br>LRA-PID-22-14F | LRA-PID-22-14H<br>LRA- PID-22-14J |
| 511, RMS, D17 | Radiation Monitoring | LRA-PID-37-01B | |
| 552, CMS/LMS | Containment Atmosphere and Leakage Monitoring | LRA-PID-33-02C | |
| 601, WCS, G33/G36 | Reactor Water Cleanup | LRA-PID-26-03A<br>LRA-PID-26-03B | |
| 602, SFC | Fuel Pool Cooling and Cleanup | LRA-PID-34-02A<br>LRA-PID-34-02B | |
| 603, LWS | Radwaste – Liquid | LRA-PID-31-01A<br>LRA-PID-31-01B<br>LRA-PID-31-01G | |
| 607/610/611, SSW/SSR/SST, D24 | Sampling | LRA-PID-21-02A<br>LRA-PID-21-02B | LRA-PID-21-02C<br>LRA-PID-21-01E |
| 609, DED/DER/DET/ DFA/DFD/DFM/ DFR/DFT/DFW/ DTM/VTP | Drains – Floor and Equipment | LRA-PID-22-08A<br>LRA-PID-23-12C<br>LRA-PID-23-12E<br>LRA-PID-26-03B<br>LRA-PID-27-05A<br>LRA-PID-27-15A<br>LRA-PID-32-05A<br>LRA-PID-32-05B<br>LRA-PID-32-09A<br>LRA-PID-32-09B<br>LRA-PID-32-09C<br>LRA-PID-32-09D<br>LRA-PID-32-09E | LRA-PID-32-09F<br>LRA-PID-32-09G<br>LRA-PID-32-09H<br>LRA-PID-32-09J<br>LRA-PID-32-09K<br>LRA-PID-32-09L<br>LRA-PID-32-09M<br>LRA-PID-32-09N<br>LRA-PID-32-09P<br>LRA-PID-32-09Q<br>LRA-PID-32-09R<br>LRA-PID-32-09S |

| System Codes | System Name | LRA Drawings |
|---|---|---|
| 655/836, DWS | Domestic Water | LRA-PID-23-01B |
| 656, ZZZ/SPC | Suppression Pool Cleanup | LRA-PID-27-08A |
| 659/810, MWS | Makeup Water | LRA-PID-09-15B |

**Table 2.3.3-18-1**
**Control Rod Drive Hydraulic System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Filter housing | Pressure boundary |
| Flow element | Pressure boundary |
| Heat exchanger (end cover) | Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Orifice | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Sight glass | Pressure boundary |
| Strainer housing | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-2**
**Fuel Transfer Equipment System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Demister housing | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Strainer housing | Pressure boundary |
| Tank | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

## Table 2.3.3-18-3
## Reactor Plant Closed Cooling Water System
## Nonsafety-Related Components Affecting Safety-Related Systems
## Components Subject to Aging Management Review

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Cooler housing | Pressure boundary |
| Demineralizer | Pressure boundary |
| Filter housing | Pressure boundary |
| Flex hose | Pressure boundary |
| Flow element | Pressure boundary |
| Orifice | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Sight glass | Pressure boundary |
| Strainer housing | Pressure boundary |
| Tank | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-4**
**Normal Service Water System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Filter housing | Pressure boundary |
| Flow element | Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Orifice | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-5**
**Compressed Air System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Filter housing | Pressure boundary |
| Piping | Pressure boundary |
| Separator | Pressure boundary |
| Trap | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-6**
**Standby Liquid Control System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
| --- | --- |
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Sight glass | Pressure boundary |
| Tank | Pressure boundary |
| Valve body | Pressure boundary |

## Table 2.3.3-18-7
## Leak Detection System
## Nonsafety-Related Components Affecting Safety-Related Systems
## Components Subject to Aging Management Review

| Component Type | Intended Function |
| --- | --- |
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Sight glass | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-8**
**Main Steam Positive Leakage Control System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Sight glass | Pressure boundary |
| Tubing | Pressure boundary |

**Table 2.3.3-18-9**
**Fire Protection – Water System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-10**
**Hydrogen Mixing, Purge and Recombiner System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Blower housing | Pressure boundary |
| Bolting | Pressure boundary |
| Flow element | Pressure boundary |
| Piping | Pressure boundary |
| Valve body | Pressure boundary |

## Table 2.3.3-18-11
## Standby Service Water System
## Nonsafety-Related Components Affecting Safety-Related Systems
## Components Subject to Aging Management Review

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-12**
**Standby Diesel Generator System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Sight glass | Pressure boundary |
| Tank | Pressure boundary |
| Trap | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-13**
**HPCS Diesel Generator System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Cooler housing | Pressure boundary |
| Dryer housing | Pressure boundary |
| Filter housing | Pressure boundary |
| Piping | Pressure boundary |
| Silencer | Pressure boundary |
| Strainer housing | Pressure boundary |
| Trap | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-14**
**HVAC – Containment Cooling System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Damper housing | Pressure boundary |
| Ducting | Pressure boundary |
| Fan housing | Pressure boundary |
| Filter housing | Pressure boundary |
| Heat exchanger (housing) | Pressure boundary |

## Table 2.3.3-18-15
## HVAC – Auxiliary Building System
## Nonsafety-Related Components Affecting Safety-Related Systems
## Components Subject to Aging Management Review

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Damper housing | Pressure boundary |
| Ducting | Pressure boundary |
| Fan housing | Pressure boundary |
| Filter housing | Pressure boundary |

**Table 2.3.3-18-16**
**HVAC – Chilled Water System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Condenser housing | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Separator | Pressure boundary |
| Sight glass | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-17**
**Radiation Monitoring System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Sight glass | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-18**
**Containment Atmosphere and Leakage Monitoring System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-19**
**Reactor Water Cleanup System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Cooler housing | Pressure boundary |
| Demineralizer | Pressure boundary |
| Expansion joint | Pressure boundary |
| Flow element | Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Orifice | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Sight glass | Pressure boundary |
| Strainer housing | Pressure boundary |
| Tank | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-20
Fuel Pool Cooling and Cleanup System
Nonsafety-Related Components Affecting Safety-Related Systems
Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Demineralizer | Pressure boundary |
| Demister housing | Pressure boundary |
| Filter housing | Pressure boundary |
| Flow element | Pressure boundary |
| Heat exchanger (end cover) | Pressure boundary |
| Heat exchanger (shell) | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Strainer housing | Pressure boundary |
| Tank | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-21**
**Radwaste – Liquid System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Orifice | Pressure boundary |
| Piping | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-22**
**Sampling System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Accumulator | Pressure boundary |
| Bolting | Pressure boundary |
| Cooling housing | Pressure boundary |
| Filter housing | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Sight glass | Pressure boundary |
| Tank | Pressure boundary |
| Trap | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-23**
**Drains – Floor and Equipment System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Cooler housing | Pressure boundary |
| Expansion joint | Pressure boundary |
| Flex hose | Pressure boundary |
| Orifice | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Sight glass | Pressure boundary |
| Strainer housing | Pressure boundary |
| Trap | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-24**
**Domestic Water System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Strainer housing | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-25**
**Suppression Pool Cleanup System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Expansion joint | Pressure boundary |
| Heat exchanger (end cover) | Pressure boundary |
| Piping | Pressure boundary |
| Pump casing | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.3-18-26**
**Makeup Water System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Filter housing | Pressure boundary |
| Flow element | Pressure boundary |
| Piping | Pressure boundary |
| Valve body | Pressure boundary |

## 2.3.4 Steam and Power Conversion Systems

The following systems are included in this section.

- Section 2.3.4.1, Condensate Makeup, Storage and Transfer
- Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

### 2.3.4.1 Condensate Makeup, Storage and Transfer

System Description

The purpose of the condensate makeup, storage and transfer system (system codes 106, CNC/CNS) is to store and distribute high-purity makeup water to the main condenser hotwell and to reactor plant auxiliary systems. The system also provides a storage volume for excess water from plant systems to be retained and reused and provides a reserve volume of makeup water to the reactor coolant inventory via the high pressure core spray (HPCS) and reactor core isolation cooling (RCIC) systems.

The system consists of a nonsafety-related condensate storage tank (CST), condensate transfer pumps, condensate storage tank sump pumps, system piping and valves, and instrumentation and controls.

In addition to supplying the HPCS and RCIC systems, the system supplies the condenser with makeup water and receives the condenser drawoff when the hotwell level reaches high or low level set points. The CST also supplies water for the condensate demineralizer system regeneration, the control rod drive (CRD) pumps, and fuel pool cooling pumps, which are used to supply demineralized water for refueling purposes. The CST is also capable of receiving HPCS system test discharges, RCIC system test discharges, the CRD pump surplus flow, fuel pool purification system discharges (including drainage from the refueling cavity), and recovered water from the recovery sample tank pumps.

The system provides sufficient capacity to fill the condensate, feedwater, and reactor auxiliary systems while maintaining a reserve volume for use by the HPCS and RCIC systems. The CST supplies water to the suction of the fuel pool cooling pumps for makeup to the fuel building pools, containment building pools, and filling of the reactor cavity and other volumes for refueling evolutions. Level in the CST is normally maintained by the demineralized water transfer pumps. The system outboard containment isolation valve automatically closes upon receipt of an automatic or manual containment isolation signal.

Although the CST normally supplies the HPCS and RCIC systems, automatic shutoff valves are provided to close on low CST level and transfer HPCS and RCIC pump suctions to the suppression pool, which is the primary safety design source of core spray water. Use of the CST by RCIC and HPCS is mentioned in the safe shutdown analysis for Appendix R; however, the credited source is the suppression pool. Use of the CST by RCIC is credited for the station blackout four-hour coping duration.

Failure of the CST during accident conditions would not preclude plant safe shutdown or post-accident mitigation processes. The systems which draw water from this tank are all capable of performing their safety function without this water supply. Specifically, the HPCS and RCIC suction would automatically shift to the suppression pool; the CRD accumulators provide enough stored energy to insert control rods; and the fuel pool cooling system receives any required makeup water from the standby service water system. Use of the CST for RCIC is credited in the event of a station blackout.

The condensate makeup, storage and transfer system has the following intended functions for 10 CFR 54.4(a)(1).

- Support pressure boundary of interconnected safety-related system.
- Support containment pressure boundary.

The condensate makeup, storage and transfer system has the following intended function for 10 CFR 54.4(a)(2).

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

The condensate makeup, storage and transfer system has the following intended function for 10 CFR 54.4(a)(3).

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

USAR References

Section 9.2.6

Components Subject to Aging Management Review

Nonsafety-related components of the system not included in other reviews whose failure could prevent satisfactory accomplishment of safety functions are reviewed in Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2). Remaining components are reviewed as listed below.

Table 2.3.4-1 lists the component types that require aging management review.

Table 3.4.2-1 provides the results of the aging management review.

License Renewal Drawings

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

| | |
|---|---|
| LRA-PID-04-03A | LRA-PID-27-04A |
| LRA-PID-04-03C | LRA-PID-34-02A |
| LRA PID-21-02B | LRA-PID-36-01A |

**Table 2.3.4-1**
**Condensate Makeup, Storage and Transfer System**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Screen | Filtration |
| Tank | Pressure boundary |
| Thermowell | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

### 2.3.4.2 Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

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

*Functional Failure*

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

*Physical Failure*

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

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

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

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

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

*Physical Impact or Flooding*

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

*Pipe Whip, Jet Impingement, or Harsh Environments*

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

*Leakage or Spray*

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

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

| System Code | System Name | Section Describing System |
|---|---|---|
| 106 | Condensate Makeup, Storage and Transfer | Section 2.3.4.1, Condensate Makeup, Storage and Transfer |
| 107/501 | Feedwater | Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) |
| 109 | Main Steam | Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) |
| 126 | Auxiliary Condensate | Section 2.3.4.2, Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) |

System Description

The following systems within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(2) are not described elsewhere in the application. Each system has the following intended function.

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

The systems described below have components that support this intended function. For systems with intended functions that meet additional scoping criteria, the additional intended functions are noted in the descriptions below with a reference to the section where the affected components are evaluated (e.g., Section 2.3.1.2, Reactor Coolant Pressure Boundary).

*Feedwater*

The purpose of the feedwater system (system codes 107/501, FWL/FWR/FWS, C33) is to provide the required make-up water flow rate to the reactor vessel at the proper pressure and temperature. The feedwater system contains the piping from the reactor feedwater pumps to the reactor vessel. The piping includes the reactor feedwater pumps, first point feedwater heaters, recirculation lines to the main condenser, the feedwater pump/motor and gear speed increaser lubrication systems, associated system piping and valves, and instrumentation and controls.

Three one-third nominal capacity, horizontal, centrifugal, motor-driven reactor feed pumps operate in series with the condensate pumps and receive condensate from the second point heaters. The reactor feed pumps discharge through the feedwater control station to the two high-pressure first point heaters arranged in parallel and then through the reactor containment isolation valves to the reactor.

Feedwater piping and valves maintain the integrity of the reactor coolant pressure boundary between the reactor vessel and the outboard containment isolation valves. The system from the reactor feedwater pumps up to, but not including, the outermost feedwater isolation valve is not safety-related.

The system provides a path for the safety-related residual heat removal (RHR) system cooling water to enter the reactor vessel during the shutdown cooling mode of operation where the RHR system tees into feedwater upstream of the outboard containment isolation valves. This connection also returns reactor water cleanup flow to the vessel during operation through the RHR line.

Safety-related feedwater motor-operated isolation valves are credited in the Appendix R evaluation to provide a means for preventing an uncontrolled injection of feedwater into the reactor pressure vessel.

In addition to the 10 CFR 54.4(a)(2) function described above, the feedwater system has the following intended functions for 10 CFR 54.4(a)(1).

- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

In addition to the 10 CFR 54.4(a)(2) function described above, the feedwater system has the following intended function for 10 CFR 54.4(a)(3).

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

Safety-related feedwater system components are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary.

*Main Steam*

The purpose of the main steam system (system codes 109, ISM/MSS/SVV, B21/T23) is to conduct steam from the reactor vessel through the primary containment to the main turbine and associated steam-driven components. The system contains the piping from the reactor vessel up to the main turbine, which includes the main steam isolation valves (MSIVs) plus main steam shutoff valves, equalizing header, turbine control valves and stop valves, other system valves, drain lines to the main condenser, and the individual piping lines which supply steam to auxiliary systems. The safety/relief valves (SRVs) are components in the automatic depressurization system (ADS, system 202, Section 2.3.2.1, Pressure Relief).

Four main steam lines originate at the reactor vessel and run through containment penetrations to a main steam header located in the turbine building. Each main steam line contains a flow restrictor and isolating valves. From the main steam header the main steam lines run to four sets of main turbine stop and control valves and then to the high pressure turbine. A turbine bypass system is provided to send steam directly to the condenser. Main steam supply for the moisture separators and reheaters, the steam jet air ejectors, the steam seal evaporator, and steam conveyed to the turbine bypass valves are all taken from the main steam header. Steam supply to the RCIC turbine is taken from one main steam line inside the drywell.

A venturi-type flow restrictor is installed in each steam line inside the primary containment. These devices limit the loss of coolant from the reactor vessel before the main steam isolation valves are closed in case of a main steam line break outside the containment. The flow restrictors are located downstream of the last safety relief valve in each steam line and upstream of the associated inboard MSIV.

Containment isolation is provided by one inboard (inside containment) and one outboard (outside containment) isolation valve for each of the four main steam lines. Each line also has a main steam shutoff valve downstream of the outboard MSIV. The MSIVs close the main steam lines within the time established by design basis accident analysis to limit the release of reactor coolant. The MSIVs provide reactor pressure vessel isolation as credited in the RBS 10 CFR 50 Appendix R safe shutdown analysis. Motive force for

MSIV closure is provided by a combination of compressed air and springs. Air accumulators provide backup operating air. The instrument air system provides air to the MSIV air accumulator tanks.

The turbine bypass system consists of two automatically and sequentially operated control valves mounted on a valve manifold. The manifold is connected to the main steam header. Each bypass valve outlet is piped individually to the main condenser. The turbine bypass system regulates reactor pressure during startup operations and during power operations if reactor steam generation exceeds the turbine requirements. The system also provides a steam path to the condenser as a heat sink during normal reactor cooldown. This system is not safety-related and is not required to function for the prevention or mitigation of an accident.

Safety-related reactor head vent valves are components in system 109 and are credited in the fire hazards analysis for isolating the head vent.

In addition to the 10 CFR 54.4(a)(2) function described above, the main steam system has the following intended functions for 10 CFR 54.4(a)(1).

- Maintain reactor coolant pressure boundary.
- Support containment pressure boundary.

In addition to the 10 CFR 54.4(a)(2) function described above, the main steam system has the following intended function for 10 CFR 54.4(a)(3).

- Perform a function (SRVs, reactor head vent valves) that demonstrates compliance with the Commission's regulations for fire protection (10 CFR 50.48).

Main steam system Class 1 components and components up through the outboard MSIV (including the SRVs) are reviewed in Section 2.3.1.2, Reactor Coolant Pressure Boundary. Components related to the MS-PLCS (system codes 208/255) are reviewed in Section 2.3.3.6, Main Steam Positive Leakage Control. Components related to accumulators for the air-operated MSIVs are reviewed in Section 2.3.3.4, Compressed Air.

*Auxiliary Condensate*

System 126 contains the auxiliary condensate system (system code CNA) and other systems that supported the auxiliary boiler that is located in the auxiliary boiler and water treatment building (system codes 126, ABD/ABF/ABM/ASR). The auxiliary boiler is no longer used and has been abandoned in place. With the exception of auxiliary condensate, these supporting systems are abandoned in place. Auxiliary condensate is still in use.

The purpose of the auxiliary condensate system is to provide demineralized condensate from the condensate system at reduced pressure to the four heater drain pump gland seals and to the steam seal evaporator.

The condensate system (system 104) provides clean water to the auxiliary condensate system from two connections downstream of the condensate demineralizers. These connections provide gland sealing water to the heater drain pump (system 108) and feedwater to the steam seal evaporator (system 114).

USAR References

The following table lists the USAR references for systems described in this section.

| System Code | System | USAR Reference |
|---|---|---|
| 107/501 | Feedwater | Section 10.4.7<br>Section 5.4.9 |
| 109 | Main Steam | Section 5.1<br>Section 5.2.2<br>Section 5.4.4<br>Section 5.4.5<br>Section 5.4.9<br>Section 6.3.2.2.2<br>Section 7.3.1.1.2<br>Section 10.3<br>Section 10.4.4 |
| 126 | Auxiliary Condensate | None |

Components Subject to Aging Management Review

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

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

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

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

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

For component types included under 10 CFR 54.4(a)(2), the intended function of *Pressure boundary* includes maintaining structural integrity for nonsafety-related SSCs directly connected to safety-related SSCs.

Series 2.3.4-2-x tables list the component types for S&PC systems that require aging management review for 10 CFR 54.4(a)(2) based on potential for physical interactions.

Series 3.4.2-2-x tables provide the results of the aging management review for S&PC systems for 10 CFR 54.4(a)(2) based on potential for physical interactions.

| System Code | System | Component Types | AMR Results |
|---|---|---|---|
| 106 | Condensate Makeup, Storage and Transfer | Table 2.3.4-2-1 | Table 3.4.2-2-1 |
| 107/501 | Feedwater | Table 2.3.4-2-2 | Table 3.4.2-2-2 |
| 109 | Main Steam | Table 2.3.4-2-3 | Table 3.4.2-2-3 |
| 126 | Auxiliary Condensate | Table 2.3.4-2-4 | Table 3.4.2-2-4 |

License Renewal Drawings

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

| System Codes | System | LRA Drawings |
|---|---|---|
| 106, CNC/CNS | Condensate Makeup, Storage and Transfer | LRA-PID-04-03A<br>LRA-PID-04-03C |
| 107/501, FWL/FWR/FWS, C33 | Feedwater | LRA-PID-06-01B |

| System Codes | System | LRA Drawings |
|---|---|---|
| 109,<br>ISM/MSS/SVV,<br>B21/T23 | Main Steam | LRA-PID-03-01A<br>LRA-PID-03-01C |
| 126,<br>CNA/ ABD/ABF/<br>ABM/ASR | Auxiliary Condensate | None |

**Table 2.3.4-2-1**
**Condensate Makeup, Storage and Transfer System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Filter housing | Pressure boundary |
| Piping | Pressure boundary |
| Tubing | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.4-2-2**
**Feedwater System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Valve body | Pressure boundary |

**Table 2.3.4-2-3**
**Main Steam System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Piping | Pressure boundary |

**Table 2.3.4-2-4**
**Auxiliary Condensate System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Components Subject to Aging Management Review**

| Component Type | Intended Function |
|---|---|
| Bolting | Pressure boundary |
| Piping | Pressure boundary |
| Valve body | Pressure boundary |

## 2.4 SCOPING AND SCREENING RESULTS: STRUCTURES

The following structures and structural components are within the scope of license renewal.

- Section 2.4.1, Reactor Building
- Section 2.4.2, Water Control Structures
- Section 2.4.3, Turbine Building, Auxiliary Building, and Yard Structures
- Section 2.4.4, Bulk Commodities

## 2.4.1 Reactor Building

Description

The reactor building is a Category I structure comprising the shield building, containment structure, and internal structures including the drywell, weir wall, reactor pedestal, and the foundation mat. The containment structure comprises a steel containment vessel (SCV) backed by hoop and vertical stiffeners and structural concrete fill above the mat.

The purpose of the reactor building is to support and protect the enclosed vital mechanical and electrical equipment, including the reactor vessel, the reactor coolant system, and engineered safety features systems required for safe operation and shutdown of the reactor. An annular space is provided between the walls and domes of the SCV and concrete shield building to allow in-service inspections. The safety function of the reactor building is to limit the release of radioactive fission products following an accident, thereby limiting the dose to the public and control room operators. The reactor building structure also provides physical support for itself, the reactor coolant system, engineered safety features, and other systems and equipment located within the structure. In addition, the reactor building supports the plant stack and also serves as a reliable final barrier against the escape of fission products to ensure the leakage limits are not exceeded and fission product releases are within the postulated design basis accidents.

The exterior walls and dome of the concrete shield building provide protection for the reactor vessel and all other safety-related system, structures and components inside the steel containment from missiles and natural phenomena. The reactor building is founded on a reinforced concrete mat which is separated from the foundations of the fuel building, auxiliary building and motor generator building by a rattle space. The concrete reactor vessel pedestal, weir wall, drywell wall, and SCV are also anchored to this mat. Floors are located within the reactor building to provide support for and access to equipment. The floors are generally constructed of steel framing with steel grating or checkered plate decks. Some areas, such as the decontamination area at the refueling level, have concrete decks supported on steel framing. Also, some floor areas, where radiation protection is required or where maintenance requires floors other than grating or checkered plate, are constructed of concrete.

A more detailed description of the reactor building is provided below.

*Steel Containment Vessel*

The containment structure consists of an SCV, penetrations, and access openings. The SCV is a continuous, essentially leaktight steel membrane which includes the cylindrical portion, the torispherical dome, and the floor liner plate with embedments. The SCV is backed by structural concrete fill up to elevation 94 feet 8 inches in the annulus area between the shield building and the SCV. This concrete portion of the containment is structurally anchored to the SCV and the shield building to form a composite section. Above this elevation, the steel shell is free standing and is designed to act as an independent structural component within the reactor building. The lower part of the cylindrical portion of the SCV serves as the outer boundary of the volume of water to be stored in that area (suppression pool). The inner water boundary is a weir wall located inside the drywell chamber. The bottom of the SCV consists of steel liner plates welded together and anchored to the top of the mat concrete. All welded floor steel liner plate seams are covered with continuously welded test channels. These channels were used to check leaktightness of welds during vessel fabrication. The suppression pool is located in the bottom of the SCV between the SCV and the drywell wall. The pool is concentric around the reactor building centerline and is filled with water. The pool is clad with a stainless steel liner to prevent corrosion of surrounding structures.

In addition, certain mechanical elements (crane supports, beam seats, weld pads, etc.) are supported by the SCV. The reactor building polar crane consists of two girders and a trolley. The crane is of welded-box girder construction with the girders connected by end ties at the left and right ends of the girders. This bridge assembly rests on circular runway rails mounted on a circular continuous girder support structure welded to the SCV. The transfer of floor loads to the SCV is accomplished through beam seats.

Two basic types of penetrations are used for piping systems, unsleeved and sleeved. Unsleeved process piping penetrations are anchored to the reinforced concrete drywell wall when passing through it, or are welded to the containment vessel when passing through the vessel wall. A flexible seal element is used to seal the annular space between the shield building wall and the process piping. Sleeved piping penetrations have a sleeve or guard pipe around the process piping. Sleeved penetrations are used for all moderate and high temperature piping systems, carrying both single and multiple piping. The sleeve or guard pipe is attached directly to the SCV or through the expansion bellows which are welded to the SCV reinforcement plate. A flexible seal element is used to seal the annular space between the shield building and the guard pipe. Electrical conduits penetrating the SCV pass through steel pipe sleeves. These sleeves are welded into the SCV reinforcement plate. The control rod drive (CRD) removal tube enclosure consists of two sections: the containment vessel, shield building section, and the drywell wall section. The first section consists of a sleeve welded to the containment vessel, projecting through the shield building wall, and passing through a larger diameter sleeve anchored in the shield building concrete wall. Expansion-type seals are installed between the CRD enclosure and the shield building sleeve. The function of the penetrations is to carry piping, mechanical systems, and electrical wiring (or in the case of the fuel transfer enclosures, new or spent fuel) through the drywell, containment vessel, and shield building walls.

The SCV access openings consist of one equipment hatch, two personnel air locks, and one dome ventilation opening. The SCV equipment hatch provides access for large pieces of equipment being moved from outside the reactor building into the containment vessel. The hatch cover is double-gasketed with a leakage test tap between the O-rings. The SCV personnel air locks are welded to the vessel with a portion of the barrel extending beyond the shield building wall. Both personnel air locks are double-closure penetrations. Each closure head is hinged and has two separate inflatable seals mounted on the door. A dome ventilation opening is installed at the apex of the SCV. This ventilation opening is permanently sealed and is no longer in service.

*Containment Internal Structure*

The containment internal structure is Seismic Category I. The containment internal structure is heavily reinforced concrete walls and slabs, with the exception of the primary shield wall and steel framing members. The containment internal structure is designed to support the principal nuclear steam supply equipment, the refueling pools, and the multiple floor levels within the SCV. The function of the containment internal structure is to protect against design basis accidents conditions and provide radiation shielding. The containment internal structure includes the drywell, weir wall, primary shield wall, reactor pressure vessel (RPV) pedestal, the upper containment pool and main steam tunnel.

The drywell is a right vertical cylinder supported by the reactor building foundation mat and is concentric with the RPV vertical centerline. The wall and top slab is reinforced concrete. The reactor building foundation mat forms the bottom of the drywell. The lower portion of the drywell wall is lined on both sides with stainless steel plate. The lower portion of the cylindrical drywell wall also contains vented openings directed radially through the wall. The inside face of the upper portion is lined with carbon steel plate. It provides a continuous membrane to inhibit leakage during an accident. Access to the drywell interior is provided through one sealed combination equipment/personnel hatch, one sealed personnel air lock, and one drywell head. The drywell combination equipment hatch and personnel door assembly consists of four main parts: the personnel door, the hatch flanged head, the body ring and flange, and the monorail. Separate double inflatable seals are used on the door. The personnel air lock located in the drywell wall consists of three main components: doors, bulkheads, and a rectangular barrel with reinforcing plates at each end of the barrel. Both the barrel and the reinforcing plates are anchored to the drywell wall. The drywell head assembly is part of the drywell structure. It is located directly above the RPV. Removal of the drywell head provides access to the reactor vessel for inspection and refueling. The head assembly consists of two parts, the removable head and the chimney section, which is anchored to the drywell roof slab. The closure joint between the head and the chimney section is a finger-pin closure, which consists of a meridional tongue and groove arrangement and radial locking pins. The drywell head flange is equipped with double O-ring seals with a leak test tap between the O-rings. Piping and electrical services pass through the drywell wall in leaktight penetrations.

The weir wall is located within the drywell. Its function is to prevent the suppression pool water from entering the interior of the drywell. The weir wall is a right vertical cylinder reinforced concrete wall located concentric with the vertical centerline of the RPV and supported on the reactor building foundation mat. The outside face of this wall in contact with the suppression pool water is lined with stainless steel plates.

The primary shield wall surrounds the major portion of the RPV. Its primary function is to provide radiation shielding and accommodate pipe restraint loads. It is located concentric with the RPV centerline and is supported on the reactor vessel pedestal. The wall surfaces are constructed of structural steel plates interconnected by horizontal and vertical stiffeners. The spaces bounded by wall surfaces and stiffeners are filled with nonstructural concrete.

The RPV pedestal is a reinforced concrete right circular cylindrical structure. The wall provides additional support to the primary shield wall and the RPV skirt. The pedestal is located concentric with the RPV centerline and is supported on the reactor building foundation mat.

The upper containment pool is located above, and supported by, the drywell. It is divided into four sections: the fuel transfer and storage area, the separator storage pool, the dryer storage pool, and the reactor cavity. The walls are constructed of reinforced concrete with a stainless steel inner liner. The dryer storage pool is connected to refueling cavity and fuel transfer tube through gates to allow the movement of fuel. The pool is connected to the fuel building by the fuel transfer tube. The fuel transfer tube enclosures are welded to the liners in the fuel pools to prevent leakage of water from the refueling pool and the spent fuel storage pool. The annular space between the ends of the fuel transfer tube and the enclosures are sealed to prevent water from the fuel pools from escaping. A bellows expansion joint provides flexibility to allow for movement of the fuel transfer tube within the enclosures due to differential movements of the buildings. A refueling platform gantry crane is used to transport fuel and reactor components to and from containment pool storage and the reactor vessel. The platform spans the fuel storage and vessel pools on bedded tracks in the refueling floor.

The function of the main steam tunnel is to provide radiation protection from the four main steam lines that are contained within it. In addition, piping system lines are contained within the tunnel. The portion of the tunnel located within the containment has a rectangular cross section and extends horizontally from the drywell wall toward the steel containment wall. The tunnel is supported by the drywell wall and is separated from the SCV by a rattle space. The bottom of the tunnel is located above the top of the reactor building foundation mat. The side walls, top, and bottom of the tunnel are constructed of reinforced concrete.

*Shield Building*

The shield building completely encloses the SCV. It is a right vertical cylinder capped with a spherical segment dome and supported on the reactor building mat. The cylindrical portion of the structure and dome is reinforced concrete. It is separated from adjacent structures with a seismic rattle space. The upper dome and exterior wall also provides support for the plant exhaust stack. The function of the shield building is to protect the SCV from tornado winds and missiles and other environmental effects. It also provides biological shielding in the event of a loss-of-coolant accident. The shield building equipment hatch provides access for equipment installation and removal. The large diameter access opening is enclosed by rectangular steel panels. In addition to design load conditions, the steel door panels provide missile protection.

The panels are mounted on the outside of the shield building wall using swing-open arrangement. The door hinges connect the panels to the stiffened section of the shield building concrete wall through the embedded metal frame. The door panels are furnished with perimeter gaskets at head, jambs, and sill to provide leaktightness. The shield building personnel door frames are anchored in the shield building wall. Each door is secured by four manually operated latches and is fitted with a compression seal in order to maintain leaktightness.

The reactor building has the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provide physical support, shelter and protection for systems, structures, and components (SSCs) within the scope of license renewal. (10 CFR 54.4(a)(1))
- Provide primary containment to limit the release of radioactive materials so that offsite doses from a postulated design basis accident are below the guideline values of 10 CFR 50.67. (10 CFR 54.4(a)(1))
- Maintain integrity of SSCs such that safety functions are not affected. (10 CFR 54.4(a)(2))
- Provide shelter, support and protection for SSCs within the scope of license renewal. The reactor building houses equipment credited in the safe shutdown analysis for fire protection (10 CFR 50.48), for station blackout (10 CFR 50.63), and for anticipated transients without scram (10 CFR 50.62). (10 CFR 54.4(a)(3))

USAR References

| | | |
|---|---|---|
| Section 3.8 | Figure 1.2-9 | Figure 3.8-5 |
| Section 3.8.2 | Figure 1.2-10 | Figure 3.8-6 |
| Section 3.8.3 | Figure 1.2-11 | Figure 3.8-7 |
| Section 3.8.4.1.6 | Figure 1.2-12 | Figure 3.8-8 |
| Section 6.2.1 | Figure 3.8-1 | |
| Section 6.2.1.1.1 | Figure 3.8-4 | |

Components Subject to Aging Management Review

Structural commodities are structural members that support or protect plant equipment including system components, piping, and electrical conductors. Structural commodities that are unique to the reactor building are included in this review. Those that are common to in-scope systems and structures (anchors, embedments, pipe and equipment supports, instrument panels and racks, cable trays, conduits, etc.) are reviewed in Section 2.4.4, Bulk Commodities.

Table 2.4-1 lists the component types that require aging management review.

Table 3.5.2-1 provides the results of the aging management review.

**Table 2.4-1**
**Reactor Building**
**Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| ***Steel and Other Metals*** | |
| Cranes: rails and structural girders | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment |
| Cranes: structural girders | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment |
| Penetration: sleeves | Enclosure protection<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Penetration: sleeves and bellows | Enclosure protection<br>Pressure boundary<br>Support for Criterion (a)(1) equipment |
| Plant exhaust stack | Support for Criterion (a)(2) equipment |
| Steel components: beams, columns and plates | Enclosure protection<br>Heat sink<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment |
| Steel components: impingement (missile) barriers | Missile barrier<br>Support for Criterion (a)(1) equipment |
| Steel components: jib cranes | Support for Criterion (a)(2) equipment |
| Steel components: monorails | Support for Criterion (a)(2) equipment |
| Steel component: primary shield wall (steel portion) | Enclosure protection<br>Missile barrier<br>Support for Criterion (a)(1) equipment |
| Steel components: reactor pressure vessel (RPV) support bearing plate | Support for Criterion (a)(1) equipment |

**Table 2.4-1 (Continued)**
**Reactor Building**
**Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| Steel components: SCV personnel airlocks and equipment hatch | Enclosure protection<br>Fire barrier<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Steel components: SCV personnel airlocks: locks, hinges, and closure mechanisms | Enclosure protection<br>Fire barrier<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Steel components: drywell personnel airlock, drywell combination equipment hatch and personnel door | Enclosure protection<br>Fire barrier<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Steel components: drywell personnel airlock, drywell combination equipment hatch and personnel door: locks, hinges, and closure mechanisms | Enclosure protection<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |

**Table 2.4-1 (Continued)
Reactor Building
Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| Steel components: shield building personnel doors, and equipment hatch | Enclosure protection<br>Fire barrier<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Steel components: shield building personnel doors and equipment hatch: locks, hinges, and closure mechanisms | Enclosure protection<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Steel components: sump liner plates | Enclosure protection<br>Pressure boundary<br>Support for Criterion (a)(1) equipment |
| Steel components: pressure retaining bolting | Pressure boundary<br>Support for Criterion (a)(1) equipment |
| Steel components: refueling platform equipment assembly and rails | Support for Criterion (a)(2) equipment |
| Steel elements: drywell head and finger pins | Enclosure protection<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment |
| Steel elements: drywell liner plate inner wall | Enclosure protection<br>Missile barrier<br>Support for Criterion (a)(1) equipment |
| Steel elements: drywell liner plate inner and outer walls, suppression pool inner wall, and weir wall liner plate | Enclosure protection<br>Missile barrier<br>Support for Criterion (a)(1) equipment |

**Table 2.4-1 (Continued)
Reactor Building
Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| Steel elements: (accessible areas): liner; liner anchors; integral attachments (steel containment vessel, floor, and suppression pool outer wall liner) | Enclosure protection<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |
| Steel elements (inaccessible areas): liner; liner anchors; integral attachments (steel containment vessel, floor and suppression pool outer wall liner) | Enclosure protection<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |
| Steel elements: liner; liner anchors; integral attachments (upper containment pool liner plate) | Enclosure protection<br>Support for Criterion (a)(1) equipment |
| Steel elements: upper containment pool gates | Enclosure protection<br>Support for Criterion (a)(1) equipment |
| Steel elements: SRV quencher support and restraint | Support for Criterion (a)(1) equipment |
| Steel elements: interior dome roof (steel framing) | Support for Criterion (a)(2) equipment |
| Support members: welds; bolted connections; support anchorage to building structure (supports and restraints for the reactor pressure vessel) | Support for Criterion (a)(1) equipment |
| ***Concrete*** | |
| Concrete (accessible areas): shield building; all | Enclosure protection<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (accessible areas): containment internal structures; all | Enclosure protection<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |

## Table 2.4-1 (Continued)
## Reactor Building
## Components Subject to Aging Management Review

| Component | Intended Function |
|---|---|
| Concrete (accessible areas): refueling canal | Enclosure protection<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (accessible areas): shield building; below grade exterior; foundation | Enclosure protection<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (accessible areas): shield building wall and dome; interior and above-grade exterior | Enclosure protection<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (inaccessible areas): shield building; all | Enclosure protection<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (inaccessible areas): containment internal structures; all | Enclosure protection<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (inaccessible areas): refueling canal | Enclosure protection<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (inaccessible areas): shield building; below grade exterior; foundation | Enclosure protection<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |

**Table 2.4-1 (Continued)**
**Reactor Building**
**Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| Concrete (inaccessible areas): shield building wall and dome; interior and above grade exterior | Enclosure protection<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |
| Masonry walls | Enclosure protection<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment |
| ***Other Materials*** | |
| Compressible and inflatable seals and gaskets for shield building equipment door and personnel doors | Pressure boundary<br>Support for Criterion (a)(1) equipment |
| Compressible and inflatable seals and gaskets for SCV equipment hatch cover, SCV personnel airlocks, drywell head, transfer tube, drywell combination hatch and personnel door | Pressure boundary<br>Support for Criterion (a)(1) equipment |
| Containment building penetration seals and sealant | Pressure boundary<br>Support for Criterion (a)(1) equipment |
| Inflatable seal for upper containment pool gates | Enclosure protection |
| Service Level I coatings | Support for Criterion (a)(2) equipment |

### 2.4.2 Water Control Structures

Description

The following water control structures are reviewed in this section.

- Standby Service Water (SSW) Cooling Tower, Pumphouse and Basin
- Service Water Cooling System Cooling Tower
- Service Water Pumps Foundation
- Service Water Cooling Heat Exchanger Foundation
- Service Water Pump Surge Tank and Chemical Injection Facility Foundation
- Service Water Cooling Electrical Switchgear Building and Transformers Foundations

*Standby Service Water Cooling Tower, Pumphouse and Basin*

The purpose of the SSW cooling tower, pumphouse and basin is to provide sufficient cooling water to permit safe shutdown and cooldown of the unit and to maintain it in a cold shutdown condition. The SSW cooling tower, pumphouse and basin provides the ultimate heat sink to support heat transfer for the SSW system.

The SSW cooling tower/pumphouse/basin consists of one seismic Category I cooling tower and one water storage basin. The SSW cooling tower and basin is a reinforced concrete structure supported on a soil bearing mat. The SSW cooling tower consists of four equal area cells, each having an induced draft fan system. The cells are completely isolated from each other and have separate missile-protected inlet distribution piping systems. The SSW cooling tower is supported by a foundation above the storage basin. The fans and tower internals are located inside the tower structure and are protected by the walls and roof. The tower's internal components include three-pass, close space polyvinyl chloride drift eliminators and a multi-cell dense vitreous clay fill. The standby cooling tower basin utilizes watertight concrete in the construction of mat and walls. The structure is tornado-missile protected and designed to seismic Category I requirements.

A pumphouse, associated with the basin, houses the SSW pumps and associated components. It consists of a concrete operating floor slab and exterior walls and roof to protect the seismic Category I equipment from tornado winds and missiles.

The SSW cooling tower and pumphouse have the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provide a flow path for cooling water for SSCs within the scope of license renewal. (10 CFR 54.4(a)(1))
- Maintain ultimate heat sink. (10 CFR 54.4(a)(1))
- Maintain structural integrity of SSCs such that safety functions are not affected. (10 CFR 54.4(a)(2))
- Provides physical support, shelter and protection for 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) or station blackout (10 CFR 50.63). (10 CFR 54.4(a)(3))

*Service Water Cooling System Cooling Tower*

The purpose of the service water cooling (SWC) system cooling tower is to support the normal service water (NSW) cooling system operations and provide the source of cooling water for plant systems and components required for safe shutdown of the reactor in the event of a fire in E, F and G tunnels.

The SWC system cooling tower, located east of the reactor building, is a nonsafety-related structure separated from safety-related systems, structures, and components such that its failure would not impact a safety function. The SWC system cooling tower is a concrete, rectangular, five-cell mechanical draft cooling tower with a pump structure, basin and flume. The SWC system cooling tower provides the heat sink for the NSW cooling system. The cooling tower basin and flume is constructed of reinforced concrete with a rectangular cross-section of variable width. Failure of the basin and flume would not jeopardize plant safety.

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

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

- Maintain structural integrity of SSCs whose failure could prevent satisfactory accomplishment of function(s) credited in the Appendix R safe shutdown analysis (10 CFR 50.48). (10 CFR 54.4(a)(3))

*Service Water Pumps Foundation*

The purpose of the service water pump foundation is to support the three NSW pumps mounted on the NSW pump foundation. The service water pump foundation is a nonsafety-related structure separated from safety-related systems, structures, and components such that its failure would not impact a safety function. The service water pumps foundation is a mat foundation constructed of reinforced concrete supported on structural backfill.

The service water pump foundation has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The service water pump foundation has the following intended function for 10 CFR 54.4(a)(3).

- Maintain structural integrity of SSCs whose failure could prevent satisfactory accomplishment of function(s) credited in the Appendix R safe shutdown analysis (10 CFR 50.48). (10 CFR 54.4(a)(3))

*Service Water Cooling Heat Exchanger Foundation*

The purpose of the SWC heat exchanger foundation is to provide support for the SWC heat exchangers, which provide cooling for service water in the normal service water cooling system. The SWC heat exchangers support the normal service water system, which provides the source of cooling water for plant systems and components required for safe shutdown of the reactor in the event of a fire in E, F and G tunnels.

The SWC heat exchanger foundation is a nonsafety-related structure separated from safety-related systems, structures, and components such that its failure would not impact a safety function. The SWC heat exchanger foundation is a mat foundation constructed of reinforced concrete supported on structural backfill.

The SWC heat exchanger foundation has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The SWC heat exchanger foundation has the following intended function for 10 CFR 54.4(a)(3).

- Maintain structural integrity of SSCs whose failure could prevent satisfactory accomplishment of function(s) credited in the Appendix R safe shutdown analysis (10 CFR 50.48). (10 CFR 54.4(a)(3))

*Service Water Pump Surge Tank and Chemical Injection Facility Foundation*

The purpose of the surge tank foundation is to support the 39,000-gallon surge tank. The purpose of the service water pump chemical injection facility is to support components used for water chemistry control in the NSW system to inhibit and to control corrosion and disperse particulates.

The service water pump surge tank and chemical injection foundation is located on a concrete truck platform on the west side of the reactor auxiliary building adjacent to the original in-plant solidification area.

The service water pump surge tank and chemical injection foundation has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The service water pump surge tank and chemical injection foundation has the following intended function for 10 CFR 54.4(a)(3).

- Maintain structural integrity of SSCs whose failure could prevent satisfactory accomplishment of function(s) credited in the Appendix R safe shutdown analysis (10 CFR 50.48). (10 CFR 54.4(a)(3))

*Service Water Cooling Electrical Switchgear Building and Transformers Foundations*

The purpose of the electrical switchgear building and transformer foundations is to provide space for switchgear and associated components. The electrical switchgear building and transformer foundations support the NSW system, which provides the source of cooling water for plant systems and components required for safe shutdown of the reactor in the event of a fire in E, F and G tunnels.

The service water cooling electrical switchgear building and transformer foundation is a nonsafety-related structure separated from safety-related systems, structures, and components such that its failure would not impact a safety function. The electrical switchgear building is a prefabricated galvanized metal building on a reinforced concrete foundation. The transformer foundations are reinforced concrete mat foundations.

The SWC electrical switchgear building and transformer foundations have no intended functions for 10 CFR 54.4(a)(1) and (a)(2).

The SWC electrical switchgear building and transformer foundations have the following intended function for 10 CFR 54.4(a)(3).

- Maintain structural integrity of SSCs whose failure could prevent satisfactory accomplishment of function(s) credited in the Appendix R safe shutdown analysis (10 CFR 50.48). (10 CFR 54.4(a)(3))

## USAR References

*SSW Cooling Tower, Pumphouse and Basin*

| | |
|---|---|
| Section 1.2.2.2 | Section 9.2.5.2 |
| Section 3.8.4.1.4 | Figure 1.2-44 |
| Section 3.8.4.4.4 | Figure 1.2-45 |

*SWC System Cooling Tower*

| | | |
|---|---|---|
| Section 1.2.2.2 | Figure 1.2-48 | Table 3.2-1 |

*Service Water Pumps Foundation*

None

*SWC Heat Exchanger Foundation*

Figure 1.2-48

*Service Water Pump Surge Tank and Chemical Injection Facility Foundation*

None

*SWC Electrical Switchgear Building and Transformer Foundations*

None

## Components Subject to Aging Management Review

Structural commodities are structural members that support or protect plant equipment including system components, piping, and electrical conductors. Structural commodities that are unique to the water control structures are included in this review. Those that are common to in-scope systems and structures (anchors, embedments, equipment supports, instrument panels, racks, cable trays, and conduits, etc.) are reviewed in Section 2.4.4, Bulk Commodities.

Table 2.4-2 lists the component types that require aging management review.

Table 3.5.2-2 provides the results of the aging management review.

**Table 2.4-2**
**Water Control Structures**
**Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| ***Steel and Other Metals*** | |
| Steel components: beams, columns, plates | Enclosure protection<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Steel components: monorail | Support for Criterion (a)(2) equipment |
| Steel components: roof opening covers | Enclosure protection<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Steel components: screen (SWC pump suction screens) | Support for Criterion (a)(3) equipment |
| Steel component: siding | Enclosure protection<br>Support for Criterion (a)(3) equipment |
| ***Concrete*** | |
| Concrete: all | Enclosure protection<br>Flood barrier<br>Heat sink<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (accessible areas): all | Enclosure protection<br>Flood barrier<br>Heat sink<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |

**Table 2.4-2 (Continued)**
**Water Control Structures**
**Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| Concrete (accessible areas): below grade exterior; foundation | Enclosure protection<br>Heat sink<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (accessible areas): exterior above-below grade; foundation; interior slab | Enclosure protection<br>Heat sink<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (accessible areas): interior and above grade exterior | Enclosure protection<br>Heat sink<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (inaccessible areas): all | Enclosure protection<br>Heat sink<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (inaccessible areas): exterior above-below grade; foundation; interior slab | Enclosure protection<br>Heat sink<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete: exterior above-below grade; foundation; interior slab | Enclosure protection<br>Heat sink<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |

**Table 2.4-2 (Continued)**
**Water Control Structures**
**Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| Masonry walls | Enclosure protection<br>Support for Criterion (a)(3) equipment |
| ***Other Materials*** | |
| Cooling tower drift eliminators (SSW and SWC cooling tower) | Heat sink<br>Support for Criterion (a)(2) equipment |
| Cooling tower tile fill (SSW and SWC cooling tower) | Heat sink<br>Support for Criterion (a)(2) equipment |

## 2.4.3 Turbine Building, Auxiliary Building, and Yard Structures

Description

The following structures are included in this review.

- Auxiliary Building
- Auxiliary Control Building
- Circulating Water Switchgear House No. 1
- Condensate Storage Tank Foundation
- Control Building
- Control House 230 kV Switchyard
- Diesel Generator Building
- Electrical Tunnels and Piping Tunnels
- Fire Protection Storage Tanks Foundations
- Fire Pump House
- Fuel Building
- Manholes, Handholes and Duct Banks
- Motor Generator Building
- Normal Switchgear Building
- Radioactive Waste Building
- Transformer and Switchyard Support Structures and Foundations
- Turbine Building Complex

*Auxiliary Building*

The purpose of the auxiliary building is to provide plant personnel with the necessary biological radiation shielding, protect the equipment inside from the effects of adverse conditions and provide protection to the cable and piping penetration areas of the reactor building.

The auxiliary building is a seismic Category I structure located immediately adjacent to and south of the reactor building. The turbine building adjoins the auxiliary building immediately to its south. Seismic rattle spaces are provided at the interface between the auxiliary building and both the reactor building and the turbine building. The auxiliary building houses the residual heat removal heat exchangers and pumps, core spray pumps, standby gas treatment equipment, and other safety-related equipment. The main steam tunnel passes through and is an integral part of this building. Other piping and electrical cables pass through this building in separate tunnels and connect with adjacent buildings. The auxiliary building is a reinforced concrete structure supported on a soil bearing reinforced concrete mat foundation. The exterior walls and roof are designed to provide tornado-missile protection. Concrete masonry walls are utilized in the auxiliary building and may be provided as removable, nonload-bearing type plugs for equipment removal. They consist of stacked concrete blocks, as required for shielding, and are contained by steel framing attached to the walls. This steel framing provides confinement of the concrete blocks. The reinforced concrete steam tunnel walls, floor, and roof protect the equipment outside the tunnel from the effects of a postulated steam line break within the tunnel.

The auxiliary building has the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provides physical support, shelter and protection for SSCs within the scope of license renewal. (10 CFR 54.4(a)(1))
- Provides physical support, shelter and protection for SSCs whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). (10 CFR 54.4(a)(2))
- Provide physical support, shelter and protection for 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) or station blackout (10 CFR 50.63). (10 CFR 54.4(a)(3))

*Auxiliary Control Building*

The purpose of the auxiliary control building is to provide an enclosed area for the auxiliary equipment, fire protection and other plant components.

The auxiliary control building is located adjacent to and south of the radwaste building and west of the heater bay portion of the turbine building. The auxiliary control building houses control panels for water treatment, fire protection, liquid and solid radwaste, sanitary sewage, etc., in the auxiliary control room on the second level. The auxiliary control room contains controls for balance of plant. The first floor houses the decontamination area, hot machine shop, and associated storage and office facilities. The auxiliary control building is a multi-story structural steel framed building with a concrete block exterior. The building is supported on soil bearing reinforced concrete mat foundation. The north lower level floor forms a portion of the ceiling for the electrical tunnel. This floor area is a rated fire barrier.

The auxiliary control building has no intended function for 10 CFR 54.4(a)(1).

The auxiliary control building has the following intended functions for 10 CFR 54.4(a)(2) and (a)(3).

- Provides physical support, shelter and protection for SSCs whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). (10 CFR 54.4(a)(2))

- Provide physical support, shelter and protection for 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). (10 CFR 54.4(a)(3))

*Circulating Water Switchgear House No. 1*

The purpose of the circulating water pump structure is to provide support to the circulating water pump structure and components identified in the shutdown analysis that are relied upon for support of fire area PT-1.

The circulating water switchgear house No.1 located adjacent to the circulating water pump structure, is a nonsafety-related structure separated from safety-related systems, structures, and components such that its failure would not impact a safety function. The circulating water switchgear house No.1 houses the switchgear components in support of the circulating water pump structure and components identified in the safe shutdown analysis. The structure consists of concrete masonry and metal siding with steel support columns, supported on a reinforced concrete foundation.

The circulating water switchgear house No.1 has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The circulating water switchgear house No.1 has the following intended function for 10 CFR 54.4(a)(3).

- Maintain structural integrity of systems, structures, and components whose failure could prevent satisfactory accomplishment of function(s) credited in the Appendix R safe shutdown analysis (10 CFR 50.48). (10 CFR 54.4(a)(3))

*Condensate Storage Tank Foundation*

The purpose of the condensate storage tank foundation is to provide support for one condensate storage tank. Failure of the condensate storage tank during accident conditions would not preclude plant safe shutdown or post-accident mitigation processes. However, the condensate storage tank is credited in the four-hour coping analysis for station blackout. Therefore, the foundation supporting the condensate storage tank performs an intended function for license renewal.

The condensate storage tank foundation located north of the reactor building is a nonsafety-related structure separated from safety-related systems, structures, and components such that its failure would not impact a safety function. The condensate storage tank foundation is a reinforced concrete slab on a compacted subgrade.

The condensate storage tank foundation has no intended functions for 10 CFR 54.4(a)(1) and (a)(2).

The condensate storage tank foundation has the following intended function for 10 CFR 54.4(a)(3).

- Provides physical support, shelter, and protection for SSCs 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))

*Control Building*

The purpose of the control building is to provide support for the major controls and related equipment necessary to start up, operate, and shut down the plant. The control building is located east of and adjacent to the auxiliary building; however, it is structurally independent.

The control building is a multi-story reinforced concrete structure including walls, floors, and roof. The building is supported on soil bearing reinforced concrete mat foundation. The lowest level is below-grade and connected to the electric tunnel west of the control building. The exterior walls and roof are constructed of thick reinforced concrete and designed to provide tornado-missile protection. The interior floors have concrete decks supported on steel framing. Fire barrier walls are located throughout the building to mitigate the consequences of a fire. Penetrations in these barriers are sealed for the required level of fire protection or have been evaluated to be adequate to withstand the fire hazards associated with the area in which they are installed. Concrete masonry walls are utilized in the control buildings and are provided as removable, nonload-bearing type plugs for equipment removal. They consist of stacked concrete blocks, as required for shielding, and are contained by steel framing attached to the walls. Steel framing provides confinement of the concrete blocks. The control room and the HVAC equipment room are maintained at a positive pressure with respect to the outside and remainder of the building. The building ventilation system has been protected against the effects of a tornado by providing special doors which can withstand a drop in pressure. The main control room is also provided with a suspended ceiling, which is seismically designed.

The control building has the following intended functions for 10 CFR 54.4(a)(1), (a)(2) or (a)(3).

- Provide physical support, shelter and protection for SSCs within the scope of license renewal. (10 CFR 54.4(a)(1))

- Provides physical support, shelter and protection for SSCs whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). (10 CFR 54.4(a)(2))

- Provide physical support, shelter and protection for SSCs 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), for components credited in the Appendix R safe shutdown analysis (10 CFR 50.48) or station blackout (10 CFR 50.63). (10 CFR 54.4(a)(3))

*Control House 230 kV Switchyard*

The purpose of the control house (also known as the Fancy Point relay house) is to provide a protected area for the relay panels which control commodities within the switchyard.

The control house 230 kV switchyard is a nonsafety-related structure separated from safety related systems, structures, and components such that its failure would not impact a safety function. The control house is a prefabricated metal building supported on a reinforced concrete foundation.

The control house 230 kV switchyard has no intended functions for 10 CFR 54.4(a)(1) and (a)(2).

The control house 230 kV switchyard has the following intended function for 10 CFR 54.4(a)(3).

- Provides physical support, shelter, and protection for SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commissions' regulations for station blackout (10 CFR 50.63). (10 CFR 54.4(a)(3))

*Diesel Generator Building*

The purpose of the diesel generator building is to provide housing for the emergency diesel generators and associated equipment located in each of three separate rooms.

The diesel generator building is a seismic Category I structure enclosing three diesel generators and their associated equipment and separated from the control building by a seismic rattle space. Three fuel oil storage tanks are located in the lower level of the building, covered with sand, with their fuel oil pumps housed in the individual diesel generator rooms. The building is equipped with missile-protected, pressure and watertight, and other specialty doors to meet design conditions.

The diesel generator building is divided into three separate rooms constructed of reinforced concrete walls and roof. Each diesel generator is housed in these rooms within the structure. The dividing walls between each room are fire barriers. There are no major openings in the walls separating the diesel generators. The diesel generator building reinforced concrete structure is founded on a soil bearing mat. The thick exterior walls and roof are designed to provide tornado-missile protection. Floors and roof are reinforced concrete formed with metal deck supported by steel framing. All ventilation intakes are arranged to preclude penetration from tornado-generated missiles. The diesel generator exhaust, including the muffler, is also arranged to provide protection from missiles.

The diesel generator building has the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provides physical support, shelter and protection for SSCs within the scope of license renewal. (10 CFR 54.4(a)(1))
- Provides physical support, shelter and protection for SSCs whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). (10 CFR 54.4(a)(2))
- Provides physical support, shelter and protection for 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). (10 CFR 54.4(a)(3))

*Electrical Tunnels and Piping Tunnels*

The purpose of the electrical tunnels and piping tunnels is to provide physical support, shelter and protection of the piping and electrical components used in support of plant operations.

The electrical tunnels and piping tunnels are seismic Category I structures below grade. The electrical tunnels and piping tunnels contain seismic Category I systems and are constructed of reinforced concrete. The tunnel walls and roof are either of sufficient thickness to provide missile protection, or the tunnels are buried underground as required for missile protection. The tunnels are isolated from adjoining structures by a seismic rattle space except that they are integrally connected to the adjacent structures when required to prevent sliding, overturning or flotation. The electrical and piping tunnels are protected from external flooding by sealing the shake-space between the tunnels and the adjoining structures using waterstops and flexible seals and by providing penetrations below grade with air and water seals, as applicable.

The electrical tunnels and piping tunnels have the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3)

- Provides physical support, shelter and protection for SSCs within the scope of license renewal. (10 CFR 54.4(a)(1))

- Provides physical support, shelter and protection for SSCs whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). (10 CFR 54.4(a)(2))
- Provides physical support, shelter and protection for 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) or station blackout (10 CFR 50.63). (10 CFR 54.4(a)(3))

*Fire Protection Storage Tanks Foundations*

The purpose of the fire water storage tanks foundations is to provide support for the two fire water storage tanks. The tanks are part of the fire water system and contain adequate storage capability to satisfy the demand requirements of the fire protection system.

The fire protection storage tanks foundations are individual foundations located adjacent to and south of the fire pump house. The fire water storage tanks foundations are nonsafety-related structures separated from safety-related systems, structures, and components such that its failure would not impact a safety function. The fire water storage tanks foundations are circular reinforced concrete foundations supported on structural fill.

The fire protection storage tanks foundations have no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The fire protection storage tanks foundations have the following intended function for 10 CFR 54.4 (a)(3).

- Provides physical support, shelter and protection for 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). (10 CFR 54.4(a)(3))

*Fire Pump House*

The purpose of the fire pump house is to provide space for three fire pumps (one motor driven and two diesel driven) and a jockey pump. The structure also provides space for domestic water and make-up water systems.

The fire pump house is a prefabricated metal building with structural steel framing and built-up roofing with exterior walls consisting of galvanized steel siding. The interior walls are of concrete block construction. The entire structure is supported on a reinforced concrete foundation supported on structural fill. Three-hour fire barriers consisting of concrete block walls separate the fire pumps, located in cubicles within the structure. The pumps take their suction from two vertical ground-level water storage tanks located south of the structure.

The fire pump house has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The fire pump house has the following intended function for 10 CFR 54.4 (a)(3).

- Provides physical support, shelter and protection for 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). (10 CFR 54.4(a)(3))

*Fuel Building*

The purpose of the fuel building is to house the new fuel, spent fuel, spent fuel storage or shipping casks, associated handling equipment, fuel pool cooling and cleanup system equipment, and fuel building air filtration equipment.

The fuel building is a seismic Category I structure located immediately adjacent to and north of the reactor building. A seismic rattle space is provided between the fuel building and the reactor building. The fuel transfer tube allows direct transfer of spent fuel from the reactor containment into the fuel building spent fuel pool, while keeping the fuel building structurally independent of the reactor building.

The fuel building is reinforced concrete structure founded on a soil bearing reinforced concrete mat foundation. The spent fuel storage pool has reinforced concrete walls lined with stainless steel plates. Leak detection channels are included in the liner design. The structural components of the fuel building are designed for tornado protection. The spent fuel cask pool is separated from the spent fuel pool by a reinforced concrete wall. The fuel building pools consist of three separate but interconnected stainless steel-lined concrete pools. The spent fuel storage pool is the largest of these pools. Adjacent to the fuel storage pool are the cask pool and the lower transfer pool. Each of these two pools is separated from the fuel storage pool by a full-height wall broken by a watertight gate. The watertight gates are normally open. Concrete masonry walls are utilized in Seismic Category I structures, specifically in the fuel building, to provide removable, nonload-bearing type plugs for equipment removal. They consist of stacked concrete blocks, as required for shielding, and are contained by steel framing attached to the walls. Steel framing provides confinement of the concrete blocks.

The new fuel storage vault is provided with 12 separate steel covers to prevent moisture and debris from entering the vault. The covers are fabricated solid steel checked plate, with steel grating attached to the underside. The covers are attached to the fuel building floor by hinges. Gasket material is attached to the fuel building floor providing a seal around the perimeter of the new fuel vault between the covers and the floor. A 125-ton spent fuel cask trolley is used to remove the spent fuel cask from cask storage pool inside the fuel building for shipment on the railroad car. The crane runway girders are supported off the steel columns of the cask handling storage area. The crane is fitted with an auxiliary bridge. A 15-ton bridge crane is provided over portions of the building for handling and transferring new fuel to the fuel storage vault. This trolley's rails are mounted on the centerlines of the auxiliary bridge girders and span their entire length.

The fuel building has the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provides physical support, shelter and protection for SSCs within the scope of license renewal. (10 CFR 54.4(a)(1))
- Maintain structural integrity of SSCs whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). (10 CFR 54.4(a)(2))
- Provides physical support, shelter and protection for 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). (10 CFR 54.4(a)(3))

*Manholes, Handholes and Duct Banks*

The purpose of manholes, handholes and duct banks is to provide structural support, shelter and protection to systems, structures, and components that are relied on in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulated events for components that are housed within these structures both during normal plant operation, and during and following postulated design basis accidents.

Manholes and handholes consist of reinforced concrete rectangular box structures buried underground with a reinforced concrete panel on top. The manholes have an opening and a cover to allow access. There are safety-related and nonsafety-related manholes located in the yard area. The safety-related manholes are generally provided with a steel plate over the standard manhole cover or a thick concrete cover for missile protection.

In some instances, adjacent to each manhole is a handhole structure, which is physically independent of the manhole structure but does become part of the underground duct as it ties into it on both sides of the manhole structure. These handholes may also provide access to communication cables located within the duct run.

Manholes, handholes and duct banks allow underground routing of cables and some piping. The redundant trains of Class 1E electrical cable are routed through Category I manholes and handholes which are either entirely separate or designed with separating, reinforced concrete walls between the trains.

Duct banks comprise 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 cables between structures and switchyard areas. Duct banks that are buried shallow in the yard may be provided with a reinforced concrete protection slab that is cast over the duct bank.

These structures have the following intended functions for 10 CFR 54.4(a)(1), (a)(2) and (a)(3).

- Provides physical support, shelter and protection for SSCs within the scope of license renewal. (10 CFR 54.4(a)(1))
- Provides physical support, shelter, and protection for SSCs whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). (10 CFR 54.4(a)(2))
- Provides physical support, shelter, and protection for SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commissions' regulations for fire protection (10 CFR 50.48) and station blackout (10 CFR 50.63). (10 CFR 54.4(a)(3))

*Motor Generator Building*

The purpose of the motor generator building is to house two motor-generator sets, motors, and motor generator control panels used for operating the reactor recirculation pumps. The motor generator sets do not supply any safety function.

The motor generator building is located on the east side and adjacent to the reactor building. The north wall is the fuel building and the south wall is the auxiliary building. The remaining portion of the structure is steel framing with metal siding and composite roof. The motor generator building is supported on a reinforced concrete mat foundation on structural fill. A seismic rattle space is provided at the interface between the auxiliary building and the reactor building.

The motor generator building has no intended functions for 10 CFR 54.4(a)(1) or (a)(3).

The motor generator building has the following intended function for 10 CFR 54.4(a)(2).

- Maintain structural integrity of SSCs whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1) (10 CFR 54.4(a)(2))

*Normal Switchgear Building*

The purpose of the normal switchgear building is to provide housing for electrical switchgear components in support of station operation.

The normal switchgear building is located west of the adjacent to and south of the control building. The normal switchgear building also connects to the electrical tunnel. The normal switchgear building does not house safe shutdown equipment, but equipment supporting use of normal service water is credited in the event of a fire in E, F, and G tunnels. The exterior walls and roof are constructed of concrete and concrete block. The interior floors have concrete decks supported on steel framing. The building is supported on soil bearing reinforced concrete mat foundation.

The normal switchgear building has no intended functions for 10 CFR 54.4(a)(1) or (a)(2).

The normal switchgear building has the following intended function for 10 CFR 54.4(a)(3).

- Maintain structural integrity of SSCs whose failure could prevent satisfactory accomplishment of function(s) credited in the Appendix R safe shutdown analysis (10 CFR 50.48). (10 CFR 54.4(a)(3))

*Radioactive Waste Building*

The purpose of the radioactive waste (radwaste) building is to house the equipment dedicated to the collection and processing of liquid and solid radioactive waste material. The design of the radwaste building has been verified to demonstrate that the structure does not collapse under seismic and tornadic loading conditions and impair the integrity of any adjacent seismic Category I structure.

The radwaste building is located west of the reactor building and separated from the reactor building by a driveway. The radwaste building contains storage facilities and equipment for the treatment of radioactive gas, liquid, and solid waste material. The radwaste building is constructed of reinforced concrete supported on a mat foundation. Concrete walls, removable concrete blocks, labyrinths, and pipe chases are used to shield the process equipment in the radwaste building, including valves and piping. Watertight concrete mixes are utilized for the foundation mat and exterior walls up to five feet above the mat level to retain the spillage within the building.

The radwaste building has no intended functions for 10 CFR 54.4(a)(1) or (a)(3)

The radwaste building has the following intended function for 10 CFR 54.4(a)(2).

- Maintain structural integrity of SSCs whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). (10 CFR 54.4(a)(2)]

*Transformer and Switchyard Support Structures and Foundations*

The purpose of transformer and switchyard support structures and foundations is to provide structural support to systems, structures, and components that are relied on in safety analysis or plant evaluations to perform a function that demonstrates compliance with the Commission's regulation for station blackout, specifically those necessary to recover offsite power following a station blackout.

The transformer and switchyard support structures and foundations are located in the switching station and 230 kV switchyard. The switching station is located adjacent to and south of the turbine building. The 230 kV switchyard is located an additional distance south of the turbine building.

The structures that provide physical support to the switching station and 230 kV switchyard components in the station blackout offsite power recovery path include the transformer foundations and foundations for the associated switchyard breakers, switchyard bus, switchyard towers, cable duct banks, and cable trenches. Therefore, the transformers and supporting structures are within the scope of license renewal based on the criterion of 10 CFR 54.4(a)(3). The transformer yard foundations are reinforced concrete pedestals that are supported by a reinforced concrete spread footing at grade or below grade. Structural steel members support the electrical components necessary for the electrical distribution system in the switchyards and are supported by the reinforced concrete pedestals. Transmission and pull-off towers are steel tower structures supported on reinforced concrete pier foundations. The transformer and switchyard support structures include the transformer and breaker foundations and supporting steel.

The transformer and switchyard support structures and foundations have no intended functions for (10 CFR 54.4(a)(1) or (a)(2).

The transformer and switchyard support structures and foundations have the following intended function for 10 CFR 54.4(a)(3).

- Provides physical support, shelter, and protection for SSCs 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))

*Turbine Building Complex*

The purpose of the turbine building complex is to house the turbine generator, condenser, moisture separator, etc., in the turbine building areas; heaters and related pumps and accessories in heater bay areas; and off-gas system equipment and tanks in off-gas areas.

The turbine building complex is located immediately adjacent to and south of the auxiliary building, with the main steam tunnel passing through north-south and terminating at the turbine generator. The turbine building complex includes the turbine building, heater bays, main steam tunnel, condensate demineralizer regenerative and off-gas area, and fire protection room. Heater bays are located west of the turbine building. The condensate demineralizer and off-gas areas are located immediately adjacent to and south of the heater bays.

The following sections describe the turbine building complex structures.

*Turbine Building*

The structure is constructed of structural steel and metal roof decking and exterior siding above the operating floor and of reinforced concrete below the operating floor. The upper floors are concrete supported by steel deck and beams except floors serving the moisture separator reheater and hoist area, which are of steel grating on beams. The turbine building roof consists of metal roof deck, insulation, and built-up roofing. Insulated metal siding is used for the exterior walls. The off-gas area is constructed of concrete walls and floors. A seismic rattle space is provided between the turbine building complex and the adjacent structures, such as the auxiliary building and the auxiliary control building. Horizontal and vertical waterstops are provided at construction joints below grade to provide watertightness. The turbine building complex is founded on select granular fill using spread footings for walls and columns. One overhead crane is provided above the operating level of the turbine building for major equipment handling during maintenance.

*Heater Bay*

The heater bay is a concrete and steel structure. A basement floor slab is provided. The upper floors include the mezzanine floor and operating floor. These upper floors are concrete supported by steel deck and beams except floors serving point heaters are of steel grating on beams. The heater bay roof consists of concrete in some areas and metal roof deck in other areas.

*Main Steam Tunnel Area*

The main steam tunnel connects the north end of the turbine building and the auxiliary building with a three-inch shake space. The structure is founded on soil-bearing reinforced concrete mat. The thickness of the reinforced concrete walls, slab, and roof meet both structural and radiation shielding requirements.

*Condensate Demineralizer and Off-Gas Area*

The condensate demineralizer and off-gas area is a multi-level structure consisting of concrete and steel construction. The structure is founded on thick reinforced concrete, continuous and combined footings, and the walls, floors, and roof meet both radiation shielding and structural requirements. Wherever radiation shielding is not required, insulated metal wall panels and steel roof deck are used. The roof is covered with rigid insulation and built-up roofing.

*Fire Protection Room*

The fire protection room is located on the southeastern quadrant of the turbine building. This structure houses fire protection piping components. The structure and roof is of concrete and steel construction. The floor is supported by the electrical tunnel.

The turbine building complex has no intended functions for 10 CFR 54.4(a)(1).

The turbine building complex has the following intended functions for 10 CFR 54.4(a)(2) and (a)(3).

- Maintain structural integrity of SSCs whose failure could prevent satisfactory accomplishment of function(s) identified for 10 CFR 54.4(a)(1). (10 CFR 54.4(a)(2))
- Provide physical support, shelter and protection for SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commissions' regulations for fire protection (10 CFR 50.48) or station blackout (10 CFR 50.63). (10 CFR 54.4(a)(3))

<u>USAR References</u>

*<u>Auxiliary Building</u>*

| | | |
|---|---|---|
| Section 3.8.4.1.1 | Figure 1.2-14 | Figure 1.2-17 |
| Section 3.8.4.4 | Figure 1.2-15 | Figure 1.2-18 |
| Figure 1.2-13 | Figure 1.2-16 | Figure 1.2-19 |

*<u>Auxiliary Control Building</u>*

| | |
|---|---|
| Section 9A.2.5.10 | Figure 9A.2-3 |

*Circulating Water Switchgear House No. 1*

None

*<u>Condensate Storage Tank Foundation</u>*

| | |
|---|---|
| Section 9.2.6 | Table 3.2-1 |

*Control Building*

| | | |
|---|---|---|
| Section 3.8.4.1.3 | Figure 1.2-24 | Table 3.2-1 |
| Section 3.8.4.4.3 | Figure 1.2-25 | |
| Section 3.8.4.4 | Figure 1.2-26 | |
| Section 9A.2.5.2 | Figure 1.2-27 | |

*Control House 230kV Switchyard*

None

*Diesel Generator Building*

Section 1.2.2.2

Section 3.8.4.1.5

*Electrical Tunnels and Piping Tunnels*

Section 3.8.4.1.7

Section 3.8.4.4.7

*Fire Protection Storage Tanks Foundations*

None

*Fire Pump House*

Section 9.5.1.2.2

Section 9A.2.5.12

*Fuel Building*

| | | |
|---|---|---|
| Section 1.2.2.2 | Section 9.1.4.1.2 | Figure 9.1-33 |
| Section 3.8.4.1.2 | Figure 1.2-20 | Figure 9.1-34 |
| Section 9.1.1.2 | Figure 1.2-21 | Figure 9.1-35 |
| Section 9.1.2.2 | Figure 1.2-22 | |
| Section 9.1.2.2.2 | Figure 1.2-23 | |

*Manholes, Handholes and Duct Banks*

None

*Motor Generator Building*

Figure 1.2-4

*Normal Switchgear Building*

Section 9A.3.7.5

*Radioactive Waste Building*

| | |
|---|---|
| Section 3.7.2.8A | Figure 1.2-29 |
| Section 3.8.4.1 | Figure 1.2-30 |
| Section 3.8.4.4.8 | Figure 1.2-31 |
| Section 3.8.5.1.2 | Figure 1.2-32 |
| Section 12.3.2.2.1 | |

*Transformer and Switchyard Support Structures and Foundations*

None

*Turbine Building Complex*

| | | |
|---|---|---|
| Section 1.2.2.2 | Figure 1.2-33 | Figure 1.2-39 |
| Section 3.8.4.1.9 | Figure 1.2-34 | Figure 1.2-40 |
| Section 3.8.4.4.9 | Figure 1.2-35 | |
| Section 3.8.5.1.2 | Figure 1.2-36 | |
| Section 9A.2.5.18 | Figure 1.2-37 | |
| Section 15C.4 | | |

Components Subject to Aging Management Review

Structural commodities are structural members that support or protect plant equipment including system components, piping, and electrical conductors. Structural commodities that are unique to the turbine building and other structures are included in this review. Those that are common to in-scope systems and structures (anchors, embedments, equipment supports, instrument panels, racks, cable trays, and conduits, etc.) are reviewed in Section 2.4.4, Bulk Commodities.

Table 2.4-3 lists the component types that require aging management review.

Table 3.5.2-3 provides the results of the aging management review.

**Table 2.4-3**
**Turbine Building, Auxiliary Building and Yard Structures**
**Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| ***Steel and Other Metals*** | |
| Control room ceiling support system | Support for Criterion (a)(1) equipment |
| Cranes: rails and structural girders | Support for Criterion (a)(2) equipment |
| Steel components: fuel building fuel handling platform | Support for Criterion (a)(1) equipment |
| Steel components: fuel building pool liner plate and gates | Enclosure protection<br>Support for Criterion (a)(1) equipment |
| Steel components: fuel storage pool gates | Enclosure protection<br>Support for Criterion (a)(1) equipment |
| Steel components: monorails | Support for Criterion (a)(2) equipment |
| Steel components: pressure relief louvers (blow-off panels) | Support for Criterion (a)(2) equipment |
| Steel components: all structural steel | Enclosure protection<br>Missile protection<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Steel components: metal siding | Enclosure protection<br>Support for Criterion (a)(2) equipment |
| Steel components: missile barriers | Missile barrier<br>Support for Criterion (a)(2) equipment |
| Steel components: roof decking or floor decking | Enclosure protection |
| Transmission tower, pull-off tower | Support for Criterion (a)(3) equipment |
| ***Concrete*** | |
| Beams, columns and floor slabs | Enclosure protection<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |

**Table 2.4-3 (Continued)**
**Turbine Building, Auxiliary Building and Yard Structures**
**Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| Concrete (accessible areas): all | Enclosure protection<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (accessible areas): interior and above-grade exterior | Enclosure protection<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (accessible areas): exterior above- and below-grade; foundation | Enclosure protection<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (inaccessible areas): all | Enclosure protection<br>Missile barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Concrete (inaccessible areas): exterior above- and below-grade; foundation | Enclosure protection<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Duct banks | Enclosure protection<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Foundations (e.g., switchyard, transformers, tanks, circuit breakers) | Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Manholes and handholes | Enclosure protection<br>Fire barrier<br>Flood barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |

**Table 2.4-3 (Continued)**
**Turbine Building, Auxiliary Building and Yard Structures**
**Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| Masonry walls | Enclosure protection<br>Fire barrier<br>Flood barrier<br>Support for Criterion (a)(2) equipment |
| ***Other Materials*** | |
| Inflatable seal for spent fuel storage pool gates | Enclosure protection |

### 2.4.4 Bulk Commodities

Description

Bulk commodities subject to aging management review are structural components or commodities that perform or support intended functions of in-scope SSCs. Bulk commodities unique to a specific structure are included in the review for that structure (Sections 2.4.1, 2.4.2, and 2.4.3). Bulk commodities common to in-scope SSCs (e.g., concrete embedments and anchors, bolted connections/bolting, component supports, cable trays, compressible joints and seals, conduit, decking, doors [including air locks and bulkhead doors], electrical panels and enclosures, hatches/plugs, instrument panels and racks, miscellaneous steel, racks, piping and equipment supports, tube track supports) are addressed in this review.

Bulk commodities evaluated in this section are designed to support both safety-related and nonsafety-related equipment during normal and accident conditions in the event of external events (tornadoes, earthquakes, floods, missiles) and internal events (LOCA, pipe breaks).

Bulk commodities are structural components that support the various intended functions performed by the structures in which they are located. These functions for 10 CFR 54.4(a)(1), (a)(2), and (a)(3) include the following.

- Provide support, shelter and protection for SSCs within the scope of license renewal. (10 CFR 54.4(a)(1))
- Maintain integrity of SSCs such that safety functions are not affected. (10 CFR 54.4(a)(2))
- Provide support and protection for SSCs credited in the Appendix R safe shutdown analysis or for fire protection (10 CFR 50.48), for environmental qualification (10 CFR 50.49), for anticipated transients without scram (10 CFR 50.62), or for station blackout (10 CFR 50.63). (10 CFR 54.4(a)(3))

Insulation may have the specific intended functions of (1) maintaining local area temperatures within design limits or (2) maintaining integrity such that falling insulation does not damage safety-related equipment.

USAR References

None

Components Subject to Aging Management Review

Bulk commodities subject to aging management review are structural components or commodities that perform or support intended functions of in-scope SSCs. Bulk commodities unique to a specific structure are addressed in the aging management review for that structure. Bulk commodities common to in-scope SSCs (anchors, embedments, pipe and equipment supports, instrument panels and racks, cable trays, conduits, etc.), as well as seismic II/I supports, are included in this evaluation. Insulation is subject to aging management review if it performs an intended function as described above.

Table 2.4-4 lists the component types that require aging management review.

Table 3.5.2-4 provides the results of the aging management review.

**Table 2.4-4**
**Bulk Commodities**
**Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| *Steel and Other Metals* | |
| Anchorage/embedments | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Cable tray | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Conduit | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Doors | Enclosure protection<br>Flood barrier<br>Missile barrier<br>Pressure boundary |
| Fire doors | Fire barrier<br>Support for Criterion (a)(3) equipment |
| Fire hose reels | Support for Criterion (a)(3) equipment |
| Fire protection components: miscellaneous steel, including framing steel, curbs, vents and louvers, radiant energy shields, tray covers | Fire barrier<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Manways, hatches, manhole covers and hatch covers | Enclosure protection<br>Flood barrier<br>Missile barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Mirror insulation | Support for Criterion (a)(2) equipment |
| Missile shields | Enclosure protection<br>Missile barrier |

**Table 2.4-4 (Continued)**
**Bulk Commodities**
**Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| Miscellaneous steel (decking, framing, grating, handrails, ladders, enclosure plates, platforms, stairs, vents and louvers, framing steel, etc.) | Enclosure protection<br>Flood barrier<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment |
| Penetration seals (end caps) | Enclosure protection<br>Fire barrier<br>Flood barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment |
| Penetration sleeves (mechanical/electrical not penetrating SCV boundary) | Enclosure protection<br>Fire barrier<br>Flood barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment |
| Racks, panels, cabinets and enclosures for electrical equipment and instrumentation | Enclosure protection<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Supports for ASME Class 1, 2, 3 piping and components (constant and variable load spring hangers; guides; stops) | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |
| Support members; welds; bolted connections; support anchorage to building structure | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Tube track | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| ***Bolted Connections*** | |
| Anchor bolts | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |

**Table 2.4-4 (Continued)
Bulk Commodities
Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| High-strength structural bolting (supports for ASME Class 1, 2, and 3 piping and components) | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(3) equipment |
| Structural bolting; structural steel and miscellaneous steel connections, including high strength bolting (decking, grating, handrails, ladders, platforms, stairs, vents and louvers, framing steel, etc.) | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Structural bolting | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| ***Concrete*** | |
| Building concrete at locations of expansion and grouted anchors; grout pads for support base plates | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Equipment pads/foundations | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Curbs | Flood barrier<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Manways, hatches/plugs, manhole covers and hatch covers | Fire barrier<br>Flood barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |
| Missile shields | Missile barrier |
| Structural fire barriers, walls, ceilings, floor slabs, curbs, dikes | Fire barrier |
| Support pedestals | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment<br>Support for Criterion (a)(3) equipment |

**Table 2.4-4 (Continued)**
**Bulk Commodities**
**Components Subject to Aging Management Review**

| Component | Intended Function |
|---|---|
| *Other Materials* | |
| Compressible joints and seals | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment |
| Fire stops | Fire barrier |
| Fire wrap | Fire barrier |
| Insulation (includes jacketing, wire mesh, tie wires, straps, clips) | Insulation<br>Support for Criterion (a)(2) equipment |
| Penetration seals | Enclosure protection<br>Fire barrier<br>Flood barrier<br>Pressure boundary<br>Support for Criterion (a)(2) equipment |
| Roof membranes | Enclosure protection<br>Support for Criterion (a)(2) equipment |
| Seals and gaskets (doors, manways and hatches) | Flood barrier<br>Pressure boundary<br>Support for Criterion (a)(1) equipment |
| Vibration isolators | Support for Criterion (a)(1) equipment<br>Support for Criterion (a)(2) equipment |

## 2.5 SCOPING AND SCREENING RESULTS: ELECTRICAL AND INSTRUMENTATION AND CONTROL SYSTEMS

Description

As stated in Section 2.1.1, plant electrical and instrumentation and control (I&C) systems are included in the scope of license renewal as are electrical and I&C components in mechanical systems. The default inclusion of plant electrical and I&C systems in the scope of license renewal is the bounding approach used for the scoping of electrical systems.

The basic philosophy used in the electrical and I&C components integrated plant assessment is that components are included in the review unless specifically screened out. When used with the plant spaces approach, this method eliminates the need for unique identification of individual components and specific component locations. This assures components are not improperly excluded from an aging management review.

The electrical and I&C integrated plant assessment began by grouping the total population of components into commodity groups. The commodity groups include similar electrical and I&C components with common characteristics. Component level intended functions of the commodity groups were identified. During the screening process, commodity groups and specific plant systems were eliminated from further review if they did not perform or support an intended function.

In addition to the plant electrical systems, certain switchyard components used to restore offsite power following a station blackout (SBO) were conservatively included within the scope of license renewal even though those components are not relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for station blackout (10 CFR 50.63). The April 1, 2002, SBO guidance letter[1] and NUREG-1800 Section 2.5.2.1.1 provide scoping guidance to include equipment needed for off-site power recovery, which includes equipment not explicitly required for compliance with 10 CFR 50.63.

LRA Drawing LRA-EE-001A depicts the electrical interconnection between RBS and the offsite transmission network. LRA Drawing LRA-EE-001A identifies major components or commodities associated with restoration of off-site power following an SBO. The highlighted portions depict the components in the SBO recovery path that are subject to aging management review. Components in the off-site power circuits that are not highlighted have no intended function for license renewal and thus are not subject to aging management review.

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1. NRC to NEI, "Staff Guidance on Scoping of Equipment Relied on to Meet the Requirements of the Station Blackout (SBO) Rule (10 CFR 50.63) for License Renewal (10 CFR 54.4(a)(3))," letter dated April 1, 2002 (ISG-02). ADAMS accession number ML020920464.

USAR References

Additional details for electrical systems and commodities can be found in USAR Chapters 7 and 8.

Scoping Boundaries

Plant electrical and I&C systems are included in the scope of license renewal as are electrical and I&C components in mechanical systems.

RBS preferred (offsite) plant power is provided by two physically and electrically independent 230 kV lines originating in the 230 kV bays of the Fancy Point Substation or Switchyard and terminating at RBS transformer Yards 1 and 2A. The two 230 kV preferred (offsite) power source lines are on separate sets of transmission towers with the tower spacing greater than the tower height to preclude a falling tower from disabling both offsite circuits. The 230 kV transmission line terminating in transformer Yard 1 is carried by the east 230 kV towers/right-of-way. It powers two preferred station service transformers (1RTX-XSR1C and 1RTX-XSR1E). The 230 kV transmission line terminating in transformer Yard 2A is carried by the west 230 kV towers/right-of-way. It powers the other two preferred station service transformers (1RTX-XSR1D and 1RTX-XSR1F). Only preferred station service transformers 1RTX-XSR1C & 1RTX-XSR1D supply power to the nonsafety-related buses (1NNS-SWG1A and 1NNS-SWG1B) and to the safety-related buses (1ENS-SWG1A and 1ENS-SWG1B). Safety-related buses 1ENS-SWG1A and 1ENS-SWG1B may also receive power from their respective standby diesel generators, should the preferred power be unavailable. All safety-related loads receive power from these two buses. RBS takes no credit for backfeeding through the main transformers as an offsite power source.

The SBO recovery path extends from the onsite electrical distribution system to the 230 kV switchyard and site transformer yard. This recovery path includes Fancy Point Switchyard, and the 230 kV Electrical Distribution systems. Electrical components or commodities in the SBO recovery path include electrical distribution switchgear (including components in the switchyard control house), service station transformers, switchyard circuit breakers and disconnects, and associated overhead or underground circuits including control circuits (including battery systems). Passive components in the recovery path are subject to aging management review.

Steel transmission towers and foundations as well as structures supporting and housing batteries, breakers, disconnects, transformers, transmission conductors, and switchyard bus, utilized in the off-site power recovery path are evaluated in Section 2.4, Scoping and Screening Results: Structures.

Commodity Groups Subject to AMR

As discussed in Section 2.1.2.3.1, RBS passive electrical commodity groups correspond to two of the passive commodity groups identified in NEI 95-10:

- High voltage insulators.
- Cables and connections, bus, electrical portions of electrical and I&C penetration assemblies (this group includes fuse holders outside of cabinets of active electrical components).

The commodity group "Cables and connections, bus, electrical portions of electrical and I&C penetration assemblies" is further subdivided into the following.

- Cable connections (metallic parts)
- Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements
- Electrical cables and connections subject to 10 CFR 50.49 EQ requirements[1]
- Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits
- EIC penetration cables and connections not subject to 10 CFR 50.49 EQ requirements[2]
- Fuse holders– insulation material
- Fuse holders– metallic clamp
- Inaccessible power ($\geq$ 400 V) cables (e.g., installed underground in conduit, duct bank or direct buried) not subject to 10 CFR 50.49 EQ requirements
- Metal enclosed bus–bus / connections
- Metal enclosed bus–enclosures assemblies (elastomers, external surfaces)
- Metal enclosed bus–insulation / insulators
- Switchyard bus and connections
- Transmission conductors and connections
- Uninsulated ground conductors[3]

1. RBS electrical cables and connections subject to 10 CFR 50.49 EQ requirements are not subject to aging management review since the components are subject to replacement based on qualified life.
2. All RBS electrical and I&C penetration assemblies are in the EQ Program (10 CFR 50.49). RBS electrical and I&C penetration assemblies in the EQ Program are not subject to aging management review since the components are subject to replacement based on qualified life.
3. RBS uninsulated ground conductors limit equipment damage in the event of a circuit failure but do not perform a license renewal intended function.

Commodity Groups Not Subject to AMR

*Electrical and I&C Penetration Assemblies*

All RBS electrical and I&C penetration assemblies are in the EQ program (10 CFR 50.49). RBS electrical and I&C penetration assemblies in the EQ program are subject to replacement based on their qualified life, so they are not subject to aging management review. Non-EQ cables and connections to electrical and I&C penetrations are evaluated in the insulated cable and connection commodity group.

*Fuse Holders – Metallic Clamp*

A review of RBS documents (e.g., drawings, procedures, USAR, RBS equipment database functional location list, and electrical design basis documents) identified fuse holders. No circuits with a license renewal intended function with fuse holders were identified needing further evaluation. From reviewing the fuses and associated drawings, a determination was made that each fuse holder was part of an active component.

*Metal-Enclosed Bus*

A review of RBS documents (e.g., drawings, procedures, USAR, RBS equipment database functional location list, and electrical design basis documents) did not identify any metal-enclosed buses with a license renewal intended function.

*Uninsulated Ground Conductors*

A review of the RBS USAR did not identify a license renewal intended function for uninsulated ground conductors. These components are not safety-related and are not credited for mitigation of regulated events. Industry and plant-specific operating experience for uninsulated ground conductors does not indicate credible failure modes that would adversely affect an intended function; therefore, credible uninsulated ground conductor failures that could prevent satisfactory accomplishment of safety functions are hypothetical. As discussed in Section 2.1.3.1.2 of NUREG-1800 and Section III.c(iii) of the Statements of Consideration (60FR22467), hypothetical failures that are not part of the current licensing basis and have not been previously experienced are not required to be considered for license renewal scoping.

Table 2.5-1 lists the component types that require aging management review.

Table 3.6.2 provides the results of the aging management review.

**Table 2.5-1**
**Electrical and I&C Systems**
**Components Subject to Aging Management Review**

| Structure and/or Component/Commodity | Intended Function |
|---|---|
| Cable connections (metallic parts) | Conducts electricity |
| Insulation material for electrical cables and connections (including terminal blocks, fuse holders, etc.) not subject to 10 CFR 50.49 EQ requirements | Insulation (electrical) |
| Insulation material for electrical cables not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits | Insulation (electrical) |
| Fuse holders (not part of active equipment): insulation material | Insulation (electrical) |
| Conductor insulation for inaccessible power cables ($\geq$ 400 V) (e.g., installed underground in conduit, duct bank or direct buried) not subject to 10 CFR 50.49 EQ requirements | Insulation (electrical) |
| High voltage insulators (for SBO recovery) | Insulation (electrical) |
| Switchyard bus and connections (for SBO recovery) | Conducts electricity |
| Transmission conductors and connectors (for SBO recovery) | Conducts electricity |

# 3.0 AGING MANAGEMENT REVIEW RESULTS

This section provides the results of the aging management review (AMR) for structures and components identified in Section 2 as subject to aging management review. Tables 3.0-1, 3.0-2, and 3.0-3 provide descriptions of the mechanical, structural, and electrical service environments, respectively, used in the AMRs to determine aging effects requiring management.

Results of the AMRs are presented in the following two table types.

- **Table 3.x.1** where

  **3** indicates the table pertaining to a Section 3 aging management review.

  **x** indicates the table number from NUREG-1800 (Ref. 3.0-1).

  **1** indicates that this is the first table type in Section 3.x.

For example, in the reactor coolant system section, this is Table 3.1.1, and in the engineered safety features section, this is Table 3.2.1. For ease of discussion, these table types will hereafter be referred to as "Table 1." These tables are derived from the corresponding tables in NUREG-1800 and present summary information from the AMRs.

- **Table 3.x.2-y** where

  **3** indicates the application section number.

  **x** indicates the table number from NUREG-1800.

  **2** indicates that this is the second table type in Section 3.x.

  **y** indicates the system table number.

For example, within the reactor coolant system subsection, the AMR results for the reactor vessel are presented in Table 3.1.2-1, and the results for the reactor vessel internals are in Table 3.1.2-2. In the engineered safety features subsection, the pressure relief system results are presented in Table 3.2.2-1, and the high pressure core spray system is in Table 3.2.2-2. For ease of discussion, these table types will hereafter be referred to as "Table 2." These tables present the results of the AMRs.

## TABLE DESCRIPTION

Table 1

The purpose of a Table 1 is to provide a summary comparison of how the RBS AMR results align with the corresponding table of NUREG-1800. These tables are essentially the same as Tables 3.1-1 through 3.6-1 provided in NUREG-1800 as amended by applicable Interim Staff Guidance documents, with the following exceptions.

- The "ID" (identification) column is labeled "Item Number" and the number has been expanded to include the table number.
- The "Type" column has been deleted. Items applicable to pressurized water reactors (PWRs) only are noted as such.
- The "Rev 2 Item" and "Rev 1 Item" columns have been replaced by a "Discussion" column.

The "Item Number" column provides a means to cross-reference to Table 1 from the Table 2s.

Information in the following columns of Table 1 is taken directly from NUREG-1800.

- Component
- Aging Effect/Mechanism
- Aging Management Programs
- Further Evaluation Recommended

Further information is provided in the "Discussion" column. The Discussion column explains, in summary, how the RBS evaluations align with NUREG-1800 and NUREG-1801 (Ref. 3.0-2). The following are examples of information that might be contained within this column:

- Any "Further Evaluation Recommended" information or reference to the location of that information.

- The name of a plant-specific program being used.

- Exceptions to the NUREG-1800 and NUREG-1801 assumptions.

- A discussion of how the line item is consistent with the corresponding line item in NUREG-1800, when it may not be intuitively obvious.

- A discussion of how the line item is different from the corresponding line item in NUREG-1800, when it may appear to be consistent.

Table 2

Table 2s provide the results of the aging management reviews for those structures and components identified in Section 2 as being subject to aging management review. There is a Table 2 for each aging management review within a system group. For example, the engineered safety features system group contains tables specific to the pressure relief, high pressure core spray, residual heat removal, low pressure core spray, reactor core isolation cooling, and standby gas treatment systems, as well as a table for containment penetrations.

Table 2s also provide a comparison of the AMR results with the AMR results in NUREG-1801. Comparison to NUREG-1801 is performed by considering the component type, material, environment, aging effect requiring management (AERM), and aging management program (AMP) listed in each Table 2 line item to determine the degree of consistency with an appropriate NUREG-1801 line item, if one exists. The comparison is documented in columns 7, 8, and 9, as discussed below.

Each Table 2 consists of the following nine columns.

*Component Type*

Column 1 identifies the component types from Section 2 of this application that are subject to aging management review, with the addition of insulated piping components.

The term "piping" in component lists includes pipe and pipe fittings (such as elbows, flued heads, reducers, tees, etc.). The term "Insulated piping components" may include insulated indoor tanks with capacity less than or equal to 100,000 gallons.

*Intended Function*

Column 2 identifies the license renewal intended functions (using abbreviations where necessary) for the listed component types. Definitions and abbreviations of intended functions are listed in Table 2.0-1 in Section 2.

*Material*

Column 3 lists the particular materials of construction for the component type being evaluated.

*Environment*

Column 4 lists the environment to which the component types are exposed. Internal and external service environments are indicated using (int) or (ext), respectively. A description of these environments is provided in Tables 3.0-1, 3.0-2, and 3.0-3 for mechanical, structural, and electrical components, respectively.

*Aging Effect Requiring Management*

Column 5 lists the aging effects requiring management for material and environment combinations for each component type.

*Aging Management Programs (AMP)*

Column 6 lists the programs used to manage the aging effects requiring management.

*NUREG-1801 Item*

Each combination of the following factors listed in Table 2 is compared to NUREG-1801 to identify consistencies.

- Component type
- Material
- Environment
- Aging effect requiring management
- Aging management program

Column 7 documents identified consistencies by noting the appropriate NUREG-1801 item number. If there is no corresponding item number in NUREG-1801 for a particular combination of factors, column 7 is left blank.

Comparisons of system and structure aging management results to NUREG-1801 items are generally within the corresponding system group and preferably within the specific system or structure. For example, aging management results for the high pressure core spray system will generally be compared to NUREG-1801 ESF system results in Chapter V, and preferably to items in Table V.D2 for the emergency core cooling systems for BWRs. In some cases where a particular aging management review result has no valid comparison within the system group, a comparison is made outside the system group. For example, a material, environment, aging effect, and program combination in the high pressure core spray aging management results may have no comparable item in the NUREG-1801, ESF system results, but a match can be found in the auxiliary systems tables.

*Table 1 Item*

Column 8 lists the corresponding line item from Table 1. If there is no corresponding item in NUREG-1800, then column 8 is left blank.

Each combination of the following that has an identified NUREG-1801 item number also has a Table 1 line item reference number.

- Component type
- Material

- Environment
- Aging effect requiring management
- Aging management program

*Notes*

Column 9 contains notes that are used to describe the degree of consistency with the line items in NUREG-1801. Notes that use letter designations are standard notes based on Table 4.2-2 of NEI 95-10 (Ref. 3.0-3). Notes that use numeric designators are specific to the plant site.

Some of the NUREG-1801 evaluations refer to plant-specific programs. In these cases, Note E is used for correlations between the combination in Table 2 and a combination for a line item in NUREG-1801.

## FURTHER EVALUATION REQUIRED

The Table 1s in NUREG-1800 indicate that further evaluation is necessary for certain aging effects and other issues discussed in NUREG-1800. Section 3 includes discussions of these issues numbered in accordance with the discussions in NUREG-1800. The discussions explain the site's approach to these areas requiring further evaluation.

## REFERENCES

3.0-1 NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Revision 2, U. S. Nuclear Regulatory Commission, December 2010.

3.0-2 NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Revision 2, U. S. Nuclear Regulatory Commission, December 2010.

3.0-3 NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule*, Revision 6, Nuclear Energy Institute (NEI), June 2005.

**Table 3.0-1**
**Service Environments for Mechanical Aging Management Reviews**

| RBS AMR Environment | Description | Corresponding NUREG-1801 Environments |
|---|---|---|
| Air – indoor | Air in an environment protected from precipitation. | Air – indoor uncontrolled<br>Air with metal temperature up to 288°C (550°F)<br>Air with reactor coolant leakage<br>Air with steam or water leakage<br>System temperature up to 288°C (550°F) |
| Air – outdoor | The outdoor environment consists of atmospheric air, ambient temperature and humidity, and exposure to precipitation. | Air – outdoor |
| Concrete | Components in contact with concrete. | Concrete |
| Condensation | Air and condensation on surfaces of indoor systems with temperatures below dew point; condensation is considered untreated water due to potential for surface contamination. For compressed air systems with dryers, condensation may be conservatively identified as the internal environment. | Condensation |
| Exhaust gas | Gases, fluids, particulates present in diesel engine exhaust. | Diesel exhaust |
| Fuel oil | Diesel oil, No. 2 oil, or other liquid hydrocarbons used to fuel diesel engines, boilers, etc. | Fuel oil |
| Gas | Internal dry non-corrosive gas environments such as nitrogen, carbon dioxide, Freon, and Halon. | Gas |
| Lube oil | Lubricating oils are low to medium viscosity hydrocarbons used for bearing, gear, and engine lubrication. An oil analysis program may be credited to preclude water contamination. | Lubricating oil |
| Neutron fluence | Neutron flux integrated over time. Neutron fluence is specified as an environment for the limiting reactor vessel components with material properties that may be significantly affected by neutron irradiation. | Neutron flux<br>High fluence (> $1 \times 10^{21}$ n/cm$^2$, E > 0.1 million electron volts [MeV]) |

**Table 3.0-1 (Continued)**
**Service Environments for Mechanical Aging Management Reviews**

| RBS AMR Environment | Description | Corresponding NUREG-1801 Environments |
|---|---|---|
| Raw water | Consists of untreated surface or ground water, whether fresh, brackish, or saline in nature, or water not treated by a chemistry program such as water supplied from an off-site source for fire protection. | Raw water |
| Sodium pentaborate solution | Treated water mixed with sodium pentaborate. (SLC system) | Sodium pentaborate solution |
| Soil | External environment for components buried in the soil; exposure to ground water is assumed in soil environments. | Soil |
| Steam | Steam, subject to a water chemistry program. In determining aging effects, steam is considered treated water. | Steam<br>Reactor coolant |
| Treated water | Treated water is demineralized water and is the base water for all clean systems.[1] | Treated water<br>Closed-cycle cooling water<br>Raw water (potable)<br>Reactor coolant |
| Treated water > 140°F | Treated water above the stress corrosion cracking (SCC) threshold for stainless steel. | Treated water > 60°C (> 140°F)<br>Closed-cycle cooling water > 60°C (> 140°F)<br>Reactor coolant |
| Treated water > 482°F | Treated or demineralized water above thermal embrittlement threshold for cast austenitic stainless steel (CASS). | Treated water > 250°C (> 482°F)<br>Reactor coolant > 250°C (> 482°F) |
| Waste water | Water in liquid waste drains such as in liquid radioactive waste systems, oily waste systems, floor drainage systems, chemical waste water systems, and secondary waste water systems. Waste waters may contain contaminants, including oil and boric acid, as well as treated water not monitored by a chemistry program. | Waste water |

1. For the aging management review process and the Table 2 presentation of review results, "treated water" encompasses a range of water types, all of which were chemically treated or demineralized. These water types include treated water, reactor coolant, raw (potable) water, and closed cycle cooling water as defined in NUREG-1801. In the Table 2 results, the type of water can normally be inferred from the context of the result (e.g., if Water Chemistry Control – Closed Treated Water Systems is the aging management program, then the treated water is equivalent to closed cycle cooling water as defined by NUREG-1801). Where such an inference is not clear, a plant-specific note identifies the water type.

   For the comparison of the aging management review results with those of NUREG-1801, as presented in the last three Table 2 columns, and for the summary of results discussed in Table 1, the NUREG-1801 definitions of water types were used. In other words, the "treated water" listed in the results was compared to the corresponding water type of NUREG-1801. The discussions in Table 1, and in the text sections referenced in Table 1 for further evaluation, use the water types defined by NUREG-1801. In these discussions, "treated water" refers only to water controlled by the Water Chemistry Control – BWR Program.

## Table 3.0-2
## Service Environments for Structural Aging Management Reviews

| RBS AMR Environment | Description | Corresponding NUREG-1801 Environments |
|---|---|---|
| Air – indoor uncontrolled | Air with temperature less than 150°F, humidity up to 100 percent and protected from precipitation. The air – indoor uncontrolled (external) environment is for indoor locations that are sheltered or protected from weather. Humidity levels up to 100 percent are assumed and the surfaces of components in this environment may be wet. This environment may contain aggressive chemical species including oxygen, halides, sulfates, or other aggressive corrosive substances that can influence the nature, rate, and severity of corrosion effects. It is assumed that these contaminants can concentrate to levels that will promote corrosive effects because of factors such as cyclic (wet-dry) condensation, contaminated insulation, accidental contamination, or leakage areas. | Air – indoor uncontrolled |
| Air – outdoor | Exposed to the weather with air temperature less than 115°F, humidity up to 100 percent.. This environment is subject to periodic wetting and wind. This environment may contain aggressive chemical species including chlorides, oxygen, halides, sulfates, or other aggressive corrosive substances that can influence the nature, rate, and severity of corrosion effects. | Air – outdoor |

**Table 3.0-2 (Continued)**
**Service Environments for Structural Aging Management Reviews**

| RBS AMR Environment | Description | Corresponding NUREG-1801 Environments |
|---|---|---|
| Exposed to fluid environment | Fluid environment for structures at RBS is defined as raw water or treated water.<br>• Raw water – Water from the Mississippi River provides the source of raw water utilized at RBS. Raw water is also rain or ground water. Raw water is water that has not been demineralized or chemically treated to any significant extent. Raw water may contain contaminants. RBS building sumps may be exposed to a variety of untreated water that is classified as raw water for the determination of aging effects.<br>• Treated water – Treated water is demineralized water or chemically purified water and is the base water for clean systems. Treated water could be deaerated and include corrosion inhibitors, biocides, or some combination of these treatments. | Ground water<br>Treated water<br>Treated water > 140°F<br>Water – flowing<br>Water – standing |
| Soil | External environment for components at the air/ soil interface, buried in the soil, or exposed to groundwater in the soil. This environment can be "aggressive or "non-aggressive" depending on its soil properties as defined in NUREG-1801. | Soil |

**Table 3.0-3**
**Service Environments for Electrical Aging Management Reviews**

| RBS AMR Environment | Description | Corresponding NUREG-1801 Environments |
|---|---|---|
| Air – indoor controlled | This environment is one to which the specified internal or external surface of the component or structure is exposed; a humidity-controlled (i.e., air-conditioned) environment. For electrical purposes, control must be sufficient to eliminate the cited aging effects of contamination and oxidation without affecting the resistance. | Air – indoor controlled |
| Air – indoor uncontrolled | Uncontrolled indoor air is associated with systems with temperatures higher than the dew point (i.e., condensation can occur, but only rarely; equipment surfaces are normally dry). | Air – indoor uncontrolled |
| Air – outdoor | The outdoor environment consists of moist, possibly salt-laden atmospheric air, ambient temperatures and humidity, and exposure to weather, including precipitation and wind. The component is exposed to air and local weather conditions, including salt water spray (if present). A component is considered susceptible to a wetted environment when it is submerged, has the potential to collect water, or is subject to external condensation. | Air – outdoor |
| Heat, moisture, or radiation and air | Condition in a limited plant area that is significantly more severe than the plant design environment for the cable or connection insulation materials caused by heat, radiation, or moisture, and air. | Adverse localized environment caused by heat, radiation or moisture |
| Significant moisture | Condition in a limited plant area that is significantly more severe than the plant design environment for the cable or connection insulation materials caused by significant moisture (moisture that lasts more than a few days—e.g., cable in standing water) | Adverse localized environment caused by significant moisture |

# 3.1 REACTOR VESSEL, INTERNALS AND REACTOR COOLANT SYSTEM

## 3.1.1 Introduction

This section provides the results of the aging management reviews for components in the reactor vessel, internals and reactor coolant system (RCS) that are subject to aging management review. The following component groups are addressed in this section (component group descriptions are available in the referenced sections).

- Reactor Vessel (Section 2.3.1.1.1)
- Reactor Vessel Internals (Section 2.3.1.1.2)
- Reactor Coolant Pressure Boundary (Section 2.3.1.2)
- Miscellaneous RCS systems in Scope for 10 CFR 54.4(a)(2) (Section 2.3.1.7)

Table 3.1.1, Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the RCS component groups. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

## 3.1.2 Results

The following tables summarize the results of aging management reviews and the NUREG-1801 comparison for the reactor vessel, internals and reactor coolant system components.

- Table 3.1.2-1 Reactor Vessel—Summary of Aging Management Evaluation
- Table 3.1.2-2 Reactor Vessel Internals—Summary of Aging Management Evaluation
- Table 3.1.2-3 Reactor Coolant Pressure Boundary—Summary of Aging Management Evaluation

*Miscellaneous RCS Systems in Scope for 10 CFR 54.4(a)(2)*

- Table 3.1.2-4-1 Nuclear Boiler Instrumentation System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.1.2-4-2 Reactor Recirculation System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

### 3.1.2.1 Materials, Environments, Aging Effects Requiring Management, and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the reactor vessel, internals and reactor coolant system components. Programs are described in Appendix B. Further details are provided in related tables.

3.1.2.1.1 Reactor Vessel

**Materials**

Reactor vessel components are constructed of the following materials.

- Carbon steel
- Carbon steel clad with stainless steel
- High-strength low-alloy steel
- Nickel alloy
- Stainless steel

**Environments**

Reactor vessel components are exposed to the following environments.

- Air – indoor
- Neutron fluence
- Treated water
- Treated water > 140°F

**Aging Effects Requiring Management**

The following aging effects associated with the reactor vessel require management.

- Cracking
- Cracking – fatigue
- Loss of material
- Loss of preload
- Reduction of fracture toughness

**Aging Management Programs**

The following aging management programs manage the aging effects for the reactor vessel components.

- Bolting Integrity

- BWR CRD Return Line Nozzle
- BWR Feedwater Nozzle
- BWR Penetrations
- BWR Stress Corrosion Cracking
- BWR Vessel ID Attachment Welds
- BWR Vessel Internals
- Flow-Accelerated Corrosion
- Inservice Inspection
- One-Time Inspection
- Reactor Head Closure Studs
- Reactor Vessel Surveillance
- Water Chemistry Control – BWR

3.1.2.1.2 Reactor Vessel Internals

**Materials**

Reactor vessel internals components are constructed of the following materials.

- Cast austenitic stainless steel (CASS)
- CASS with stellite hard facing
- Nickel alloy
- Stainless steel

**Environments**

Reactor vessel internals components are exposed to the following environments.

- Air – indoor
- Neutron fluence
- Treated water
- Treated water > 140°F
- Treated water > 482°F

**Aging Effects Requiring Management**

The following aging effects associated with the reactor vessel internals require management.

- Cracking
- Cracking – fatigue
- Loss of material
- Loss of material – wear
- Loss of preload

- Reduction of fracture toughness

**Aging Management Programs**

The following aging management programs manage the aging effects for the reactor vessel internals components.

- BWR Vessel Internals
- Inservice Inspection
- Water Chemistry Control – BWR

3.1.2.1.3 Reactor Coolant Pressure Boundary

**Materials**

Reactor coolant pressure boundary components are constructed of the following materials.

- Carbon steel
- CASS
- High-strength steel
- Nickel alloy
- Stainless steel

**Environments**

Reactor coolant pressure boundary components are exposed to the following environments.

- Air – indoor
- Lube oil
- Steam
- Treated water
- Treated water > 140°F
- Treated water > 482°F

**Aging Effects Requiring Management**

The following aging effects associated with the reactor coolant pressure boundary require management.

- Cracking
- Cracking – fatigue
- Loss of material

- Loss of material – FAC
- Loss of preload
- Reduction of fracture toughness

**Aging Management Programs**

The following aging management programs manage the aging effects for the reactor coolant pressure boundary components.

- Bolting Integrity
- BWR Stress Corrosion Cracking
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Inservice Inspection
- Oil Analysis
- One-Time Inspection
- One-Time Inspection – Small-Bore Piping
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems

3.1.2.1.4 Miscellaneous RCS Systems in Scope for 10 CFR 54.4(a)(2)

The following lists encompass materials, environments, aging effects requiring management, and aging management programs for the series 3.1.2-4-x tables.

**Materials**

Nonsafety-related components affecting safety-related systems are constructed of the following materials.

- Aluminum (Al)
- Carbon steel
- Copper alloy > 15% zinc (Zn) or > 8% aluminum
- Glass
- Nickel alloy
- Stainless steel

**Environments**

Nonsafety-related components affecting safety-related systems are exposed to the following environments.

- Air – indoor
- Lube oil

- Treated water
- Waste water

**Aging Effects Requiring Management**

The following aging effects associated with nonsafety-related components affecting safety-related systems require management.

- Cracking – fatigue
- Loss of material
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the aging effects for nonsafety-related components affecting safety-related systems.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Water Chemistry Control – BWR

### 3.1.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.1.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the RBS approach to these areas requiring further evaluation. Programs are described in Appendix B.

#### 3.1.2.2.1 Cumulative Fatigue Damage

Fatigue is considered a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3 for the reactor vessel, selected components of the reactor vessel internals, and most components of the reactor coolant pressure boundary. TLAAs are evaluated in accordance with 10 CFR 54.21(c). The evaluation of fatigue for the reactor vessel is discussed in Section 4.3.1.1.

The evaluation of fatigue TLAA for the ASME Class 1 portions of the reactor coolant pressure boundary piping and components, including those for interconnecting systems, is discussed in Sections 4.3.1.3 through 4.3.1.5.

3.1.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

1. This paragraph in NUREG-1800 pertains to PWR steam generators and is therefore not applicable to RBS.

2. This paragraph in NUREG-1800 pertains to PWR steam generator shell assemblies and is therefore not applicable to RBS.

3.1.2.2.3 Loss of Fracture Toughness due to Neutron Irradiation Embrittlement

1. Neutron irradiation embrittlement is a TLAA evaluated for the period of extended operation in accordance with 10 CFR 54.21(c). The evaluation of loss of fracture toughness for the reactor vessel beltline shell and welds is discussed in Section 4.2.

2. The Reactor Vessel Surveillance Program manages reduction in fracture toughness due to neutron embrittlement of reactor vessel beltline materials. RBS is a participant in the Boiling Water Reactor Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP). This program manages changes in the fracture toughness properties of ferritic materials in the reactor pressure vessel (RPV) beltline region. The Reactor Vessel Surveillance Program is described in Appendix B, Section B.1.37.

3. This paragraph in NUREG-1800 pertains to a plant-specific TLAA for Babcock and Wilcox reactor internals and is therefore not applicable to RBS.

3.1.2.2.4 Cracking due to Stress Corrosion Cracking (SCC) and Intergranular Stress Corrosion Cracking (IGSCC)

1. Cracking due to SCC and IGSCC of the nickel alloy nozzle and stainless steel reactor vessel closure head flange leak detection line will be managed by the Water Chemistry Control – BWR and One-Time Inspection Programs. The leak detection line flow path from the nickel alloy nozzle to the drain is carbon steel. The stainless steel portion of the vessel flange leak detection line is an instrumentation branch line supplying a pressure switch. The Water Chemistry Control – BWR Program minimizes contaminants which promote SCC. The One-Time Inspection Program will use visual or other nondestructive examination (NDE) techniques to verify the absence of significant cracking of the line.

2. This paragraph in NUREG-1800 pertains to BWR isolation condenser components. RBS does not have an isolation condenser, so this paragraph was not used.

3.1.2.2.5 Crack Growth due to Cyclic Loading

This paragraph in NUREG-1800 applies to PWRs only.

3.1.2.2.6 Cracking due to Stress Corrosion Cracking

Both paragraphs in NUREG-1800 apply to PWRs only.

3.1.2.2.7 Cracking due to Cyclic Loading

This paragraph in NUREG-1800 pertains to BWR isolation condenser components. Since RBS does not have an isolation condenser, this paragraph was not used.

3.1.2.2.8 Loss of Material due to Erosion

This paragraph in NUREG-1800 applies to PWRs only.

3.1.2.2.9 Removed as a result of LR-ISG-2011-04

This paragraph was removed from NUREG-1800 by LR-ISG-2011-04.

3.1.2.2.10 Removed as a result of LR-ISG-2011-04

This paragraph was removed from NUREG-1800 by LR-ISG-2011-04.

3.1.2.2.11 Cracking due to Primary Water Stress Corrosion Cracking (PWSCC)

Both paragraphs in NUREG-1800 apply to PWRs only.

3.1.2.2.12 Removed as a result of LR-ISG-2011-04

This paragraph was removed from NUREG-1800 by LR-ISG-2011-04.

3.1.2.2.13 Removed as a result of LR-ISG-2011-04

This paragraph was removed from NUREG-1800 by LR-ISG-2011-04.

3.1.2.2.14 Removed as a result of LR-ISG-2011-04

This paragraph was removed from NUREG-1800 by LR-ISG-2011-04.

3.1.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of RBS quality assurance procedures and administrative controls for aging management programs.

3.1.2.2.16 Ongoing Review of Operating Experience

See Appendix B Section B.0.4 for discussion of RBS operating experience review programs.

### 3.1.2.3 Time-Limited Aging Analyses

TLAAs identified for the reactor coolant system include reactor vessel neutron embrittlement and metal fatigue. These topics are addressed in Section 4.

## 3.1.3 Conclusion

The reactor vessel, internals, and reactor coolant system components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21. The aging management programs selected to manage the effects for the reactor vessel, internals, and reactor coolant system components are identified in Section 3.1.2.1 and in the following tables. A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the reactor vessel, internals, and reactor coolant system components will be managed such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

**Table 3.1.1**
**Summary of Aging Management Programs for the Reactor Coolant System Evaluated in Chapter IV of NUREG-1801**

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-1 | High strength, low-alloy steel top head closure stud assembly exposed to air with potential for reactor coolant leakage | Cumulative fatigue damage due to fatigue | Fatigue is a TLAA, evaluated for the period of extended operation (See SRP, Sec 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1)) | Yes, TLAA | Fatigue is a TLAA.<br>See Section 3.1.2.2.1. |
| 3.1.1-2 | PWR only | | | | |
| 3.1.1-3 | Stainless steel or nickel alloy reactor vessel internal components exposed to reactor coolant and neutron flux | Cumulative fatigue damage due to fatigue | Fatigue is a TLAA, evaluated for the period of extended operation (See SRP, Sec 4.3 “Metal Fatigue,” for acceptable methods to comply with 10 CFR 54.21(c)(1)) | Yes, TLAA | Fatigue is a TLAA.<br>See Section 3.1.2.2.1. |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-4 | Steel pressure vessel support skirt and attachment welds | Cumulative fatigue damage due to fatigue | Fatigue is a TLAA, evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1)) | Yes, TLAA | Fatigue is a TLAA.<br>See Section 3.1.2.2.1. |
| 3.1.1-5 | PWR only | | | | |
| 3.1.1-6 | Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy reactor coolant pressure boundary components: piping, piping components, and piping elements exposed to reactor coolant | Cumulative fatigue damage due to fatigue | Fatigue is a TLAA, evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1)) | Yes, TLAA | Fatigue is a TLAA.<br>See Section 3.1.2.2.1. |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-7 | Steel (with or without nickel-alloy or stainless steel cladding), or stainless steel; or nickel alloy reactor vessel components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds exposed to reactor coolant | Cumulative fatigue damage due to fatigue | Fatigue is a TLAA, evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1)) | Yes, TLAA | Fatigue is a TLAA.<br>See Section 3.1.2.2.1. |
| 3.1.1-8 | PWR only | | | | |
| 3.1.1-9 | PWR only | | | | |
| 3.1.1-10 | PWR only | | | | |
| 3.1.1-11 | Steel or stainless steel pump and valve closure bolting exposed to high temperatures and thermal cycles | Cumulative fatigue damage due to fatigue | Fatigue is a TLAA, evaluated for the period of extended operation (See SRP, Sec 4.3 "Metal Fatigue," for acceptable methods to comply with 10 CFR 54.21(c)(1)) | Yes, TLAA | Fatigue is a TLAA.<br>See Section 3.1.2.2.1. |
| 3.1.1-12 | PWR only | | | | |

**Table 3.1.1: Reactor Coolant System**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-13 | Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds exposed to reactor coolant and neutron flux | Loss of fracture toughness due to neutron irradiation embrittlement | TLAA is to be evaluated in accordance with Appendix G of 10 CFR Part 50 and RG 1.99. The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations | Yes, TLAA | Fatigue is a TLAA.<br>See Section 3.1.2.2.3 Item 1. |
| 3.1.1-14 | Steel (with or without cladding) reactor vessel beltline shell, nozzles, and welds; safety injection nozzles | Loss of fracture toughness due to neutron irradiation embrittlement | Chapter XI.M31, "Reactor Vessel Surveillance" | Yes, plant specific or integrated surveillance program | Consistent with NUREG-1801. The Reactor Vessel Surveillance Program will manage loss of fracture toughness of the reactor vessel beltline materials.<br>See Section 3.1.2.2.3 Item 2. |
| 3.1.1-15 | PWR only | | | | |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-16 | Stainless steel and nickel alloy top head enclosure vessel flange leak detection line | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking | A plant-specific aging management program is to be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC in the vessel flange leak detection line. | Yes, plant-specific | The main leak detection line is carbon steel. Cracking of the nickel alloy nozzle and the stainless steel instrument line off the main leak detection line is managed by the One-Time Inspection and Water Chemistry Control – BWR Programs.<br>See Section 3.1.2.2.4 Item 1. |
| 3.1.1-17 | Stainless steel isolation condenser components exposed to reactor coolant | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking | Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry" for BWR water, and a plant-specific verification program | Yes, detection of aging effects is to be evaluated | This item was not used. RBS does not have an isolation condenser.<br>See Section 3.1.2.2.4 Item 2. |
| 3.1.1-18 | PWR only | | | | |
| 3.1.1-19 | PWR only | | | | |
| 3.1.1-20 | PWR only | | | | |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-21 | Steel and stainless steel isolation condenser components exposed to reactor coolant | Cracking due to cyclic loading | Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components. The [inservice inspection] ISI program is to be augmented by a plant-specific verification program. | Yes, detection of aging effects is to be evaluated | This item was not used. RBS does not have an isolation condenser.<br>See Section 3.1.2.2.7. |
| 3.1.1-22 | PWR only | | | | |
| 3.1.1-23 | [There is no 3.1.1-23 in NUREG-1800 as modified by the ISGs.] | | | | |
| 3.1.1-24 | [There is no 3.1.1-24 in NUREG-1800 as modified by the ISGs.] | | | | |
| 3.1.1-25 | PWR only | | | | |
| 3.1.1-26 | [There is no 3.1.1-26 in NUREG-1800 as modified by the ISGs.] | | | | |
| 3.1.1-27 | [There is no 3.1.1-27 in NUREG-1800 as modified by the ISGs.] | | | | |
| 3.1.1-28 | PWR only | | | | |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-29 | Nickel alloy core shroud and core plate access hole cover (welded covers) exposed to reactor coolant | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking | Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry," and for BWRs with a crevice in the access hole covers, augmented inspection using [ultrasonic testing] UT or other acceptable techniques | No | Cracking of nickel alloy elements of the shroud support access hole cover is managed by the BWR Vessel Internals Program using periodic visual inspections in accordance with BWRVIP-180, supplemented by the Water Chemistry Control – BWR Program. The shroud support access hole cover does not contain creviced welds. |
| 3.1.1-30 | Stainless steel or nickel alloy penetration: drain line exposed to reactor coolant | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading | Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry" | No | This item was not used. The RBS vessel does not have a stainless steel or nickel alloy drain penetration. |
| 3.1.1-31 | Steel and stainless steel isolation condenser components exposed to reactor coolant | Loss of material due to general (steel only), pitting, and crevice corrosion | Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and Chapter XI.M2, "Water Chemistry" | No | This item was not used. RBS does not have an isolation condenser. |

| Table 3.1.1: 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 | Cast austenitic stainless steel Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant >250 deg-C (>482 deg-F) | Loss of fracture toughness due to thermal aging embrittlement | Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components. For pump casings and valve bodies, screening for susceptibility to thermal aging is not necessary. | No | Consistent with NUREG-1801. The Inservice Inspection Program manages the reduction of fracture toughness in cast austenitic stainless steel pump casings and valve bodies in the reactor coolant pressure boundary. |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-39 | Steel, stainless steel, or steel with stainless steel cladding Class 1 piping, fittings and branch connections < NPS 4 exposed to reactor coolant | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking (for stainless steel only), and thermal, mechanical, and vibratory loading | Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, Chapter XI.M2, "Water Chemistry," and XI.M35, "One-Time Inspection of ASME Code Class 1 Small-bore Piping" | No | Consistent with NUREG-1801. Cracking in steel and stainless steel components of the reactor coolant pressure boundary exposed to reactor coolant is managed by the Inservice Inspection and Water Chemistry Control – BWR Programs. The One-Time Inspection – Small-Bore Piping Program will verify the effectiveness of the water chemistry program and will manage cracking in piping and fittings < 4" NPS. |
| 3.1.1-40 | PWR only | | | | |
| 3.1.1-40.5 | PWR only | | | | |
| 3.1.1-41 | Nickel alloy core shroud and core plate access hole cover (mechanical covers) exposed to reactor coolant | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking | Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry" | No | This item was not used. The shroud support access hole cover is welded. |
| 3.1.1-42 | PWR only | | | | |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-43 | Stainless steel and nickel-alloy reactor vessel internals exposed to reactor coolant | Loss of material due to pitting and crevice corrosion | Chapter XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" for Class 1 components, and Chapter XI.M2, "Water Chemistry" | No | Loss of material for stainless steel and nickel alloy reactor vessel internals components is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry program. With minor exceptions, the reactor vessel internals are not ASME Class 1 pressure boundary components, and the scope of internals components inspected under the Inservice Inspection Program is limited. |
| 3.1.1-44 | PWR only | | | | |
| 3.1.1-45 | PWR only | | | | |
| 3.1.1-46 | PWR only | | | | |
| 3.1.1-47 | PWR only | | | | |
| 3.1.1-48 | PWR only | | | | |
| 3.1.1-49 | PWR only | | | | |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-50 | Cast austenitic stainless steel Class 1 piping, piping component, and piping elements and control rod drive pressure housings exposed to reactor coolant >250 deg-C (>482 deg-F) | Loss of fracture toughness due to thermal aging embrittlement | Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)" | No | This item was not used. The Inservice Inspection Program manages the reduction of fracture toughness in cast austenitic stainless steel pump casings and valve bodies in the reactor coolant pressure boundary (see Table Item 3.1.1-38). There are no other Class 1 CASS components in the reactor coolant system pressure boundary.<br>The main steam line flow elements (flow restrictors) and recirculation loop flow elements are not Class 1 components (elements are completely internal to the carbon steel pipe). The CASS subcomponents of the flow elements are not susceptible to thermal aging embrittlement since they are composed of low-molybdenum CASS (CF8) and were centrifugally cast. |
| 3.1.1-51a | PWR only | | | | |
| 3.1.1-51b | PWR only | | | | |
| 3.1.1-52a | PWR only | | | | |
| 3.1.1-52b | PWR only | | | | |
| 3.1.1-52c | PWR only | | | | |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-53a | PWR only | | | | |
| 3.1.1-53b | PWR only | | | | |
| 3.1.1-53c | PWR only | | | | |
| 3.1.1-54 | PWR only | | | | |
| 3.1.1-55a | PWR only | | | | |
| 3.1.1-55b | PWR only | | | | |
| 3.1.1-55c | PWR only | | | | |
| 3.1.1-56a | PWR only | | | | |
| 3.1.1-56b | PWR only | | | | |
| 3.1.1-56c | PWR only | | | | |
| 3.1.1-57 | [There is no 3.1.1-57 in NUREG-1800.] | | | | |
| 3.1.1-58a | PWR only | | | | |
| 3.1.1-58b | PWR only | | | | |
| 3.1.1-59a | PWR only | | | | |
| 3.1.1-59b | PWR only | | | | |
| 3.1.1-59c | PWR only | | | | |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
| 3.1.1-60 | Steel piping, piping components, and piping elements exposed to reactor coolant | Wall thinning due to flow-accelerated corrosion | Chapter XI.M17, "Flow-Accelerated Corrosion" | No | Consistent with NUREG-1801. The Flow-Accelerated Corrosion Program manages wall thinning due to flow-accelerated corrosion in steel piping components exposed to reactor coolant. |
| 3.1.1-61 | PWR only | | | | |
| 3.1.1-62 | PWR only | | | | |
| 3.1.1-63 | Steel or stainless steel closure bolting exposed to air with reactor coolant leakage | Loss of material due to general (steel only), pitting, and crevice corrosion or wear | Chapter XI.M18, "Bolting Integrity" | No | The Bolting Integrity Program, which applies to all pressure boundary bolting in the reactor coolant system with the exception of the reactor closure head studs, manages loss of material for steel bolting.<br>Industry operating experience indicates that loss of material due to wear is not a significant aging effect for this bolting. Occasional thread failures due to wear related mechanisms, such as galling, are event-driven conditions that are resolved as required. |
| 3.1.1-64 | PWR only | | | | |
| 3.1.1-65 | PWR only | | | | |
| 3.1.1-66 | PWR only | | | | |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-67 | Steel or stainless steel closure bolting exposed to air – indoor with potential for reactor coolant leakage | Loss of preload due to thermal effects, gasket creep, and self-loosening | Chapter XI.M18, "Bolting Integrity" | No | Consistent with NUREG-1801. The Bolting Integrity Program manages loss of preload for all pressure boundary bolting in the reactor coolant system with the exception of the reactor closure head studs. |
| 3.1.1-68 | PWR only | | | | |
| 3.1.1-69 | PWR only | | | | |
| 3.1.1-70 | PWR only | | | | |
| 3.1.1-71 | PWR only | | | | |
| 3.1.1-72 | PWR only | | | | |
| 3.1.1-73 | PWR only | | | | |
| 3.1.1-74 | PWR only | | | | |
| 3.1.1-75 | PWR only | | | | |
| 3.1.1-76 | PWR only | | | | |
| 3.1.1-77 | PWR only | | | | |
| 3.1.1-78 | PWR only | | | | |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-79 | Stainless steel; steel with nickel-alloy or stainless steel cladding; and nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant | Loss of material due to pitting and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material in stainless steel and nickel alloy reactor coolant pressure boundary components is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material. Nickel-alloy reactor vessel components supporting the reactor coolant pressure boundary are addressed in Item 3.1.1-85. |
| 3.1.1-80 | PWR only | | | | |
| 3.1.1-81 | PWR only | | | | |
| 3.1.1-82 | PWR only | | | | |
| 3.1.1-83 | PWR only | | | | |
| 3.1.1-84 | Steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and spare) exposed to reactor coolant | Loss of material due to general, pitting and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material in steel reactor vessel components is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material. |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-85 | Stainless steel, nickel-alloy, and steel with nickel-alloy or stainless steel cladding reactor vessel flanges, nozzles, penetrations, safe ends, vessel shells, heads and welds exposed to reactor coolant | Loss of material due to pitting and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material in stainless steel, nickel-alloy, and steel with stainless steel cladding reactor vessel components is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material. |
| 3.1.1-86 | PWR only | | | | |
| 3.1.1-87 | [not used] | | | | |
| 3.1.1-88 | PWR only | | | | |
| 3.1.1-89 | PWR only | | | | |
| 3.1.1-90 | PWR only | | | | |
| 3.1.1-91 | High-strength low alloy steel closure head stud assembly exposed to air with potential for reactor coolant leakage | Cracking due to stress corrosion cracking; loss of material due to general, pitting, and crevice corrosion, or wear (BWR) | Chapter XI.M3, "Reactor Head Closure Stud Bolting" | No | Consistent with NUREG-1801. Cracking and loss of material in closure head stud assembly components is managed by the Reactor Head Closure Studs Program. |
| 3.1.1-92 | PWR only | | | | |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-93 | PWR only | | | | |
| 3.1.1-94 | Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking | Chapter XI.M4, "BWR Vessel ID [inside diameter] Attachment Welds," and Chapter XI.M2, "Water Chemistry" | No | Consistent with NUREG-1801. The BWR Vessel ID Attachment Welds and Water Chemistry Control – BWR Programs manage cracking in stainless steel and nickel alloy vessel attachment welds exposed to reactor coolant. |
| 3.1.1-95 | Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant | Cracking due to cyclic loading | Chapter XI.M5, "BWR Feedwater Nozzle" | No | Consistent with NUREG-1801. The BWR Feedwater Nozzle Program manages cracking in the carbon steel feedwater nozzles exposed to reactor coolant. |
| 3.1.1-96 | Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant | Cracking due to cyclic loading | Chapter XI.M6, "BWR Control Rod Drive Return Line Nozzle" | No | This item was not used. Under the BWR CRD Return Line Nozzle Program, the RBS control rod drive return line was cut and capped before initial plant operation. The nozzles have not been exposed to thermal cyclic loading from operation of the return line. |

**Table 3.1.1: Reactor Coolant System**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-97 | Stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to 4 NPS; nozzle safe ends and associated welds | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking | Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry" | No | Cracking in stainless steel, nickel alloy and steel clad with stainless steel components in reactor coolant is managed by a combination of several programs. Consistent with NUREG-1801 for some components of the reactor vessel and reactor coolant pressure boundary, the BWR Stress Corrosion Cracking and Water Chemistry Control – BWR Programs, further supplemented by the Inservice Inspection Program for some components, manage cracking. For other components, to which the BWR Stress Corrosion Cracking Program is not applicable, cracking is managed by the Water Chemistry Control – BWR Program and either the Inservice Inspection or BWR CRD Return Line Nozzle Program. |
| 3.1.1-98 | Stainless steel or nickel alloy penetrations: instrumentation and standby liquid control exposed to reactor coolant | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading | Chapter XI.M8, "BWR Penetrations," and Chapter XI.M2, "Water Chemistry" | No | Consistent with NUREG-1801. Cracking in stainless steel and nickel alloy nozzles and penetrations in the reactor vessel is managed by the BWR Penetrations and Water Chemistry Control – BWR Programs. |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-99 | Cast austenitic stainless steel; PH [precipitation-hardened] martensitic stainless steel; martensitic stainless steel; X-750 alloy reactor internal components exposed to reactor coolant and neutron flux | Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement | Chapter XI.M9, "BWR Vessel Internals" | No | Consistent with NUREG-1801 for CASS and X-750 (nickel alloy) components. The BWR Vessel Internals Program manages reduction of fracture toughness for CASS and X-750 components. Martensitic stainless steels are not used in the RBS vessel internals. |
| 3.1.1-100 | Stainless steel reactor vessel internals components (jet pump wedge surface) exposed to reactor coolant | Loss of material due to wear | Chapter XI.M9, "BWR Vessel Internals" | No | Consistent with NUREG-1801. The BWR Vessel Internals Program manages wear of the jet pump wedges. |
| 3.1.1-101 | Stainless steel steam dryers exposed to reactor coolant | Cracking due to flow-induced vibration | Chapter XI.M9, "BWR Vessel Internals" for steam dryer | No | Consistent with NUREG-1801. The BWR Vessel Internals Program manages cracking of the stainless steel steam dryer due to flow induced vibration. |
| 3.1.1-102 | Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking | Chapter XI.M9, "BWR Vessel Internals," and Chapter XI.M2, "Water Chemistry" | No | Consistent with NUREG-1801. The BWR Vessel Internals and Water Chemistry Control – BWR Programs manage cracking of the stainless steel fuel supports and control rod guide components. |

**Table 3.1.1: Reactor Coolant System**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-103 | Stainless steel and nickel alloy reactor internal components exposed to reactor coolant and neutron flux | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking | Chapter XI.M9, "BWR Vessel Internals," and Chapter XI.M2, "Water Chemistry" | No | Consistent with NUREG-1801 for most components. The BWR Vessel Internals and Water Chemistry Control – BWR Programs manage cracking of most stainless steel and nickel alloy reactor internals components. Cracking of the incore instrument dry tubes is managed by the Inservice Inspection and Water Chemistry Control – BWR Programs. |
| 3.1.1-104 | X-750 alloy reactor vessel internal components exposed to reactor coolant and neutron flux | Cracking due to intergranular stress corrosion cracking | Chapter XI.M9, "BWR Vessel Internals" for core plate, and Chapter XI.M2, "Water Chemistry" | No | This item was not used. The RBS vessel internals do not have X-750 alloy core plate components. |

| Table 3.1.1: Reactor Coolant System | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.1.1-105 | Steel piping, piping components and piping element exposed to concrete | None | None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete | No, if conditions are met. | This item was not used. No steel reactor coolant pressure boundary piping components are embedded in concrete. |
| 3.1.1-106 | Nickel alloy piping, piping components and piping element exposed to air – indoor, uncontrolled, or air with borated water leakage | None | None | NA – No [aging effect/ mechanism] AEM or AMP | Consistent with NUREG-1801. |
| 3.1.1-107 | Stainless steel piping, piping components and piping element exposed to gas, concrete, air with borated water leakage, air – indoors, uncontrolled | None | None | NA – No AEM or AMP | Consistent with NUREG-1801. |
| 3.1.1-108 | [There is no 3.1.1-108 in NUREG-1800.] | | | | |

**Table 3.1.1: Reactor Coolant System**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-109 | [There is no 3.1.1-109 in NUREG-1800.] | | | | |
| 3.1.1-110 | Any material, piping, piping components, and piping elements exposed to reactor coolant | Wall thinning due to erosion | Chapter XI.M17, "Flow-Accelerated Corrosion" | No | This line was not used. Based on plant operating experience, components of the reactor coolant system are not susceptible to erosion. |

## Notes for Tables 3.1.2-1 through 3.1.2-4-2

Generic Notes

A. Consistent with component, material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different AMP is credited or NUREG-1801 identifies a plant-specific AMP.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

101. The One-Time Inspection Program will verify effectiveness of the Water Chemistry Control – BWR Program.

102. High component surface temperature precludes moisture accumulation that could result in corrosion.

103. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program.

104. Stress corrosion cracking of the steam dryer is not an identified aging mechanism in NUREG-1801.

105. For the purposes of evaluating cracking due to fatigue, this environment can be considered equivalent to the NUREG-1801 environment.

**Table 3.1.2-1**
**Reactor Vessel**
**Summary of Aging Management Evaluation**

| **Table 3.1.2-1: Reactor Vessel** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Reactor vessel components | Pressure boundary<br>Structural support | Carbon steel, nickel alloy, stainless steel, carbon steel clad with stainless steel | Treated water | Cracking – fatigue | TLAA – metal fatigue | IV.A1.R-04 | 3.1.1-7 | A |
| Reactor vessel bolting<br>• Closure head studs, nuts, and washers<br>• Upper head nozzle flange bolting<br>• CRD flange bolting<br>• In-core housing bolting<br>• Vibration instrument flange bolting | Pressure boundary | High-strength low-alloy steel | Air – indoor (ext) | Cracking – fatigue | TLAA – metal fatigue | IV.A1.RP-201 | 3.1.1-1 | A |
| Reactor vessel external attachments<br>• Support skirt | Structural support | Carbon steel | Air – indoor (ext) | Cracking – fatigue | TLAA – metal fatigue | IV.A1.R-70 | 3.1.1-4 | A |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| **Attachments and Supports and Welds** | | | | | | | | |
| Reactor vessel external attachments<br>• Support skirt | Structural support | Carbon steel | Air – indoor (ext) | Loss of material | Inservice Inspection | -- | -- | H |
| Reactor vessel internal attachments<br>• Steam dryer hold down bracket | Structural support | Carbon steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-50 | 3.1.1-84 | A, 101 |
| Reactor vessel internal attachments<br>• Guide rod brackets<br>• Steam dryer support bracket<br>• Core spray brackets and pads<br>• Feedwater sparger brackets<br>• Surveillance specimen brackets and pads<br>• Jet pump riser support pads and pad to riser brackets | Structural support | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel ID Attachment Welds<br>Water Chemistry Control – BWR | IV.A1.R-64 | 3.1.1-94 | A |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Reactor vessel internal attachments<br>• Guide rod brackets<br>• Steam dryer support bracket<br>• Core spray brackets and pads<br>• Feedwater sparger brackets<br>• Surveillance specimen brackets and pads<br>• Jet pump riser support pads and pad to riser brackets | Structural support | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Reactor vessel internal attachments<br>• Jet pump riser support pads and pad to riser bracket welds<br>• Shroud support leg, baffle and pad | Structural support | Nickel alloy | Treated water (ext) | Cracking | BWR Vessel ID Attachment Welds<br>Water Chemistry Control – BWR | IV.A1.R-64 | 3.1.1-94 | A |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Reactor vessel internal attachments<br>• Jet pump riser support pads and pad to riser bracket welds<br>• Shroud support leg, baffle and pad | Structural support | Nickel alloy | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Welds<br>• Guide rod brackets to vessel<br>• Steam dryer support brackets to vessel<br>• Core spray brackets and pads to vessel<br>• Feedwater sparger brackets to vessel<br>• Surveillance specimen brackets and pads to vessel<br>• Shroud support leg, baffle and pad to vessel | Structural support | Nickel alloy | Treated water (ext) | Cracking | BWR Vessel ID Attachment Welds<br>Water Chemistry Control – BWR | IV.A1.R-64 | 3.1.1-94 | A |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Welds<br>• Guide rod brackets to vessel<br>• Steam dryer support brackets to vessel<br>• Core spray brackets and pads to vessel<br>• Feedwater sparger brackets to vessel<br>• Surveillance specimen brackets and pads to vessel<br>• Shroud support leg, baffle and pad to vessel | Structural support | Nickel alloy | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| **Bolting** | | | | | | | | |
| In-core housing bolting<br>CRD flange bolting<br>Upper head nozzle flange bolting<br>Vibration instrument flange bolting | Pressure boundary | High-strength low-alloy steel | Air – indoor (ext) | Cracking | Bolting Integrity | V.E.E-03 | 3.2.1-12 | D |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| In-core housing bolting<br>CRD flange bolting<br>Upper head nozzle flange bolting<br>Vibration instrument flange bolting | Pressure boundary | High-strength low-alloy steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | IV.C1.RP-43 | 3.1.1-67 | D |
| Reactor vessel closure flange bolting<br>• Closure studs, nuts, and washers | Pressure boundary | High-strength low-alloy steel | Air – indoor (ext) | Cracking | Reactor Head Closure Studs | IV.A1.RP-51 | 3.1.1-91 | B |
| Reactor vessel closure flange bolting<br>• Closure studs, nuts, and washers | Pressure boundary | High-strength low-alloy steel | Air – indoor (ext) | Loss of material | Reactor Head Closure Studs | IV.A1.RP-165 | 3.1.1-91 | B |
| **Penetrations, Nozzles and Welds** | | | | | | | | |
| Penetrations<br>• CRD housings | Pressure boundary | Stainless steel, nickel alloy | Air – indoor (ext) | None | None | IV.E.RP-04<br>IV.E.RP-03 | 3.1.1-107<br>3.1.1-106 | A<br>A |
| Penetrations<br>• CRD housings | Pressure boundary | Stainless steel, nickel alloy | Treated water > 140°F (int) | Cracking | BWR Penetrations<br>Water Chemistry Control – BWR | IV.A1.RP-369 | 3.1.1-98 | A |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Penetrations<br>• CRD housings | Pressure boundary | Stainless steel, nickel alloy | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Penetrations<br>• In-core housings | Pressure boundary | Stainless steel, nickel alloy | Air – indoor (ext) | None | None | IV.E.RP-04<br>IV.E.RP-03 | 3.1.1-107<br>3.1.1-106 | A<br>A |
| Penetrations<br>• In-core housings | Pressure boundary | Stainless steel, nickel alloy | Treated water > 140°F (int) | Cracking | BWR Penetrations<br>Water Chemistry Control – BWR | IV.A1.RP-369 | 3.1.1-98 | A |
| Penetrations<br>• In-core housings | Pressure boundary | Stainless steel, nickel alloy | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Penetrations<br>• Core differential pressure /SLC (N11, N18)<br>• Core differential pressure stubs | Pressure boundary | Nickel alloy | Air – indoor (ext) | None | None | IV.E.RP-03 | 3.1.1-106 | A |
| Penetrations<br>• Core differential pressure /SLC (N11, N18)<br>• Core differential pressure stubs | Pressure boundary | Nickel alloy | Treated water (int) | Cracking | BWR Penetrations<br>Water Chemistry Control – BWR | IV.A1.RP-369 | 3.1.1-98 | A |

**Table 3.1.2-1: Reactor Vessel**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Penetrations<br>• Core differential pressure /SLC (N11, N18)<br>• Core differential pressure stubs | Pressure boundary | Nickel alloy | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Nozzles<br>• Recirc outlet (N1)<br>• Recirc inlet (N2)<br>• Steam (N3)<br>• Core spray (N5)<br>• RHR/LPCI (N6)<br>• Vent (N7)<br>• Spare head (N8)<br>• Jet pump instrument (N9)<br>• CRD return (N10)<br>• Vibration instrument (N16) | Pressure boundary | Carbon steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |

**Table 3.1.2-1: Reactor Vessel**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Nozzles<br>• Recirc outlet (N1)<br>• Recirc inlet (N2)<br>• Steam (N3)<br>• Core spray (N5)<br>• RHR/LPCI (N6)<br>• Vent (N7)<br>• Spare head (N8)<br>• Jet pump instrument (N9)<br>• CRD return (N10)<br>• Vibration instrument (N16) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-50 | 3.1.1-84 | A, 101 |
| Nozzle<br>• Drain line (N15) | Pressure boundary | Carbon steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |
| Nozzle<br>• Drain line (N15) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Flow-Accelerated Corrosion<br>Water Chemistry Control – BWR | IV.C1.R-23<br>IV.A1.RP-50 | 3.1.1-60<br>3.1.1-84 | C<br>A, 101 |
| Nozzles<br>• Feedwater (N4-A, B, C, D) | Pressure boundary | Carbon steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Nozzles<br>• Feedwater (N4-A, B, C, D) | Pressure boundary | Carbon steel | Treated water (int) | Cracking | BWR Feedwater Nozzle | IV.A1.R-65 | 3.1.1-95 | A |
| Nozzles<br>• Feedwater (N4-A, B, C, D) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-50 | 3.1.1-84 | A, 101 |
| Nozzles<br>• Water level instrumentation (N12, N13, N14) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Nozzles<br>• Water level instrumentation (N12, N13, N14) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | BWR Penetrations<br>Water Chemistry Control – BWR | IV.A1.RP-369 | 3.1.1-98 | A |
| Nozzles<br>• Water level instrumentation (N12, N13, N14) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Nozzles<br>• Seal leak detection (N17) | Pressure boundary | Nickel alloy | Air – indoor (ext) | None | None | IV.E.RP-03 | 3.1.1-106 | A |

**Table 3.1.2-1: Reactor Vessel**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Nozzles<br>• Seal leak detection (N17) | Pressure boundary | Nickel alloy | Treated water (int) | Cracking | One-Time Inspection<br>Water Chemistry Control – BWR | IV.A1.R-61 | 3.1.1-16 | E |
| Nozzles<br>• Seal leak detection (N17) | Pressure boundary | Nickel alloy | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| **Safe Ends, Thermal Sleeves, Flanges, Caps, and Welds** | | | | | | | | |
| CRD return line cap (N10) | Pressure boundary | Nickel alloy | Air – indoor (ext) | None | None | IV.E.RP-03 | 3.1.1-106 | A |
| CRD return line cap (N10) | Pressure boundary | Nickel alloy | Treated water (int) | Cracking | BWR CRD Return Line Nozzle<br>Water Chemistry Control – BWR | IV.A1.R-68 | 3.1.1-97 | E |
| CRD return line cap (N10) | Pressure boundary | Nickel alloy | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Nozzle flanges<br>• Vent (N7)<br>• Spare head nozzle (N8)<br>• Vibration Instrument (N16) | Pressure boundary | Carbon steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Nozzle flanges<br>• Vent (N7)<br>• Spare head nozzle (N8)<br>• Vibration Instrument (N16) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-50 | 3.1.1-84 | A, 101 |
| Nozzle safe ends or extensions ≥ 4"<br>• Recirculation outlets (N1)<br>• Recirculation inlets (N2)<br>• Jet pump instrumentation (N9) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| • Nozzle safe ends or extensions ≥ 4"<br>• Recirculation outlets (N1)<br>• Recirculation inlets (N2)<br>• Jet pump instrumentation (N9) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | BWR Stress Corrosion Cracking<br>Water Chemistry Control – BWR | IV.A1.R-68 | 3.1.1-97 | A |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Nozzle safe ends or extensions ≥ 4"<br>• Recirculation outlets (N1)<br>• Recirculation inlets (N2)<br>• Jet pump instrumentation (N9) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Nozzle safe ends ≥ 4"<br>• Recirculation inlets (N2)<br>• Feedwater (N4-B, -C, -D)<br>• Core spray (N5)<br>• RHR/LPCI (N6) | Pressure boundary | Nickel alloy | Air – indoor (ext) | None | None | IV.E.RP-03 | 3.1.1-106 | A |
| Nozzle safe ends ≥ 4"<br>• Recirculation inlets (N2)<br>• Feedwater (N4-B, -C, -D)<br>• Core spray (N5)<br>• RHR/LPCI (N6) | Pressure boundary | Nickel alloy | Treated water (int) | Cracking | BWR Stress Corrosion Cracking<br>Water Chemistry Control – BWR | IV.A1.R-68 | 3.1.1-97 | A |

**Table 3.1.2-1: Reactor Vessel**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Nozzle safe ends ≥ 4"<br>• Recirculation inlets (N2)<br>• Feedwater (N4-B, -C, -D)<br>• Core spray (N5)<br>• RHR/LPCI (N6) | Pressure boundary | Nickel alloy | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Nozzle safe ends or extensions ≥ 4"<br>• Steam (N3)<br>• Feedwater (N4-A) safe end<br>• Feedwater (N4-B, -C, -D) extension<br>• Core spray (N5)<br>• RHR/LPCI (N6) | Pressure boundary | Carbon steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |
| Nozzle safe ends or extensions ≥ 4"<br>• Steam (N3)<br>• Feedwater (N4-A) safe end<br>• Feedwater (N4-B, -C, -D) extension<br>• Core spray (N5)<br>• RHR/LPCI (N6) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-50 | 3.1.1-84 | A, 101 |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Nozzle safe ends < 4"<br>• Core differential pressure / SLC (N11, N18) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Nozzle safe ends < 4"<br>• Core differential pressure / SLC (N11, N18) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | BWR Penetrations<br>Water Chemistry Control – BWR | IV.A1.RP-369 | 3.1.1-98 | A |
| Nozzle safe ends < 4"<br>• Core differential pressure / SLC (N11, N18) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Nozzle safe end < 4"<br>• CRD return line (N10) | Pressure boundary | Carbon steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |
| Nozzle safe end < 4"<br>• CRD return line (N10) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-50 | 3.1.1-84 | A, 101 |
| Thermal sleeves < 4"<br>• CRD return line (N10) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-99 | 3.1.1-103 | C |

**Table 3.1.2-1: Reactor Vessel**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Thermal sleeves < 4"<br>• CRD return line (N10) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Thermal sleeves or extensions ≥ 4"<br>• Recirculation inlets (N2)<br>• Feedwater (N4-B, -C, -D)<br>• Feedwater (N4-A) thermal sleeve<br>• Core spray (N5)<br>• RHR/LPCI (N6) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-99 | 3.1.1-103 | C |
| Thermal sleeves or extensions ≥ 4"<br>• Recirculation inlets (N2)<br>• Feedwater (N4-B, -C, -D)<br>• Feedwater (N4-A) thermal sleeve<br>• Core spray (N5)<br>• RHR/LPCI (N6) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Thermal sleeve extensions ≥ 4"<br>• Feedwater (N4-A) extension | Pressure boundary | Carbon steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |
| Thermal sleeve extensions ≥ 4"<br>• Feedwater (N4-A) extension | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-50 | 3.1.1-84 | A, 101 |
| Thermal sleeve extensions ≥ 4"<br>• Recirculation inlets (N2)<br>• Feedwater (N4-B, -C, -D)<br>• Core spray inlets (N5)<br>• RHR/LPCI (N6) | Pressure boundary | Nickel alloy | Treated water (int) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-99 | 3.1.1-103 | C |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Thermal sleeve extensions ≥ 4"<br>• Recirculation inlets (N2)<br>• Feedwater (N4-B, -C, -D)<br>• Core spray inlets (N5)<br>• RHR/LPCI (N6) | Pressure boundary | Nickel alloy | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Welds ≥ 4" (nozzle to safe end)<br>• Recirculation outlet (N1)<br>• Recirculation inlet (N2)<br>• Jet pump instrumentation (N9) | Pressure boundary | Nickel alloy | Air – indoor (ext) | None | None | IV.E.RP-03 | 3.1.1-106 | A |
| Welds ≥ 4" (nozzle to safe end)<br>• Recirculation outlet (N1)<br>• Recirculation inlet (N2)<br>• Jet pump instrumentation (N9) | Pressure boundary | Nickel alloy | Treated water (int) | Cracking | BWR Stress Corrosion Cracking<br>Water Chemistry Control – BWR | IV.A1.R-68 | 3.1.1-97 | A |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Welds ≥ 4" (nozzle to safe end)<br>• Recirculation outlet (N1)<br>• Recirculation inlet (N2)<br>• Jet pump instrumentation (N9) | Pressure boundary | Nickel alloy | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Welds (nozzle to vessel)<br>• Core differential pressure/ SLC (N11, N18)<br>• Water level instrumentation (N12, N13, N14) | Pressure boundary | Nickel alloy | Air – indoor (ext) | None | None | IV.E.RP-03 | 3.1.1-106 | A |
| Welds (nozzle to vessel)<br>• Core differential pressure/ SLC (N11, N18)<br>• Water level instrumentation (N12, N13, N14) | Pressure boundary | Nickel alloy | Treated water (int) | Cracking | BWR Penetrations<br>Water Chemistry Control – BWR | IV.A1.RP-369 | 3.1.1-98 | A |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Welds (nozzle to vessel)<br>• Core differential pressure/ SLC (N11, N18)<br>• Water level instrumentation (N12, N13, N14) | Pressure boundary | Nickel alloy | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| **Shell and Heads** | | | | | | | | |
| Reactor pressure vessel<br>• Top head | Pressure boundary | Carbon steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |
| Reactor pressure vessel<br>• Top head | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-50 | 3.1.1-84 | A, 101 |
| Reactor pressure vessel<br>• Top head/closure flange<br>• Non-beltline shell plates/ closure flange<br>• Bottom head | Pressure boundary | Carbon steel clad with stainless steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |

| Table 3.1.2-1: Reactor Vessel | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Reactor pressure vessel<br>• Top head/closure flange<br>• Non-beltline shell plates/ closure flange<br>• Bottom head | Pressure boundary | Carbon steel clad with stainless steel | Treated water > 140°F (int) | Cracking | Inservice Inspection<br>Water Chemistry Control – BWR | IV.A1.R-68 | 3.1.1-97 | E |
| Reactor pressure vessel<br>• Top head/closure flange<br>• Non-beltline shell plates/ closure flange<br>• Bottom head | Pressure boundary | Carbon steel clad with stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Reactor pressure vessel<br>• Beltline shell plates and connecting welds | Pressure boundary | Carbon steel clad with stainless steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |

**Table 3.1.2-1: Reactor Vessel**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Reactor pressure vessel<br>• Beltline shell plates and connecting welds | Pressure boundary | Carbon steel clad with stainless steel | Treated water > 140°F (int) | Cracking | Inservice Inspection<br>Water Chemistry Control – BWR | IV.A1.R-68 | 3.1.1-97 | E |
| Reactor pressure vessel<br>• Beltline shell plates and connecting welds | Pressure boundary | Carbon steel clad with stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.A1.RP-157 | 3.1.1-85 | A, 101 |
| Reactor pressure vessel<br>• Beltline shell plates and connecting welds | Pressure boundary | Carbon steel clad with stainless steel | Treated water > 140°F (int)<br>Neutron fluence | Reduction of fracture toughness | Reactor Vessel Surveillance<br>TLAA – neutron fluence | IV.A1.RP-227<br>IV.A1.R-62 | 3.1.1-14<br>3.1.1-13 | B<br>A |

**Table 3.1.2-2**
**Reactor Vessel Internals**
**Summary of Aging Management Evaluation**

| Table 3.1.2-2: Reactor Vessel Internals | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| RV internals | Structural support<br>Flow distribution<br>Floodable volume | Stainless steel, nickel alloy | Treated water (ext) | Cracking – fatigue | TLAA – metal fatigue | IV.B1.R-53 | 3.1.1-3 | A |
| RVI connectors<br>• Bolts<br>• Brackets | Structural support | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| RVI connectors<br>• Bolts<br>• Brackets | Structural support | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-99 | 3.1.1-103 | C |
| RVI connectors<br>• Bolts<br>• Brackets | Structural support | Stainless steel | Treated water > 140°F (ext) | Loss of preload | BWR Vessel Internals | -- | -- | H |
| Access hole cover | Floodable volume | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |

| Table 3.1.2-2: Reactor Vessel Internals | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Access hole cover | Floodable volume | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-97 | 3.1.1-103 | C |
| Access hole cover weld | Floodable volume | Nickel alloy | Treated water (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-94 | 3.1.1-29 | E |
| Access hole cover weld | Floodable volume | Nickel alloy | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Access hole cover weld | Floodable volume | Nickel alloy | Treated water (int) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-94 | 3.1.1-29 | E |
| Access hole cover weld | Floodable volume | Nickel alloy | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Control rod guide tubes<br>• Tubes<br>• Thermal sleeve | Structural support<br>Limit thermal cycling | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-104 | 3.1.1-102 | A |

| Table 3.1.2-2: Reactor Vessel Internals | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Control rod guide tubes<br>• Tubes<br>• Thermal sleeve | Structural support<br>Limit thermal cycling | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Control rod guide tubes<br>• Tubes<br>• Thermal sleeve | Structural support<br>Limit thermal cycling | Stainless steel | Treated water > 140°F (int) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-104 | 3.1.1-102 | A |
| Control rod guide tubes<br>• Tubes<br>• Thermal sleeve | Structural support<br>Limit thermal cycling | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Control rod guide tubes<br>• Base | Structural support | CASS | Treated water > 482°F (ext)<br>Neutron fluence | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-104 | 3.1.1-102 | A |
| Control rod guide tubes<br>• Base | Structural support | CASS | Treated water > 482°F (ext)<br>Neutron fluence | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |

**Table 3.1.2-2: Reactor Vessel Internals**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Control rod guide tubes<br>• Base | Structural support | CASS | Treated water > 482°F (ext)<br>Neutron fluence | Reduction of fracture toughness | BWR Vessel Internals | IV.B1.RP-220 | 3.1.1-99 | A |
| Core support plate and core plate wedge retainers | Structural support | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-92 | 3.1.1-103 | A |
| Core support plate and core plate wedge retainers | Structural support | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Core spray lines, nozzles, orifices and spargers | Flow distribution | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-99 | 3.1.1-103 | A |
| Core spray lines, nozzles, orifices and spargers | Flow distribution | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Core spray lines, nozzles, orifices and spargers | Flow distribution | Stainless steel | Treated water > 140°F (int) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-99 | 3.1.1-103 | A |

| Table 3.1.2-2: Reactor Vessel Internals | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Core spray lines, nozzles, orifices and spargers | Flow distribution | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Fuel supports<br>• Four lobed | Structural support | CASS | Treated water > 482°F (ext)<br>Neutron fluence | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-104 | 3.1.1-102 | A |
| Fuel supports<br>• Four lobed | Structural support | CASS | Treated water > 482°F (ext)<br>Neutron fluence | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Fuel supports<br>• Four lobed | Structural support | CASS | Treated water > 482°F (ext)<br>Neutron fluence | Reduction of fracture toughness | BWR Vessel Internals | IV.B1.RP-220 | 3.1.1-99 | A |
| Fuel supports<br>• Peripheral | Structural support | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-104 | 3.1.1-102 | A |
| Fuel supports<br>• Peripheral | Structural support | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |

| Table 3.1.2-2: Reactor Vessel Internals | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Fuel supports<br>• Orifices | Flow distribution | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-104 | 3.1.1-102 | A |
| Fuel supports<br>• Orifices | Flow distribution | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| In-core instrument flux monitoring<br>• Guide tube<br>• Clamps, tie bars, and spacers | Structural support | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-105 | 3.1.1-103 | A |
| In-core instrument flux monitoring<br>• Guide tube<br>• Clamps, tie bars, and spacers | Structural support | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| In-core instrument flux monitoring<br>• Guide tube<br>• Clamps, tie bars, and spacers | Structural support | Stainless steel | Treated water > 140°F (int) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-105 | 3.1.1-103 | A |

| Table 3.1.2-2: Reactor Vessel Internals | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| In-core instrument flux monitoring<br>• Guide tube<br>• Clamps, tie bars, and spacers | Structural support | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| In-core instrument flux monitoring<br>• Dry tube<br>• Stabilizers | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-82 | 3.2.1-63 | C |
| In-core instrument flux monitoring<br>• Dry tube<br>• Stabilizers | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | V.F.EP-82 | 3.2.1-63 | C |
| In-core instrument flux monitoring<br>• Dry tube<br>• Stabilizers | Pressure boundary | Stainless steel | Treated water > 140°F (ext) | Cracking | Inservice Inspection<br>Water Chemistry Control – BWR | IV.B1.R-105 | 3.1.1-103 | E |
| In-core instrument flux monitoring<br>• Dry tube<br>• Stabilizers | Pressure boundary | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |

**Table 3.1.2-2: Reactor Vessel Internals**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Jet pump assembly<br>• Riser braces<br>• Riser repair clamp | Structural support | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-100 | 3.1.1-103 | A |
| Jet pump assembly<br>• Riser braces<br>• Riser repair clamp | Structural support | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Jet pump assembly<br>• Hold-down beam | Structural support | Nickel alloy (Alloy X-750) | Treated water (ext.)<br>Neutron fluence | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-100 | 3.1.1-103 | A |
| Jet pump assembly<br>• Hold-down beam | Structural support | Nickel alloy (Alloy X-750) | Treated water (ext.)<br>Neutron fluence | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Jet pump assembly<br>• Hold-down beam | Structural support | Nickel alloy (Alloy X-750) | Treated water (ext.)<br>Neutron fluence | Reduction of fracture toughness | BWR Vessel Internals | IV.B1.RP-200 | 3.1.1-99 | A |
| Jet pump assembly<br>• Lower ring | Floodable volume | Nickel alloy | Treated water (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-100 | 3.1.1-103 | A |

**Table 3.1.2-2: Reactor Vessel Internals**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Jet pump assembly<br>• Lower ring | Floodable volume | Nickel alloy | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Jet pump assembly<br>• Transition piece<br>• Suction inlet elbow<br>• Suction inlet nozzle<br>• Mixer adapter<br>• Mixer throat (barrel)<br>• Diffuser collar<br>• Diffuser tail pipe | Floodable volume | CASS | Treated water > 482°F (ext)<br>Neutron fluence | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-100 | 3.1.1-103 | A |
| Jet pump assembly<br>• Transition piece<br>• Suction inlet elbow<br>• Suction inlet nozzle<br>• Mixer adapter<br>• Mixer throat (barrel)<br>• Diffuser collar<br>• Diffuser tail pipe | Floodable volume | CASS | Treated water > 482°F (ext)<br>Neutron fluence | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |

| Table 3.1.2-2: Reactor Vessel Internals | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Jet pump assembly<br>• Transition piece<br>• Suction inlet elbow<br>• Suction inlet nozzle<br>• Mixer adapter<br>• Mixer throat (barrel)<br>• Diffuser collar<br>• Diffuser tail pipe | Floodable volume | CASS | Treated water > 482°F (ext)<br>Neutron fluence | Reduction of fracture toughness | BWR Vessel Internals | IV.B1.RP-219 | 3.1.1-99 | A |
| Jet pump assembly<br>• Transition piece<br>• Suction inlet elbow<br>• Suction inlet nozzle<br>• Mixer adapter<br>• Mixer throat (barrel)<br>• Diffuser collar<br>• Diffuser tail pipe | Floodable volume | CASS | Treated water > 482°F (int)<br>Neutron fluence | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-100 | 3.1.1-103 | A |
| Jet pump assembly<br>• Transition piece<br>• Suction inlet elbow<br>• Suction inlet nozzle<br>• Mixer adapter<br>• Mixer throat (barrel)<br>• Diffuser collar<br>• Diffuser tail pipe | Floodable volume | CASS | Treated water > 482°F (int)<br>Neutron fluence | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |

| Table 3.1.2-2: Reactor Vessel Internals | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Jet pump assembly<br>• Transition piece<br>• Suction inlet elbow<br>• Suction inlet nozzle<br>• Mixer adapter<br>• Mixer throat (barrel)<br>• Diffuser collar<br>• Diffuser tail pipe | Floodable volume | CASS | Treated water > 482°F (int)<br>Neutron fluence | Reduction of fracture toughness | BWR Vessel Internals | IV.B1.RP-219 | 3.1.1-99 | A |
| Jet pump assembly<br>• Restrainer bracket<br>• Wedge | Structural support | CASS with stellite hard facing | Treated water > 482°F (ext)<br>Neutron fluence | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-100 | 3.1.1-103 | A |
| Jet pump assembly<br>• Restrainer bracket<br>• Wedge | Structural support | CASS with stellite hard facing | Treated water > 482°F (ext)<br>Neutron fluence | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Jet pump assembly<br>• Restrainer bracket<br>• Wedge | Structural support | CASS with stellite hard facing | Treated water > 482°F (ext)<br>Neutron fluence | Loss of material – wear | BWR Vessel Internals | IV.B1.RP-377 | 3.1.1-100 | A |
| Jet pump assembly<br>• Restrainer bracket<br>• Wedge | Structural support | CASS with stellite hard facing | Treated water > 482°F (ext)<br>Neutron fluence | Reduction of fracture toughness | BWR Vessel Internals | IV.B1.RP-219 | 3.1.1-99 | A |

| Table 3.1.2-2: Reactor Vessel Internals | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| LPCI assembly<br>• Deflector | Flow distribution | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-97 | 3.1.1-103 | C |
| LPCI assembly<br>• Deflector | Flow distribution | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| LPCI assembly<br>• Screw<br>• Strut and pad | Structural support | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-97 | 3.1.1-103 | C |
| LPCI assembly<br>• Screw<br>• Strut and pad | Structural support | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| LPCI assembly<br>• Thermal shield | Limit thermal cycling | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-97 | 3.1.1-103 | C |
| LPCI assembly<br>• Thermal shield | Limit thermal cycling | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |

| Table 3.1.2-2: Reactor Vessel Internals | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| LPCI assembly<br>• Thermal shield | Limit thermal cycling | Stainless steel | Treated water > 140°F (int) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-97 | 3.1.1-103 | C |
| LPCI assembly<br>• Thermal shield | Limit thermal cycling | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| LPCI assembly<br>• Extensions<br>• Ring<br>• Collar<br>• Sleeve | Flow distribution | CASS | Treated water > 482°F (ext)<br>Neutron fluence | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-97 | 3.1.1-103 | C |
| LPCI assembly<br>• Extensions<br>• Ring<br>• Collar<br>• Sleeve | Flow distribution | CASS | Treated water > 482°F (ext)<br>Neutron fluence | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| LPCI assembly<br>• Extensions<br>• Ring<br>• Collar<br>• Sleeve | Flow distribution | CASS | Treated water > 482°F (ext)<br>Neutron fluence | Reduction of fracture toughness | BWR Vessel Internals | IV.B1.RP-220 | 3.1.1-99 | C |

**Table 3.1.2-2: Reactor Vessel Internals**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| LPCI assembly<br>• Extensions<br>• Ring<br>• Collar<br>• Sleeve | Flow distribution | CASS | Treated water > 482°F (int)<br>Neutron fluence | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-97 | 3.1.1-103 | C |
| LPCI assembly<br>• Extensions<br>• Ring<br>• Collar<br>• Sleeve | Flow distribution | CASS | Treated water > 482°F (int)<br>Neutron fluence | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| LPCI assembly<br>• Extensions<br>• Ring<br>• Collar<br>• Sleeve | Flow distribution | CASS | Treated water > 482°F (int)<br>Neutron fluence | Reduction of fracture toughness | BWR Vessel Internals | IV.B1.RP-220 | 3.1.1-99 | C |
| LPCI assembly<br>• Seal rings | Flow distribution | Nickel alloy | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-100 | 3.1.1-103 | C |
| LPCI assembly<br>• Seal rings | Flow distribution | Nickel alloy | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |

**Table 3.1.2-2: Reactor Vessel Internals**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| LPCI assembly<br>• Elbows | Flow distribution | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-97 | 3.1.1-103 | C |
| LPCI assembly<br>• Elbows | Flow distribution | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| LPCI assembly<br>• Elbows | Flow distribution | Stainless steel | Treated water > 140°F (int) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-97 | 3.1.1-103 | C |
| LPCI assembly<br>• Elbows | Flow distribution | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Shroud | Floodable volume | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-92 | 3.1.1-103 | A |
| Shroud | Floodable volume | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Shroud | Floodable volume | Stainless steel | Treated water > 140°F (int) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-92 | 3.1.1-103 | A |

| Table 3.1.2-2: Reactor Vessel Internals | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Shroud | Floodable volume | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Shroud support plate and shroud support cylinder | Structural support<br>Floodable volume | Nickel alloy | Treated water (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-96 | 3.1.1-103 | A |
| Shroud support plate and shroud support cylinder | Structural support<br>Floodable volume | Nickel alloy | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Steam dryer | Structural integrity | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.RP-155<br>-- | 3.1.1-101<br>-- | A<br>H, 104 |
| Steam dryer | Structural integrity | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |
| Top guide assembly | Structural support | Stainless steel | Treated water > 140°F (ext) | Cracking | BWR Vessel Internals<br>Water Chemistry Control – BWR | IV.B1.R-98 | 3.1.1-103 | A |
| Top guide assembly | Structural support | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | IV.B1.RP-26 | 3.1.1-43 | E |

**Table 3.1.2-3**
**Reactor Coolant Pressure Boundary**
**Summary of Aging Management Evaluation**

| Table 3.1.2-3: Reactor Coolant Pressure Boundary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel, stainless steel | Air – indoor (ext) | Cracking – fatigue | TLAA – metal fatigue | IV.C1.RP-44 | 3.1.1-11 | A |
| Reactor coolant pressure boundary components | Pressure boundary | Carbon steel, nickel alloy, stainless steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | IV.C1.R-220 | 3.1.1-6 | A |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | IV.C1.RP-42 | 3.1.1-63 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | IV.C1.RP-43 | 3.1.1-67 | B |
| Bolting | Pressure boundary | High-strength steel | Air – indoor (ext) | Cracking | Bolting Integrity | V.E.E-03 | 3.2.1-12 | D |
| Bolting | Pressure boundary | High-strength steel | Air – indoor (ext) | Loss of material | Bolting Integrity | IV.C1.RP-42 | 3.1.1-63 | B |

**Table 3.1.2-3: Reactor Coolant Pressure Boundary**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | High-strength steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | IV.C1.RP-43 | 3.1.1-67 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | IV.C1.RP-43 | 3.1.1-67 | B |
| Condensing chamber | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Condensing chamber | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Inservice Inspection<br>Water Chemistry Control – BWR | IV.C1.R-20 | 3.1.1-97 | E |
| Condensing chamber | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Flange seal leak detection components (non-Class 1)<br>• Piping<br>• Valves | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |

**Table 3.1.2-3: Reactor Coolant Pressure Boundary**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Flange seal leak detection components (non-Class 1)<br>• Piping<br>• Valves | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | One-Time Inspection<br>Water Chemistry Control – BWR | -- | -- | F |
| Flange seal leak detection components (non-Class 1)<br>• Flex hose<br>• Orifice<br>• Piping<br>• Valves | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Flange seal leak detection components (non-Class 1)<br>• Flex hose<br>• Orifice<br>• Piping<br>• Valves | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | One-Time Inspection<br>Water Chemistry Control – BWR | IV.A1.R-61 | 3.1.1-16 | E |

| Table 3.1.2-3: Reactor Coolant Pressure Boundary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flange seal leak detection components (non-Class 1)<br>• Flex hose<br>• Orifice<br>• Piping<br>• Valves | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | One-Time Inspection<br>Water Chemistry Control – BWR | -- | -- | H |
| Flex hose (non-Class 1) | Pressure boundary | Nickel alloy | Air – indoor (ext) | None | None | IV.E.RP-03 | 3.1.1-106 | A |
| Flex hose (non-Class 1) | Pressure boundary | Nickel alloy | Treated water (int) | Cracking | Water Chemistry Control – BWR | -- | -- | H |
| Flex hose (non-Class 1) | Pressure boundary | Nickel alloy | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Flex hose (non-Class 1) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Flex hose (non-Class 1) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 101 |
| Flex hose (non-Class 1) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Flow element (main steam flow restrictors) | Flow control | CASS | Steam | Cracking | Water Chemistry Control – BWR | VIII.B2.SP-98 | 3.4.1-11 | C, 101 |

**Table 3.1.2-3: Reactor Coolant Pressure Boundary**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Flow element (main steam flow restrictors) | Flow control | CASS | Steam | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-155 | 3.4.1-16 | C, 101 |
| Flow element (main steam flow restrictors) | Flow control | Carbon steel | Steam | Loss of material | Water Chemistry Control – BWR | VIII.A.SP-71 | 3.4.1-14 | C, 101 |
| Flow element (main steam flow restrictors) | Flow control | Carbon steel | Steam | Loss of material – FAC | Flow-Accelerated Corrosion | IV.C1.R-23 | 3.1.1-60 | A |
| Flow element (reactor water cleanup system) | Pressure boundary<br>Flow control | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Flow element (reactor water cleanup system) | Pressure boundary<br>Flow control | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | C, 101 |
| Mixing tee (non-Class 1) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Mixing tee (non-Class 1) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | C, 101 |
| Mixing tee (non-Class 1) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – FAC | Flow-Accelerated Corrosion | IV.C1.R-23 | 3.1.1-60 | A |

| Table 3.1.2-3: Reactor Coolant Pressure Boundary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Orifice (non-Class 1) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Orifice (non-Class 1) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Orifice (non-Class 1) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 101 |
| Orifice (non-Class 1) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Piping (non-Class 1) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Piping (non-Class 1) | Pressure boundary | Carbon steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.A.SP-71 | 3.4.1-14 | C, 101 |
| Piping (non-Class 1) | Pressure boundary | Carbon steel | Steam (int) | Loss of material – FAC | Flow-Accelerated Corrosion | IV.C1.R-23 | 3.1.1-60 | A |
| Piping (non-Class 1) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | C, 101 |
| Piping (non-Class 1) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – FAC | Flow-Accelerated Corrosion | IV.C1.R-23 | 3.1.1-60 | A |
| Piping (non-Class 1) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |

| Table 3.1.2-3: Reactor Coolant Pressure Boundary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping (non-Class 1) | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | V.F.EP-82 | 3.2.1-63 | C |
| Piping (non-Class 1) | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.E4.AP-138 | 3.3.1-100 | C, 103 |
| Piping (non-Class 1) | Pressure boundary | Stainless steel | Steam (int) | Cracking | Water Chemistry Control – BWR | VIII.B2.SP-98 | 3.4.1-11 | C, 101 |
| Piping (non-Class 1) | Pressure boundary | Stainless steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-155 | 3.4.1-16 | C, 101 |
| Piping (non-Class 1) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Piping (non-Class 1) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 101 |
| Piping (non-Class 1) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Piping < 4" NPS | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Piping < 4" NPS | Pressure boundary | Carbon steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |

| Table 3.1.2-3: Reactor Coolant Pressure Boundary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping < 4" NPS | Pressure boundary | Carbon steel | Steam (int) | Cracking | Inservice Inspection<br>One-Time Inspection – Small-Bore Piping<br>Water Chemistry Control – BWR | IV.C1.RP-230 | 3.1.1-39 | A |
| Piping < 4" NPS | Pressure boundary | Carbon steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.A.SP-71 | 3.4.1-14 | C, 101 |
| Piping < 4" NPS | Pressure boundary | Carbon steel | Steam (int) | Loss of material – FAC | Flow-Accelerated Corrosion | IV.C1.R-23 | 3.1.1-60 | A |
| Piping < 4" NPS | Pressure boundary | Carbon steel | Treated water (int) | Cracking | Inservice Inspection<br>One-Time Inspection – Small-Bore Piping<br>Water Chemistry Control – BWR | IV.C1.RP-230 | 3.1.1-39 | A |
| Piping < 4" NPS | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | C, 101 |
| Piping < 4" NPS | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – FAC | Flow-Accelerated Corrosion | IV.C1.R-23 | 3.1.1-60 | A |
| Piping < 4" NPS | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |

| Table 3.1.2-3: Reactor Coolant Pressure Boundary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping < 4" NPS | Pressure boundary | Stainless steel | Steam (int) | Cracking | Inservice Inspection<br>One-Time Inspection – Small-Bore Piping<br>Water Chemistry Control – BWR | IV.C1.RP-230 | 3.1.1-39 | A |
| Piping < 4" NPS | Pressure boundary | Stainless steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-155 | 3.4.1-16 | C, 101 |
| Piping < 4" NPS | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Piping < 4" NPS | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Inservice Inspection<br>One-Time Inspection – Small-Bore Piping<br>Water Chemistry Control – BWR | IV.C1.RP-230 | 3.1.1-39 | A |
| Piping < 4" NPS | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Piping ≥ 4" NPS | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Piping ≥ 4" NPS | Pressure boundary | Carbon steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |

| Table 3.1.2-3: Reactor Coolant Pressure Boundary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping ≥ 4" NPS | Pressure boundary | Carbon steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.A.SP-71 | 3.4.1-14 | C, 101 |
| Piping ≥ 4" NPS | Pressure boundary | Carbon steel | Steam (int) | Loss of material – FAC | Flow-Accelerated Corrosion | IV.C1.R-23 | 3.1.1-60 | A |
| Piping ≥ 4" NPS | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | C, 101 |
| Piping ≥ 4" NPS | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – FAC | Flow-Accelerated Corrosion | IV.C1.R-23 | 3.1.1-60 | A |
| Piping ≥ 4" NPS | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Piping ≥ 4" NPS | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | BWR Stress Corrosion Cracking<br><br>Inservice Inspection<br>Water Chemistry Control – BWR | IV.C1.R-20 | 3.1.1-97 | A |
| Piping ≥ 4" NPS | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Recirculation pumps<br>• Pump casing and cover | Pressure boundary | CASS | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |

**Table 3.1.2-3: Reactor Coolant Pressure Boundary**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Recirculation pumps<br>• Pump casing and cover | Pressure boundary | CASS | Treated water > 140°F (int) | Cracking | BWR Stress Corrosion Cracking<br>Inservice Inspection<br>Water Chemistry Control – BWR | IV.C1.R-20 | 3.1.1-97 | A |
| Recirculation pumps<br>• Pump casing and cover | Pressure boundary | CASS | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Recirculation pumps<br>• Pump casing and cover | Pressure boundary | CASS | Treated water > 482°F (int) | Reduction of fracture toughness | Inservice Inspection | IV.C1.R-08 | 3.1.1-38 | A |
| Recirculation pumps<br>• Seal injection water heat exchanger inner tube | Pressure boundary | Stainless steel | Treated water > 140°F (ext) | Cracking | Water Chemistry Control – Closed Treated Water Systems | V.D2.EP-98 | 3.2.1-28 | C |
| Recirculation pumps<br>• Seal injection water heat exchanger inner tube | Pressure boundary | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | V.D2.EP-93 | 3.2.1-31 | C |
| Recirculation pumps<br>• Seal injection water heat exchanger inner tube | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Inservice Inspection<br>Water Chemistry Control – BWR | IV.C1.R-20 | 3.1.1-97 | E |

**Table 3.1.2-3: Reactor Coolant Pressure Boundary**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Recirculation pumps<br>• Seal injection water heat exchanger inner tube | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Recirculation pumps<br>• Seal injection water heat exchanger outer tube (shell) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | C |
| Recirculation pumps<br>• Seal injection water heat exchanger outer tube (shell) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – Closed Treated Water Systems | V.D2.EP-98 | 3.2.1-28 | C |
| Recirculation pumps<br>• Seal injection water heat exchanger outer tube (shell) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | V.D2.EP-93 | 3.2.1-31 | C |
| Recirculation system sample probe | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Recirculation system sample probe | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Inservice Inspection<br>Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 101 |
| Recirculation system sample probe | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |

**Table 3.1.2-3: Reactor Coolant Pressure Boundary**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Thermowell | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Thermowell | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Inservice Inspection<br>Water Chemistry Control – BWR | IV.C1.R-20 | 3.1.1-97 | E |
| Thermowell | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Tubing (non-Class 1) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Tubing (non-Class 1) | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | V.F.EP-82 | 3.2.1-63 | C |
| Tubing (non-Class 1) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Valve body (non-Class 1) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Valve body (non-Class 1) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | C, 101 |
| Valve body (non-Class 1) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – FAC | Flow-Accelerated Corrosion | IV.C1.R-23 | 3.1.1-60 | A |
| Valve body (non-Class 1) | Pressure boundary | CASS | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |

| Table 3.1.2-3: Reactor Coolant Pressure Boundary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body (non-Class 1) | Pressure boundary | CASS | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 101 |
| Valve body (non-Class 1) | Pressure boundary | CASS | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Valve body (non-Class 1) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Valve body (non-Class 1) | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | V.F.EP-82 | 3.2.1-63 | C |
| Valve body (non-Class 1) | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.E4.AP-138 | 3.3.1-100 | C, 103 |
| Valve body (non-Class 1) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Valve body (non-Class 1) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 101 |
| Valve body (non-Class 1) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Valve body (main steam safety/relief valves) | Pressure boundary | Carbon steel (body) | Air – indoor (ext) | None | None | -- | -- | G, 102 |
| Valve body (main steam safety/relief valves) | Pressure boundary | Nickel alloy (disk insert) | Steam (int) | Cracking | Inservice Inspection<br>Water Chemistry Control – BWR | IV.C1.R-21 | 3.1.1-97 | E |

**Table 3.1.2-3: Reactor Coolant Pressure Boundary**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve body (main steam safety/relief valves) | Pressure boundary | Nickel alloy (disk insert) | Steam (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Valve body (main steam safety/relief valves) | Pressure boundary | Stainless steel (nozzle) | Steam (int) | Cracking | Inservice Inspection<br>Water Chemistry Control – BWR | IV.C1.R-20 | 3.1.1-97 | E |
| Valve body (main steam safety/relief valves) | Pressure boundary | Stainless steel (nozzle) | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-155 | 3.4.1-16 | C, 101 |
| Valve body < 4" NPS | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Valve body < 4" NPS | Pressure boundary | Carbon steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |
| Valve body < 4" NPS | Pressure boundary | Carbon steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.A.SP-71 | 3.4.1-14 | C, 101 |
| Valve body < 4" NPS | Pressure boundary | Carbon steel | Steam (int) | Loss of material – FAC | Flow-Accelerated Corrosion | IV.C1.R-23 | 3.1.1-60 | A |
| Valve body < 4" NPS | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | C, 101 |
| Valve body < 4" NPS | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – FAC | Flow-Accelerated Corrosion | IV.C1.R-23 | 3.1.1-60 | A |

| Table 3.1.2-3: Reactor Coolant Pressure Boundary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body < 4" NPS | Pressure boundary | CASS | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Valve body < 4" NPS | Pressure boundary | CASS | Treated water > 140°F (int) | Cracking | Inservice Inspection<br>Water Chemistry Control – BWR | IV.C1.R-20 | 3.1.1-97 | E |
| Valve body < 4" NPS | Pressure boundary | CASS | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Valve body < 4" NPS | Pressure boundary | CASS | Treated water > 482°F (int) | Reduction of fracture toughness | Inservice Inspection | IV.C1.R-08 | 3.1.1-38 | A |
| Valve body < 4" NPS | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Valve body < 4" NPS | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Valve body < 4" NPS | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Inservice Inspection<br>Water Chemistry Control – BWR | IV.C1.R-20 | 3.1.1-97 | E |
| Valve body < 4" NPS | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Valve body ≥ 4" NPS | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |

| Table 3.1.2-3: Reactor Coolant Pressure Boundary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body ≥ 4" NPS | Pressure boundary | Carbon steel | Air – indoor (ext) | None | None | -- | -- | G, 102 |
| Valve body ≥ 4" NPS | Pressure boundary | Carbon steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.A.SP-71 | 3.4.1-14 | C, 101 |
| Valve body ≥ 4" NPS | Pressure boundary | Carbon steel | Steam (int) | Loss of material – FAC | Flow-Accelerated Corrosion | IV.C1.R-23 | 3.1.1-60 | A |
| Valve body ≥ 4" NPS | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | C, 101 |
| Valve body ≥ 4" NPS | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – FAC | Flow-Accelerated Corrosion | IV.C1.R-23 | 3.1.1-60 | A |
| Valve body ≥ 4" NPS | Pressure boundary | CASS | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Valve body ≥ 4" NPS | Pressure boundary | CASS | Treated water > 140°F (int) | Cracking | BWR Stress Corrosion Cracking<br>Inservice Inspection<br>Water Chemistry Control – BWR | IV.C1.R-20 | 3.1.1-97 | A |
| Valve body ≥ 4" NPS | Pressure boundary | CASS | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Valve body ≥ 4" NPS | Pressure boundary | CASS | Treated water > 482°F (int) | Reduction of fracture toughness | Inservice Inspection | IV.C1.R-08 | 3.1.1-38 | A |

| Table 3.1.2-3: Reactor Coolant Pressure Boundary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body ≥ 4" NPS | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Valve body ≥ 4" NPS | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | BWR Stress Corrosion Cracking<br>Inservice Inspection<br>Water Chemistry Control – BWR | IV.C1.R-20 | 3.1.1-97 | A |
| Valve body ≥ 4" NPS | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |

# Table 3.1.2-4-1
# Nuclear Boiler Instrumentation System
# Nonsafety-Related Components Affecting Safety-Related Systems
# Summary of Aging Management Evaluation

**Table 3.1.2-4-1: Nuclear Boiler Instrumentation System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Filter housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Filter housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | IV.C1.RP-158 | 3.1.1-79 | A, 101 |

# Table 3.1.2-4-2
# Reactor Recirculation System
# Nonsafety-Related Components Affecting Safety-Related Systems
# Summary of Aging Management Evaluation

**Table 3.1.2-4-2: Reactor Recirculation System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Accumulator | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Accumulator | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | C, 103 |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | IV.C1.RP-43 | 3.1.1-67 | B |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Filter housing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | C, 103 |
| Flex hose | Pressure boundary | Nickel alloy | Air – indoor (ext) | None | None | IV.E.RP-03 | 3.1.1-106 | A |
| Flex hose | Pressure boundary | Nickel alloy | Lube oil (int) | Cracking – fatigue | TLAA – metal fatigue | IV.C1.R-220 | 3.1.1-6 | C, 105 |
| Flex hose | Pressure boundary | Nickel alloy | Lube oil (int) | Loss of material | Oil Analysis | -- | -- | G |

| Table 3.1.2-4-2: Reactor Recirculation System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Flex hose | Pressure boundary | Stainless steel | Lube oil (int) | Cracking – fatigue | TLAA – metal fatigue | IV.C1.R-220 | 3.1.1-6 | C |
| Flex hose | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.E4.AP-138 | 3.3.1-100 | C, 103 |
| Heat exchanger (coil) | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | V.F.EP-10 | 3.2.1-57 | C |
| Heat exchanger (coil) | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-76 | 3.2.1-50 | C, 103 |
| Orifice | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Orifice | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | C, 103 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |

| Table 3.1.2-4-2: Reactor Recirculation System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Piping | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.E4.AP-138 | 3.3.1-100 | C, 103 |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Pump casing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | C, 103 |
| Sight glass | Pressure boundary | Aluminum | Air – indoor (ext) | None | None | V.F.EP-3 | 3.2.1-56 | C |
| Sight glass | Pressure boundary | Aluminum | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-162 | 3.3.1-99 | C, 103 |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | V.F.EP-15 | 3.2.1-60 | C |
| Sight glass | Pressure boundary | Glass | Lube oil (int) | None | None | V.F.EP-16 | 3.2.1-60 | C |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Strainer housing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | C, 103 |

| Table 3.1.2-4-2: Reactor Recirculation System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tank | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Tank | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.E4.AP-138 | 3.3.1-100 | C, 103 |
| Thermowell | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Thermowell | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.E4.AP-138 | 3.3.1-100 | C, 103 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Tubing | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.E4.AP-138 | 3.3.1-100 | C, 103 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | C |
| Valve body | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | C, 103 |
| Valve body | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |

| Table 3.1.2-4-2: Reactor Recirculation System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | V.F.EP-10 | 3.2.1-57 | C |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-76 | 3.2.1-50 | C, 202 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | IV.E.RP-04 | 3.1.1-107 | A |
| Valve body | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.E4.AP-138 | 3.3.1-100 | C, 103 |
| Valve body | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | C |

## 3.2 ENGINEERED SAFETY FEATURES SYSTEMS

### 3.2.1 Introduction

This section provides the results of the aging management reviews for components in the engineered safety features (ESF) systems that are subject to aging management review. The following systems are addressed in this section (system descriptions are available in the referenced sections).

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

Table 3.2.1, Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the engineered safety features component groups. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

### 3.2.2 Results

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for systems in the ESF system group.

- Table 3.2.2-1 Pressure Relief System—Summary of Aging Management Evaluation
- Table 3.2.2-2 High Pressure Core Spray System—Summary of Aging Management Evaluation
- Table 3.2.2-3 Residual Heat Removal System—Summary of Aging Management Evaluation
- Table 3.2.2-4 Low Pressure Core Spray System—Summary of Aging Management Evaluation
- Table 3.2.2-5 Reactor Core Isolation Cooling System—Summary of Aging Management Evaluation
- Table 3.2.2-6 Standby Gas Treatment System—Summary of Aging Management Evaluation

- Table 3.2.2-7 Containment Penetrations—Summary of Aging Management Evaluation

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

- Table 3.2.2-8-1 Pressure Relief System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.2.2-8-2 High Pressure Core Spray System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.2.2-8-3 Residual Heat Removal System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.2.2-8-4 Low Pressure Core Spray System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.2.2-8-5 Reactor Core Isolation Cooling System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

### 3.2.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the ESF systems. Programs are described in Appendix B. Further details are provided in the system tables.

#### 3.2.2.1.1 Pressure Relief System

**Materials**

Pressure relief system components are constructed of the following materials.

- Carbon steel
- Stainless steel

**Environments**

Pressure relief system components are exposed to the following environments.

- Air – indoor
- Steam

- Treated water

**Aging Effects Requiring Management**

The following aging effects associated with the pressure relief system require management.

- Cracking
- Cracking – fatigue
- Loss of material
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the effects of aging on the pressure relief system components.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- One-Time Inspection
- Water Chemistry Control – BWR

3.2.2.1.2 High Pressure Core Spray System

**Materials**

High pressure core spray system components are constructed of the following materials.

- Carbon steel
- Stainless steel

**Environments**

High pressure core spray system components are exposed to the following environments.

- Air – indoor
- Condensation
- Treated water

**Aging Effects Requiring Management**

The following aging effects associated with the high pressure core spray system require management.

- Cracking – fatigue
- Loss of material
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the effects of aging on the high pressure core spray components.

- Bolting Integrity
- External Surfaces Monitoring
- One-Time Inspection
- Water Chemistry Control – BWR

3.2.2.1.3 Residual Heat Removal System

**Materials**

Residual heat removal system components are constructed of the following materials.

- Carbon steel
- Carbon steel clad with copper alloy
- Copper alloy
- Stainless steel

**Environments**

Residual heat removal system components are exposed to the following environments.

- Air – indoor
- Treated water
- Treated water > 140°F

**Aging Effects Requiring Management**

The following aging effects associated with the residual heat removal system require management.

- Cracking
- Cracking – fatigue
- Loss of material
- Loss of material – FAC
- Loss of preload
- Reduction of heat transfer

**Aging Management Programs**

The following aging management programs manage the effects of aging on the residual heat removal system components.

- Bolting Integrity
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- One-Time Inspection
- Service Water Integrity
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems

3.2.2.1.4 Low Pressure Core Spray System

**Materials**

Low pressure core spray system components are constructed of the following materials.

- Carbon steel
- Stainless steel

**Environments**

Low pressure core spray system components are exposed to the following environments.

- Air – indoor
- Treated water
- Waste water

**Aging Effects Requiring Management**

The following aging effects associated with the low pressure core spray system require management.

- Cracking – fatigue
- Loss of material
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the effects of aging on the low pressure core spray system components.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- One-Time Inspection
- Water Chemistry Control – BWR

3.2.2.1.5 Reactor Core Isolation Cooling System

**Materials**

Reactor core isolation cooling system components are constructed of the following materials.

- Carbon steel
- Copper alloy > 15% zinc or > 8% aluminum
- Glass
- Stainless steel

**Environments**

Reactor core isolation cooling system components are exposed to the following environments.

- Air – indoor
- Lube oil
- Steam
- Treated water

**Aging Effects Requiring Management**

The following aging effects associated with the reactor core isolation cooling system require management.

- Cracking
- Cracking – fatigue
- Loss of material
- Loss of material – FAC
- Loss of preload
- Reduction of heat transfer

**Aging Management Programs**

The following aging management programs manage the effects of aging on the reactor core isolation cooling system components.

- Bolting Integrity
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Oil Analysis
- One-Time Inspection
- Water Chemistry Control – BWR

3.2.2.1.6 Standby Gas Treatment System

**Materials**

Standby gas treatment system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Fiberglass
- Stainless steel

**Environments**

Standby gas treatment system components are exposed to the following environments.

- Air – indoor
- Waste water

**Aging Effects Requiring Management**

The following aging effects associated with the standby gas treatment system require management.

- Change in material properties
- Loss of material
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the effects of aging on the standby gas treatment system components.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components

3.2.2.1.7 Containment Penetrations

**Materials**

Containment penetrations components are constructed of the following materials.

- Carbon steel
- Stainless steel

**Environments**

Containment penetrations components are exposed to the following environments.

- Air – indoor
- Treated water
- Treated water > 140°F

**Aging Effects Requiring Management**

The following aging effects associated with containment penetrations components require management.

- Cracking
- Cracking – fatigue
- Loss of material
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the effects of aging on the containment penetrations components.

- Bolting Integrity
- External Surfaces Monitoring
- One-Time Inspection
- Water Chemistry Control – BWR

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

The following lists encompass materials, environments, aging effects requiring management, and aging management programs for the series 3.2.2-8-x tables.

**Materials**

Nonsafety-related components affecting safety-related systems are constructed of the following materials.

- Carbon steel
- Copper alloy > 15% zinc or > 8% aluminum
- Stainless steel

**Environments**

Nonsafety-related components affecting safety-related systems are exposed to the following environments.

- Air – indoor
- Condensation
- Treated water
- Treated water > 140°F
- Waste water

**Aging Effects Requiring Management**

The following aging effects associated with nonsafety-related components affecting safety-related systems require management.

- Cracking
- Loss of material
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the effects of aging on nonsafety-related components affecting safety-related systems.

- Bolting Integrity
- Compressed Air Monitoring
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- One-Time Inspection
- Water Chemistry Control – BWR

### 3.2.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.2.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the RBS approach to those areas requiring further evaluation. Programs are described in Appendix B.

#### 3.2.2.2.1 Cumulative Fatigue Damage

Where fatigue is identified as an aging effect requiring management, the analysis of fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). Evaluation of this TLAA is addressed in Section 4.3.

#### 3.2.2.2.2 Loss of Material due to Cladding [Breach]

This paragraph in NUREG-1800 pertains to PWR steel charging pump casings with stainless steel cladding and is therefore not applicable to RBS.

#### 3.2.2.2.3 Loss of Material due to Pitting and Crevice Corrosion

1. This paragraph in NUREG-1800 pertains to loss of material due to pitting and crevice corrosion in partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering. Although this paragraph is referenced only by a PWR table line (V.D1.E-01) in NUREG-1801, it could also apply to BWR plants. However, the ESF systems at RBS do not include partially encased stainless steel tanks exposed to this environment. Therefore, this paragraph is not applicable.

2. Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Chloride contamination of components exposed to outdoor air may occur. However, at RBS there are no ESF system components exposed to

outdoor air in the scope of license renewal. At RBS, there are no stainless steel ESF system components located indoors near unducted air intakes.

3.2.2.2.4 Loss of Material due to Erosion

This paragraph in NUREG-1800 pertains to PWR high pressure safety injection (HPSI) pump miniflow recirculation orifice and is therefore not applicable to RBS.

3.2.2.2.5 Loss of Material due to General Corrosion and Fouling that Leads to Corrosion

This item refers to loss of material due to general corrosion and fouling occurring for steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to indoor air. RBS does not use drywell or suppression chamber sprays. There are no steel nozzles or orifices in the RBS ESF systems internally exposed to an indoor air environment. Therefore, this item was not used.

3.2.2.2.6 Cracking due to Stress Corrosion Cracking

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Water in the RBS cooling towers is treated with chlorine compounds. Chloride contamination of components exposed to outdoor air may occur. However, at RBS there are no ESF system components exposed to outdoor air in the scope of license renewal. At RBS, there are no stainless steel ESF system components located indoors near unducted air intakes.

3.2.2.2.7 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of RBS quality assurance procedures and administrative controls for aging management programs.

3.2.2.2.8 Ongoing Review of Operating Experience

See Appendix B Section B.0.4 for discussion of RBS operating experience review programs.

3.2.2.2.9 Loss of Material due to Recurring Internal Corrosion

A review of 10 years of plant operating experience identified no conditions of recurring internal corrosion (RIC) as defined in LR-ISG 2012-02, Section A, in the piping components of the engineered safety features systems in the scope of license renewal.

#### 3.2.2.3 Time-Limited Aging Analyses

The only time-limited aging analysis identified for the ESF systems components is metal fatigue. This is evaluated in Section 4.3.

### 3.2.3 Conclusion

The ESF system components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21. The aging management programs selected to manage the effects of aging on ESF components are identified in Section 3.2.2.1 and in the following tables. A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the ESF components will be managed such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

# Table 3.2.1
## Summary of Aging Management Programs for Engineered Safety Features Evaluated in Chapter V of NUREG-1801

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-1 | Stainless steel, steel piping, piping components, and piping elements exposed to Treated water (borated) | Cumulative fatigue damage due to fatigue | Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1). | Yes, TLAA | Fatigue is a TLAA.<br>See Section 3.2.2.2.1. |
| 3.2.1-2 | PWR only | | | | |
| 3.2.1-3 | PWR only | | | | |
| 3.2.1-4 | Stainless steel piping, piping components, and piping elements; tanks exposed to Air – outdoor | Loss of material due to pitting and crevice corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | Yes, environmental conditions need to be evaluated. | This item was not used. There are no stainless steel ESF system components exposed to outdoor air included in the scope of license renewal.<br>See Section 3.2.2.2.3, Item 2. |
| 3.2.1-5 | PWR only | | | | |

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-6 | Steel Drywell and suppression chamber spray system (internal surfaces): flow orifice; spray nozzles exposed to Air – indoor, uncontrolled (Internal) | Loss of material due to general corrosion; fouling that leads to corrosion | A plant-specific aging management program is to be evaluated | Yes, plant-specific | This item was not used. There are no steel orifices or spray nozzles exposed to indoor air in the RBS ESF systems.<br>See Section 3.2.2.2.5. |
| 3.2.1-7 | Stainless steel Piping, piping components, and piping elements; tanks exposed to Air – outdoor | Cracking due to stress corrosion cracking | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | Yes, environmental conditions need to be evaluated | This item was not used. There are no stainless steel ESF system components exposed to outdoor air included in the scope of license renewal.<br>See Section 3.2.2.2.6. |
| 3.2.1-8 | PWR only | | | | |
| 3.2.1-9 | PWR only | | | | |
| 3.2.1-10 | Cast austenitic stainless steel Piping, piping components, and piping elements exposed to Treated water (borated) >250°C (>482°F), Treated water >250°C (>482°F) | Loss of fracture toughness due to thermal aging embrittlement | Chapter XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)" | No | This item was not used. There are no cast austenitic stainless steel components exposed to treated water > 250°C (> 482°F) within the scope of license renewal that are outside the reactor coolant system pressure boundary. |

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-11 | Steel piping, piping components, and piping elements exposed to steam, treated water | Wall thinning due to flow-accelerated corrosion | Chapter XI.M17, "Flow-Accelerated Corrosion" | No | Consistent with NUREG-1801. Loss of material due to flow-accelerated corrosion in steel components exposed to steam or treated water is managed by the Flow-Accelerated Corrosion Program. |
| 3.2.1-12 | Steel, high-strength closure bolting exposed to air with steam or water leakage | Cracking due to cyclic loading, stress corrosion cracking | Chapter XI.M18, "Bolting Integrity" | No | Consistent with NUREG-1801. Cracking of high-strength steel reactor coolant system closure bolting (Tables 3.1.2-x) is managed by the Bolting Integrity Program. |
| 3.2.1-13 | Steel; stainless steel bolting, closure bolting exposed to air – outdoor (external), air – indoor, uncontrolled (external) | Loss of material due to general (steel only), pitting, and crevice corrosion | Chapter XI.M18, "Bolting Integrity" | No | Consistent with NUREG-1801. Loss of material for steel closure bolting exposed to indoor air is managed by the Bolting Integrity Program. Loss of material is not an aging effect for stainless steel closure bolting in indoor air unless exposed to prolonged leakage (an event-driven condition). Nevertheless, the Bolting Integrity Program also applies to stainless steel bolting exposed to indoor air. There is no ESF system bolting exposed to outdoor air in the scope of license renewal. |

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-14 | Steel closure bolting exposed to air with steam or water leakage | Loss of material due to general corrosion | Chapter XI.M18, "Bolting Integrity" | No | This item was not used. As stated in Item 3.2.1-13, loss of material of steel bolting exposed to air in the ESF systems is managed by the Bolting Integrity Program. However, steam or water leakage is not considered as a separate aspect of the indoor air environment. |
| 3.2.1-15 | Copper alloy, nickel alloy, steel; stainless steel, stainless steel, steel; stainless steel bolting, closure bolting exposed to any environment, air – outdoor (external), raw water, treated borated water, fuel oil, treated water, air – indoor, uncontrolled (external) | Loss of preload due to thermal effects, gasket creep, and self-loosening | Chapter XI.M18, "Bolting Integrity" | No | Consistent with NUREG-1801. Loss of preload for steel and stainless steel bolting is managed by the Bolting Integrity Program. Copper alloy and nickel alloy bolting is not included in the scope of license renewal for ESF systems. |

| Table 3.2.1: Engineered Safety Features | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Program** | **Further Evaluation Recommended** | **Discussion** |
| 3.2.1-16 | Steel containment isolation piping and components (internal surfaces), piping, piping components, and piping elements exposed to treated water | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for steel containment isolation and other ESF system components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material. |

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-17 | Aluminum, stainless steel piping, piping components, and piping elements exposed to treated water | Loss of material due to pitting and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801 for most components. Loss of material for aluminum and stainless steel components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material.<br>For piping that passes through the waterline region of the suppression pool, the environment for the internal and external surfaces of the piping may alternate between wet and dry. The One-Time Inspection Program will use visual or other NDE techniques to inspect this piping to manage the potential for accelerated loss of material. |

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-18 | Stainless steel containment isolation piping and components (internal surfaces) exposed to treated water | Loss of material due to pitting and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for stainless steel components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material. |
| 3.2.1-19 | Stainless steel heat exchanger tubes exposed to treated water, treated water (borated) | Reduction of heat transfer due to fouling | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Reduction of heat transfer for stainless steel heat exchanger tubes exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage reduction of heat transfer. |
| 3.2.1-20 | PWR only | | | | |
| 3.2.1-21 | PWR only | | | | |
| 3.2.1-22 | PWR only | | | | |

| Table 3.2.1: Engineered Safety Features | | | | | |
|---|---|---|---|---|---|
| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
| 3.2.1-23 | Steel heat exchanger components, containment isolation piping and components (internal surfaces) exposed to raw water | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. There are no steel ESF system components exposed to raw water in the scope of license renewal. |
| 3.2.1-24 | PWR only | | | | |
| 3.2.1-25 | Stainless steel heat exchanger components, containment isolation piping and components (internal surfaces) exposed to raw water | Loss of material due to pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. There are no stainless steel ESF system components exposed to raw water in the scope of license renewal. |
| 3.2.1-26 | Stainless steel heat exchanger tubes exposed to raw water | Reduction of heat transfer due to fouling | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. There are no stainless steel ESF system components exposed to raw water in the scope of license renewal. |
| 3.2.1-27 | Stainless steel, steel heat exchanger tubes exposed to raw water | Reduction of heat transfer due to fouling | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. There are no steel or stainless steel ESF system components exposed to raw water in the scope of license renewal. |

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-28 | Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water >60°C (> 140°F) | Cracking due to stress corrosion cracking | Chapter XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-1801. The Water Chemistry Control – Closed Treated Water Systems Program manages cracking of reactor recirculation pump cooler assembly subcomponents (Table 3.1.2-3) exposed to closed-cycle cooling water > 60°C (> 140°F). There are no stainless steel ESF system components exposed to closed-cycle cooling water > 60°C (> 140°F) in the scope of license renewal. |
| 3.2.1-29 | Steel Piping, piping components, and piping elements exposed to closed-cycle cooling water | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-1801. Loss of material of steel components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program. |

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-30 | Steel heat exchanger components exposed to closed-cycle cooling water | Loss of material due to general, pitting, crevice, and galvanic corrosion | Chapter XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-1801 for some components. Loss of material of steel heat exchanger components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program. For heat exchanger components cooled by the normal service water system (also a closed treated water system), the Service Water Integrity Program manages loss of material. |
| 3.2.1-31 | Stainless steel heat exchanger components, piping, piping components, and piping elements exposed to closed-cycle cooling water | Loss of material due to pitting and crevice corrosion | Chapter XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-1801. Loss of material of stainless steel heat exchanger components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program. |

| Table 3.2.1: Engineered Safety Features | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Program** | **Further Evaluation Recommended** | **Discussion** |
| 3.2.1-32 | Copper alloy heat exchanger components, piping, piping components, and piping elements exposed to Closed-cycle cooling water | Loss of material due to pitting, crevice, and galvanic corrosion | Chapter XI.M21A, "Closed Treated Water Systems" | No | Copper alloy heat exchanger components in the ESF systems exposed to closed-cycle cooling water are cooled by the normal service water system (also a closed treated water system). Loss of material for these components is managed by the Service Water Integrity Program. |
| 3.2.1-33 | Copper alloy, Stainless steel Heat exchanger tubes exposed to Closed-cycle cooling water | Reduction of heat transfer due to fouling | Chapter XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-1801. Reduction of heat transfer for stainless steel heat exchanger tubes exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program. ESF system copper alloy heat exchanger tubes exposed to closed-cycle cooling water with a heat transfer intended function are addressed in Table 3.3.1, Item 3.3.1-50). |
| 3.2.1-34 | Copper alloy (>15% Zn or >8% Al) piping, piping components, and piping elements, heat exchanger components exposed to closed-cycle cooling water | Loss of material due to selective leaching | Chapter XI.M33, "Selective Leaching" | No | This item was not used. There are no copper alloy (> 15% Zn or > 8% Al) ESF system components exposed to closed-cycle cooling water in the scope of license renewal. |

| Table 3.2.1: Engineered Safety Features | | | | | |
|---|---|---|---|---|---|
| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
| 3.2.1-35 | PWR only | | | | |
| 3.2.1-36 | PWR only | | | | |
| 3.2.1-37 | Gray cast iron piping, piping components, and piping elements exposed to soil | Loss of material due to selective leaching | Chapter XI.M33, "Selective Leaching" | No | This item was not used. There are no ESF system components exposed to soil in the scope of license renewal. |
| 3.2.1-38 | Elastomers, elastomer seals and components exposed to air – indoor, uncontrolled (external) | Hardening and loss of strength due to elastomer degradation | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | This item was not used. There are no elastomer ESF system components in the scope of license renewal. |
| 3.2.1-39 | Steel containment isolation piping and components (external surfaces) exposed to condensation (external) | Loss of material due to general corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | Consistent with NUREG-1801. Loss of material in steel components exposed to external condensation is managed by the External Surfaces Monitoring Program. |
| 3.2.1-40 | Steel ducting, piping, and components (external surfaces), ducting, closure bolting, containment isolation piping and components (external surfaces) exposed to air – indoor, uncontrolled (external) | Loss of material due to general corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | Consistent with NUREG-1801. Loss of material of external surfaces of steel components exposed to indoor air is managed by the External Surfaces Monitoring Program. |

| Table 3.2.1: Engineered Safety Features | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Program** | **Further Evaluation Recommended** | **Discussion** |
| 3.2.1-41 | Steel external surfaces exposed to air – outdoor (external) | Loss of material due to general corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | This item was not used. There are no steel ESF system components exposed to outdoor air included in the scope of license renewal. |
| 3.2.1-42 | Aluminum piping, piping components, and piping elements exposed to air - outdoor | Loss of material due to pitting and crevice corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | This item was not used. There are no aluminum ESF system components exposed to outdoor air in the scope of license renewal. |
| 3.2.1-43 | Elastomers elastomer seals and components exposed to air – indoor, uncontrolled (internal) | Hardening and loss of strength due to elastomer degradation | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | This item was not used. There are no elastomer ESF system components in the scope of license renewal. |

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-44 | Steel piping and components (internal surfaces), ducting and components (internal surfaces) exposed to air – indoor, uncontrolled (internal) | Loss of material due to general corrosion | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | Consistent with NUREG-1801 for most components. Loss of material from the internal surfaces of steel components exposed to air – indoor is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program.<br>The External Surfaces Monitoring Program manages loss of material for external carbon steel components by visual inspection of external surfaces. For those components where internal carbon steel surfaces are exposed to the same environment as external surfaces, external surface conditions will be representative of internal surfaces. Thus, loss of material on internal carbon steel surfaces is also managed by the External Surfaces Monitoring Program. |

| Table 3.2.1: Engineered Safety Features | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Program** | **Further Evaluation Recommended** | **Discussion** |
| 3.2.1-45 | PWR only | | | | |
| 3.2.1-46 | Steel piping and components (internal surfaces) exposed to condensation (internal) | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | This item was not used. Steel EFS system components exposed internally to condensation are in compressed air systems. These components are addressed in Table 3.3.1, Item 3.3.1-55. |
| 3.2.1-47 | PWR only | | | | |
| 3.2.1-48 | Stainless steel piping, piping components, and piping elements (internal surfaces); tanks exposed to condensation (internal) | Loss of material due to pitting and crevice corrosion | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | This item was not used. Stainless steel EFS system components exposed internally to condensation are in compressed air systems. These components are addressed in Table 3.3.1, Item 3.3.1-56. |
| 3.2.1-49 | Steel piping, piping components, and piping elements exposed to lubricating oil | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for steel components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material. |

| Table 3.2.1: Engineered Safety Features | | | | | |
|---|---|---|---|---|---|
| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
| 3.2.1-50 | Copper alloy, stainless steel (PWR only) piping, piping components, and piping elements exposed to lubricating oil | Loss of material due to pitting and crevice corrosion | Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for copper alloy components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material. |
| 3.2.1-51 | Steel, copper alloy, stainless steel heat exchanger tubes exposed to lubricating oil | Reduction of heat transfer due to fouling | Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Reduction of heat transfer for copper alloy and stainless steel heat exchanger tubes exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage reduction of heat transfer. There are no steel ESF system heat exchanger tubes exposed to lube oil with an intended function of heat transfer in the scope of license renewal. |
| 3.2.1-52 | Steel (with coating or wrapping) piping, piping components, and piping elements exposed to soil or concrete | Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. There are no buried or underground ESF system components exposed to soil or concrete in the scope of license renewal. |

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-53 | Stainless steel, nickel alloy piping, piping components, and piping elements exposed to soil or concrete | Loss of material due to pitting and crevice corrosion | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. There are no buried or underground ESF system components exposed to soil or concrete in the scope of license renewal. |
| 3.2.1-53.5 | Steel; stainless steel, nickel alloy underground piping, piping components, and piping elements exposed to air-indoor uncontrolled or condensation (external) | Loss of material due to general (steel only), pitting and crevice corrosion | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. There are no buried or underground ESF system components exposed to condensation in the scope of license renewal. |
| 3.2.1-54 | Stainless steel piping, piping components, and piping elements exposed to treated water >60°c (> 140°f) | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking | Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry" | No | This item was not used. Stainless steel components of the ESF systems subject to evaluation under the BWR Stress Corrosion Cracking Program, were reviewed as part of the Class 1 reactor coolant pressure boundary (Table 3.1.2-3). |

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-55 | Steel piping, piping components, and piping elements exposed to concrete | None | None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete | No, if conditions are met. | This item was not used. There are no ESF system components embedded in concrete in the scope of license renewal. |
| 3.2.1-56 | Aluminum piping, piping components, and piping elements exposed to air – indoor, uncontrolled (internal/external) | None | None | NA - No AEM or AMP | Consistent with NUREG-1801. |
| 3.2.1-57 | Copper alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), gas | None | None | NA - No AEM or AMP | Consistent with NUREG-1801 for copper alloy components exposed to indoor air. There are no copper alloy ESF system components exposed to gas in the scope of license renewal. |
| 3.2.1-58 | PWR only | | | | |
| 3.2.1-59 | Galvanized steel ducting, piping, and components exposed to air – indoor, controlled (external) | None | None | NA - No AEM or AMP | This item was not used. Galvanized steel is evaluated as steel. |

| Table 3.2.1: Engineered Safety Features | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Program** | **Further Evaluation Recommended** | **Discussion** |
| 3.2.1-60 | Glass piping elements exposed to air – indoor, uncontrolled (external), lubricating oil, raw water, treated water, treated water (borated), air with borated water leakage, condensation (internal/ external), gas, closed-cycle cooling water, air – outdoor | None | None | NA - No AEM or AMP | Consistent with NUREG-1801 for glass components exposed to indoor air and lube oil. There are no glass ESF system components exposed to other environments in the scope of license renewal. |
| 3.2.1-61 | Nickel alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external) | None | None | NA - No AEM or AMP | This item was not used. There are no nickel alloy ESF system components exposed to indoor air in the scope of license renewal. |
| 3.2.1-62 | Nickel alloy piping, piping components, and piping elements exposed to air with borated water leakage | None | None | NA - No AEM or AMP | This item was not used. There are no nickel alloy ESF system components exposed to indoor air in the scope of license renewal. |
| 3.2.1-63 | Stainless steel piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), air with borated water leakage, concrete, gas, air – indoor, uncontrolled (internal) | None | None | NA - No AEM or AMP | Consistent with NUREG-1801 for stainless steel components exposed to indoor air and gas. There are no stainless steel ESF system components exposed to air with borated water leakage, concrete or gas in the scope of license renewal. |

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-64 | Steel piping, piping components, and piping elements exposed to air – indoor, controlled (external), gas | None | None | NA - No AEM or AMP | This item was not used. There are no steel ESF system components exposed to controlled indoor air or gas in the scope of license renewal. |
| 3.2.1-65 | Any material, piping, piping components, and piping elements exposed to treated water, treated water (borated) | Wall thinning due to erosion | Chapter XI.M17, "Flow-Accelerated Corrosion" | No | This item was not used. There are no ESF system components subject to loss of material due to erosion in the scope of license renewal. |
| 3.2.1-66 | Metallic piping, piping components, and tanks exposed to raw water or waste water | Loss of material due to recurring internal corrosion | A plant-specific aging management program is to be evaluated to address recurring internal corrosion | Yes, plant-specific | Recurring internal corrosion was not identified in the RBS engineered safety features systems in the scope of license renewal.<br>(See Section 3.2.2.2.9.) |
| 3.2.1-67 | Stainless steel or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation | Cracking due to stress corrosion cracking | Chapter XI.M29, "Aboveground Metallic Tanks" | No | This item was not used. There are no stainless steel or aluminum tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the engineered safety features systems. |

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-68 | Steel, stainless steel, or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation | Loss of material due to general (steel only), pitting, and crevice corrosion | Chapter XI.M29, "Aboveground Metallic Tanks" | No | This item was not used. There are no steel, stainless steel or aluminum tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the engineered safety features systems. |
| 3.2.1-69 | Insulated steel, stainless steel, copper alloy, or aluminum, piping, piping components, and tanks exposed to condensation, air- outdoor | Loss of material due to general (steel, and copper alloy only), pitting, and crevice corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, "Aboveground Metallic Tanks," (for tanks only) | No | This item was not used. There are no steel, stainless steel, aluminum, or copper alloy insulated piping components or tanks exposed to condensation or outdoor air in the engineered safety features systems in the scope of license renewal. |
| 3.2.1-70 | Steel, stainless steel or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to treated water, treated borated water | Loss of material due to general (steel only), pitting and crevice corrosion | Chapter XI.M29, "Aboveground Metallic Tanks" | No | This item was not used. There are no steel, stainless steel or aluminum tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the engineered safety features systems. |

| Table 3.2.1: Engineered Safety Features | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Program** | **Further Evaluation Recommended** | **Discussion** |
| 3.2.1-71 | Insulated stainless steel, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air- outdoor | Cracking due to stress corrosion cracking | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, "Aboveground Metallic Tanks" (for tanks only) | No | This item was not used. There are no stainless steel, aluminum, or copper alloy insulated piping components or tanks exposed to condensation or outdoor air in the engineered safety features systems in the scope of license renewal. |
| 3.2.1-72 | Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil | Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings | Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks" | No | This item was not used. There are no metallic components with internal coatings in the ESF systems in the scope of license renewal. |
| 3.2.1-73 | Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion | Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks" | No | This item was not used. There are no metallic components with internal coatings in the ESF systems in the scope of license renewal. |

**Table 3.2.1: Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Program | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-74 | Gray cast iron piping components with internal coatings/linings exposed to closed-cycle cooling water, raw water, or treated water | Loss of material due to selective leaching | Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks" | No | This item was not used. There are no metallic components with internal coatings in the ESF systems in the scope of license renewal. |

**Notes for Tables 3.2.2-1 through 3.2.2-8-5**

Generic Notes

A. Consistent with component, material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different AMP is credited or NUREG-1801 identifies a plant-specific AMP.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

201. The One-Time Inspection Program will verify effectiveness of the Water Chemistry Control – BWR Program.

202. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program.

203. This piping passes through the waterline region of suppression pool. The environment for the internal and external surfaces of the piping in this region may alternate between wet and dry. The One-Time Inspection Program will use visual or other NDE techniques to inspect this piping to manage the potential accelerated loss of material.

204. This steam environment for this component type is produced from and is equivalent to treated water for the purposes of evaluating loss of material due to erosion.

205. For the purposes of evaluating cracking due to fatigue, this environment can be considered equivalent to the NUREG-1801 environment.

**Table 3.2.2-1**
**Pressure Relief System**
**Summary of Aging Management Evaluation**

| Table 3.2.2-1: Pressure Relief System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | V.E.EP-70 | 3.2.1-13 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Diffuser | Pressure boundary<br>Flow control | Stainless steel | Steam (int) | Cracking | Water Chemistry Control – BWR | VIII.B2.SP-98 | 3.4.1-11 | C, 201 |
| Diffuser | Pressure boundary<br>Flow control | Stainless steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 205 |
| Diffuser | Pressure boundary<br>Flow control | Stainless steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-155 | 3.4.1-16 | C, 201 |
| Diffuser | Pressure boundary<br>Flow control | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |

| Table 3.2.2-1: Pressure Relief System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Diffuser | Pressure boundary<br>Flow control | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | A |
| Piping | Pressure boundary | Carbon steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VIII.B2.S-08 | 3.4.1-1 | C |
| Piping | Pressure boundary | Carbon steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201, 204 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Piping | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | V.F.EP-82 | 3.2.1-63 | A |
| Piping | Pressure boundary | Stainless steel | Steam (int) | Cracking | Water Chemistry Control – BWR | VIII.B2.SP-98 | 3.4.1-11 | C, 201 |
| Piping | Pressure boundary | Stainless steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 205 |
| Piping | Pressure boundary | Stainless steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-155 | 3.4.1-16 | C, 201 |

| Table 3.2.2-1: Pressure Relief System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | One-Time Inspection | V.D2.EP-73 | 3.2.1-17 | E, 203 |
| Piping | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | One-Time Inspection | V.D2.EP-73 | 3.2.1-17 | E, 203 |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Thermowell | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Thermowell | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | V.F.EP-82 | 3.2.1-63 | A |
| Thermowell | Pressure boundary | Stainless steel | Steam (int) | Cracking | Water Chemistry Control – BWR | VIII.B2.SP-98 | 3.4.1-11 | C, 201 |
| Thermowell | Pressure boundary | Stainless steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 205 |
| Thermowell | Pressure boundary | Stainless steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-155 | 3.4.1-16 | C, 201 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |

| Table 3.2.2-1: Pressure Relief System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | A |
| Valve body | Pressure boundary | Carbon steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VIII.B2.S-08 | 3.4.1-1 | C |
| Valve body | Pressure boundary | Carbon steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201, 204 |

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

**Table 3.2.2-2: High Pressure Core Spray System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | V.E.EP-70 | 3.2.1-13 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Bolting | Pressure boundary | Carbon steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | C, 201 |
| Bolting | Pressure boundary | Carbon steel | Treated water (ext) | Loss of preload | Bolting Integrity | V.E.EP-122 | 3.2.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | C, 201 |
| Bolting | Pressure boundary | Stainless steel | Treated water (ext) | Loss of preload | Bolting Integrity | V.E.EP-122 | 3.2.1-15 | B |
| Cyclone separator | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Cyclone separator | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Flex hose | Pressure boundary | Stainless steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 205 |

| Table 3.2.2-2: High Pressure Core Spray System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flex hose | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Flow element | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Flow element | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Piping | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Piping | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |

| Table 3.2.2-2: High Pressure Core Spray System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Pump casing | Pressure boundary | Carbon steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Pump casing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Strainer | Filtration | Stainless steel | Treated water (ext) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 205 |
| Strainer | Filtration | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Strainer housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Suction barrel | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | V.E.E-46 | 3.2.1-39 | A |
| Suction barrel | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |

| Table 3.2.2-2: High Pressure Core Spray System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Thermowell | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Thermowell | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |

## Table 3.2.2-3
## Residual Heat Removal System
## Summary of Aging Management Evaluation

**Table 3.2.2-3: Residual Heat Removal System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | V.E.EP-70 | 3.2.1-13 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Bolting | Pressure boundary | Carbon steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | C, 201 |
| Bolting | Pressure boundary | Carbon steel | Treated water (ext) | Loss of preload | Bolting Integrity | V.E.EP-122 | 3.2.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | C, 201 |
| Bolting | Pressure boundary | Stainless steel | Treated water (ext) | Loss of preload | Bolting Integrity | V.E.EP-122 | 3.2.1-15 | B |
| Cyclone separator | Pressure boundary<br>Filtration | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Cyclone separator | Pressure boundary<br>Filtration | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.E.SP-88 | 3.4.1-11 | C, 201 |

| Table 3.2.2-3: Residual Heat Removal System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Cyclone separator | Pressure boundary<br>Filtration | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Cyclone separator | Pressure boundary<br>Filtration | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Flex hose | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.E.SP-88 | 3.4.1-11 | C, 201 |
| Flex hose | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Flex hose | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Flow element | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Flow element | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Flow element | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Flow element | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |

| Table 3.2.2-3: Residual Heat Removal System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flow element | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.E.SP-88 | 3.4.1-11 | C, 201 |
| Flow element | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Flow element | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | A |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Service Water Integrity | V.D2.EP-92 | 3.2.1-30 | E |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | A |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | V.D2.EP-92 | 3.2.1-30 | A |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-140 | 3.3.1-22 | C, 201 |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Treated water (ext) | Reduction of heat transfer | Water Chemistry Control – BWR | VIII.E.SP-100 | 3.4.1-18 | C, 201 |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Service Water Integrity | V.D2.EP-94 | 3.2.1-32 | E |

| Table 3.2.2-3: Residual Heat Removal System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Treated water (int) | Reduction of heat transfer | Service Water Integrity | VII.C2.AP-205 | 3.3.1-50 | E |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | V.D2.EP-93 | 3.2.1-31 | A |
| Heat exchanger (tubes) | Heat transfer | Stainless steel | Treated water (ext) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | V.D2.EP-96 | 3.2.1-33 | A |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VII.E3.AP-112 | 3.3.1-20 | C, 201 |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-111 | 3.3.1-25 | C, 201 |
| Heat exchanger (tubes) | Heat transfer | Stainless steel | Treated water > 140°F (int) | Reduction of heat transfer | Water Chemistry Control – BWR | V.D2.EP-74 | 3.2.1-19 | A, 201 |
| Heat exchanger (tubesheet) | Pressure boundary | Carbon steel clad with copper alloy | Treated water (ext) | Loss of material | Service Water Integrity | V.D2.EP-94 | 3.2.1-32 | E |
| Heat exchanger (tubesheet) | Pressure boundary | Carbon steel clad with copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-140 | 3.3.1-22 | C, 201 |
| Nozzle | Flow control | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |

| Table 3.2.2-3: Residual Heat Removal System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Orifice | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.E.SP-88 | 3.4.1-11 | C, 201 |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | V.D2.E-10 | 3.2.1-1 | C |
| Piping | Pressure boundary | Carbon steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |

| Table 3.2.2-3: Residual Heat Removal System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – FAC | Flow-Accelerated Corrosion | V.D2.E-09 | 3.2.1-11 | A |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Piping | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | One-Time Inspection | V.D2.EP-73 | 3.2.1-17 | E, 203 |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | One-Time Inspection | V.D2.EP-73 | 3.2.1-17 | E, 203 |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.E.SP-88 | 3.4.1-11 | C, 201 |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Pump casing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |

| Table 3.2.2-3: Residual Heat Removal System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Strainer | Filtration | Stainless steel | Treated water (ext) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Strainer | Filtration | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Strainer housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Strainer housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Strainer housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Strainer housing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.E.SP-88 | 3.4.1-11 | C, 201 |
| Strainer housing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Strainer housing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Suction barrel | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Suction barrel | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | V.D2.E-10 | 3.2.1-1 | C |

| Table 3.2.2-3: Residual Heat Removal System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Suction barrel | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Thermowell | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Thermowell | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | V.D2.E-10 | 3.2.1-1 | C |
| Thermowell | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.E.SP-88 | 3.4.1-11 | C, 201 |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | V.D2.E-10 | 3.2.1-1 | C |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |

| Table 3.2.2-3: Residual Heat Removal System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | V.C.EP-99 | 3.2.1-29 | C |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.E.SP-88 | 3.4.1-11 | C, 201 |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |

## Table 3.2.2-4
## Low Pressure Core Spray System
## Summary of Aging Management Evaluation

| Table 3.2.2-4: Low Pressure Core Spray System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | V.E.EP-70 | 3.2.1-13 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | C, 201 |
| Bolting | Pressure boundary | Stainless steel | Treated water (ext) | Loss of preload | Bolting Integrity | V.E.EP-122 | 3.2.1-15 | B |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Flex hose | Pressure boundary | Stainless steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Flex hose | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Flow element | Pressure boundary<br>Flow control | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Flow element | Pressure boundary<br>Flow control | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |

| Table 3.2.2-4: Low Pressure Core Spray System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Piping | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |

| Table 3.2.2-4: Low Pressure Core Spray System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Pump casing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Strainer | Filtration | Stainless steel | Treated water (ext) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Strainer | Filtration | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Strainer housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Thermowell | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Thermowell | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |

| Table 3.2.2-4: Low Pressure Core Spray System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Valve body | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |

**Table 3.2.2-5**
**Reactor Core Isolation Cooling System**
**Summary of Aging Management Evaluation**

**Table 3.2.2-5: Reactor Core Isolation Cooling System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Accumulator | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Accumulator | Pressure boundary | Stainless steel | Steam (int) | Cracking | Water Chemistry Control – BWR | VIII.B2.SP-98 | 3.4.1-11 | C, 201 |
| Accumulator | Pressure boundary | Stainless steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 205 |
| Accumulator | Pressure boundary | Stainless steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-155 | 3.4.1-16 | C, 201 |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | V.E.EP-70 | 3.2.1-13 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | C, 201 |
| Bolting | Pressure boundary | Stainless steel | Treated water (ext) | Loss of preload | Bolting Integrity | V.E.EP-122 | 3.2.1-15 | B |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |

| Table 3.2.2-5: Reactor Core Isolation Cooling System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Filter housing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | A, 202 |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Flex hose | Pressure boundary | Stainless steel | Steam (int) | Cracking | Water Chemistry Control – BWR | VIII.B2.SP-98 | 3.4.1-11 | C, 201 |
| Flex hose | Pressure boundary | Stainless steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 205 |
| Flex hose | Pressure boundary | Stainless steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-155 | 3.4.1-16 | C, 201 |
| Flow element | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Flow element | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Heat exchanger (channel head) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | C |
| Heat exchanger (channel head) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-111 | 3.3.1-25 | C, 201 |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | A |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | C, 202 |

| Table 3.2.2-5: Reactor Core Isolation Cooling System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Lube oil (ext) | Loss of material | Oil Analysis | VII.C1.AP-138 | 3.3.1-100 | C, 202 |
| Heat exchanger (tubes) | Heat transfer | Stainless steel | Lube oil (ext) | Reduction of heat transfer | Oil Analysis | V.D2.EP-79 | 3.2.1-51 | A, 201 |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-111 | 3.3.1-25 | C, 201 |
| Heat exchanger (tubes) | Heat transfer | Stainless steel | Treated water (int) | Reduction of heat transfer | Water Chemistry Control – BWR | V.D2.EP-74 | 3.2.1-19 | A, 201 |
| Heat exchanger (tubesheet) | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-138 | 3.3.1-100 | C, 202 |
| Heat exchanger (tubesheet) | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-111 | 3.3.1-25 | C, 201 |
| Orifice | Pressure boundary<br>Flow control | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Orifice | Pressure boundary<br>Flow control | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | A, 202 |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |

| Table 3.2.2-5: Reactor Core Isolation Cooling System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-138 | 3.3.1-100 | C, 202 |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Steam (int) | Cracking | Water Chemistry Control – BWR | VIII.B2.SP-98 | 3.4.1-11 | C, 201 |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 205 |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-155 | 3.4.1-16 | C, 201 |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | External Surfaces Monitoring | V.D2.E-29 | 3.2.1-44 | E |
| Piping | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | A, 202 |
| Piping | Pressure boundary | Carbon steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VIII.B2.S-08 | 3.4.1-1 | C |

| Table 3.2.2-5: Reactor Core Isolation Cooling System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201, 204 |
| Piping | Pressure boundary | Carbon steel | Steam (int) | Loss of material – FAC | Flow-Accelerated Corrosion | V.D2.E-07 | 3.2.1-11 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Piping | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | One-Time Inspection | V.D2.EP-73 | 3.2.1-17 | E, 203 |
| Piping | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | One-Time Inspection | V.D2.EP-73 | 3.2.1-17 | E, 203 |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Pump casing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | A, 202 |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |

| Table 3.2.2-5: Reactor Core Isolation Cooling System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Pump casing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Sight glass | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Sight glass | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | A, 202 |
| Sight glass | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | V.F.EP-10 | 3.2.1-57 | A |
| Sight glass | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-76 | 3.2.1-50 | A, 202 |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | V.F.EP-15 | 3.2.1-60 | A |
| Sight glass | Pressure boundary | Glass | Lube oil (int) | None | None | V.F.EP-16 | 3.2.1-60 | A |
| Strainer | Filtration | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Strainer housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |

| Table 3.2.2-5: Reactor Core Isolation Cooling System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tank | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | A |
| Tank | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | C, 202 |
| Thermowell | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Thermowell | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Thermowell | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Thermowell | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-138 | 3.3.1-100 | C, 202 |
| Tubing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Tubing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | A, 202 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Tubing | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-138 | 3.3.1-100 | C, 202 |
| Tubing | Pressure boundary | Stainless steel | Steam (int) | Cracking | Water Chemistry Control – BWR | VIII.B2.SP-98 | 3.4.1-11 | C, 201 |

| Table 3.2.2-5: Reactor Core Isolation Cooling System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tubing | Pressure boundary | Stainless steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 205 |
| Tubing | Pressure boundary | Stainless steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-155 | 3.4.1-16 | C, 201 |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Turbine casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | A |
| Turbine casing | Pressure boundary | Carbon steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201, 204 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | External Surfaces Monitoring | V.D2.E-29 | 3.2.1-44 | E |
| Valve body | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | V.D2.EP-77 | 3.2.1-49 | A, 202 |
| Valve body | Pressure boundary | Carbon steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VIII.B2.S-08 | 3.4.1-1 | C |
| Valve body | Pressure boundary | Carbon steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201, 204 |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |

| Table 3.2.2-5: Reactor Core Isolation Cooling System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Valve body | Pressure boundary | Stainless steel | Steam (int) | Cracking | Water Chemistry Control – BWR | VIII.B2.SP-98 | 3.4.1-11 | C, 201 |
| Valve body | Pressure boundary | Stainless steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 205 |
| Valve body | Pressure boundary | Stainless steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-155 | 3.4.1-16 | C, 201 |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |

**Table 3.2.2-6**
**Standby Gas Treatment System**
**Summary of Aging Management Evaluation**

| Table 3.2.2-6: Standby Gas Treatment System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | V.E.EP-70 | 3.2.1-13 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Damper housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.B.E-26 | 3.2.1-40 | A |
| Damper housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | A |
| Ducting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.B.E-26 | 3.2.1-40 | A |
| Ducting | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | A |

| Table 3.2.2-6: Standby Gas Treatment System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Fan housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.B.E-26 | 3.2.1-40 | A |
| Fan housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | A |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.B.E-26 | 3.2.1-40 | A |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | A |
| Flex connection | Pressure boundary | Fiberglass | Air – indoor (ext) | Change in material properties | External Surfaces Monitoring | -- | -- | G |
| Flex connection | Pressure boundary | Fiberglass | Air – indoor (int) | Change in material properties | External Surfaces Monitoring | -- | -- | G |
| Flow element | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Flow element | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | V.F.EP-82 | 3.2.1-63 | A |

| Table 3.2.2-6: Standby Gas Treatment System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| HEPA filter frames | Pressure boundary | Aluminum | Air – indoor (ext) | None | None | V.F.EP-3 | 3.2.1-56 | C |
| HEPA filter frames | Pressure boundary | Aluminum | Air – indoor (int) | None | None | V.F.EP-3 | 3.2.1-56 | C |
| Moisture separator | Pressure boundary<br>Filtration | Stainless steel | Waste water (ext) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | C |
| Moisture separator | Pressure boundary<br>Filtration | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | C |
| Moisture separator housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Moisture separator housing | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | C |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | A |

**Table 3.2.2-6: Standby Gas Treatment System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | C |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | V.F.EP-82 | 3.2.1-63 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | V.F.EP-82 | 3.2.1-63 | A |

**Table 3.2.2-7**
**Containment Penetrations**
**Summary of Aging Management Evaluation**

| Table 3.2.2-7: Containment Penetrations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | V.E.EP-70 | 3.2.1-13 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Flex hose | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.E.SP-88 | 3.4.1-11 | C, 201 |
| Flex hose | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Flex hose | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | V.C.EP-63 | 3.2.1-18 | A, 201 |
| Flow element | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Flow element | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.E.SP-88 | 3.4.1-11 | C, 201 |
| Flow element | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |

| Table 3.2.2-7: Containment Penetrations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flow element | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | V.C.EP-63 | 3.2.1-18 | A, 201 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.C.E-35 | 3.2.1-40 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | V.D2.E-10 | 3.2.1-1 | C |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.C.EP-62 | 3.2.1-16 | A, 201 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Piping | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | V.F.EP-82 | 3.2.1-63 | A |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.C.EP-63 | 3.2.1-18 | A, 201 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.C.EP-63 | 3.2.1-18 | A, 201 |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.E.SP-88 | 3.4.1-11 | C, 201 |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |

| Table 3.2.2-7: Containment Penetrations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | V.C.EP-63 | 3.2.1-18 | A, 201 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.C.E-35 | 3.2.1-40 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | V.D2.E-10 | 3.2.1-1 | C |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.C.EP-62 | 3.2.1-16 | A, 201 |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.C.EP-62 | 3.2.1-16 | A, 201 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | V.F.EP-82 | 3.2.1-63 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.C.EP-63 | 3.2.1-18 | A, 201 |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.E.SP-88 | 3.4.1-11 | C, 201 |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | V.C.EP-63 | 3.2.1-18 | A, 201 |

**Table 3.2.2-8-1**
**Pressure Relief System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

**Table 3.2.2-8-1: Pressure Relief System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Accumulator | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Accumulator | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | C |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | V.E.EP-70 | 3.2.1-13 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Filter housing | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | D |
| Orifice | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Orifice | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | D |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |

| Table 3.2.2-8-1: Pressure Relief System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
| Piping | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | D |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Piping | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | D |
| Trap | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Trap | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Valve body | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | D |

| Table 3.2.2-8-1: Pressure Relief System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | V.F.EP-10 | 3.2.1-57 | A |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-240 | 3.3.1-54 | D |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Valve body | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | D |
| Valve body | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | C |

**Table 3.2.2-8-2**
**High Pressure Core Spray System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

**Table 3.2.2-8-2: High Pressure Core Spray System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | V.E.EP-70 | 3.2.1-13 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.E.E-44 | 3.2.1-40 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-16 | A, 201 |

| Table 3.2.2-8-2: High Pressure Core Spray System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |

**Table 3.2.2-8-3
Residual Heat Removal System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation**

**Table 3.2.2-8-3: Residual Heat Removal System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | V.E.EP-70 | 3.2.1-13 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.E.SP-88 | 3.4.1-11 | C, 201 |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |

**Table 3.2.2-8-4**
**Low Pressure Core Spray System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

**Table 3.2.2-8-4: Low Pressure Core Spray System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | V.E.EP-70 | 3.2.1-13 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |

# Table 3.2.2-8-5
# Reactor Core Isolation Cooling System
# Nonsafety-Related Components Affecting Safety-Related Systems
# Summary of Aging Management Evaluation

**Table 3.2.2-8-5: Reactor Core Isolation Cooling System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | V.E.EP-70 | 3.2.1-13 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | V.E.EP-69 | 3.2.1-15 | B |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Flex hose | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | V.D2.E-26 | 3.2.1-40 | A |

| Table 3.2.2-8-5: Reactor Core Isolation Cooling System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-60 | 3.2.1-16 | A, 201 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | V.F.EP-18 | 3.2.1-63 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-73 | 3.2.1-17 | A, 201 |

# 3.3 AUXILIARY SYSTEMS

## 3.3.1 Introduction

This section provides the results of the aging management reviews for those components in the auxiliary systems which are subject to aging management review. The following systems are addressed in this section (system descriptions are available in the referenced sections).

- Control Rod Drive (Section 2.3.3.1)
- Component Cooling Water (Section 2.3.3.2)
- Service Water (Section 2.3.3.3)
- Compressed Air (Section 2.3.3.4)
- Standby Liquid Control (Section 2.3.3.5)
- Main Steam Positive Leakage Control (Section 2.3.3.6)
- Fire Protection – Water (Section 2.3.3.7)
- Fire Protection – Halon (Section 2.3.3.8)
- Combustible Gas Control (Section 2.3.3.9)
- Standby Diesel Generator (Section 2.3.3.10)
- HPCS Diesel Generator (Section 2.3.3.11)
- Control Building HVAC (Section 2.3.3.12)
- Miscellaneous HVAC (Section 2.3.3.13)
- Chilled Water (Section 2.3.3.14)
- Fuel Pool Cooling and Cleanup (Section 2.3.3.15)
- Plant Drains (Section 2.3.3.16)
- Fuel Oil (Section 2.3.3.17)
- Auxiliary Systems in Scope for 10 CFR 54.4(a)(2) (Section 2.3.3.18)

Table 3.3.1, Summary of Aging Management Programs for Auxiliary Systems Evaluated in Chapter VII of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the auxiliary systems component group. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

## 3.3.2 Results

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for auxiliary systems.

- Table 3.3.2-1 Control Rod Drive System—Summary of Aging Management Evaluation
- Table 3.3.2-2 Component Cooling Water System—Summary of Aging Management Evaluation
- Table 3.3.2-3 Service Water Systems—Summary of Aging Management Evaluation
- Table 3.3.2-4 Compressed Air System—Summary of Aging Management Evaluation

- Table 3.3.2-5 Standby Liquid Control System—Summary of Aging Management Evaluation
- Table 3.3.2-6 Main Steam Positive Leakage Control System—Summary of Aging Management Evaluation
- Table 3.3.2-7 Fire Protection – Water System—Summary of Aging Management Evaluation
- Table 3.3.2-8 Fire Protection – Halon System—Summary of Aging Management Evaluation
- Table 3.3.2-9 Combustible Gas Control System—Summary of Aging Management Evaluation
- Table 3.3.2-10 Standby Diesel Generator System—Summary of Aging Management Evaluation
- Table 3.3.2-11 HPCS Diesel Generator System—Summary of Aging Management Evaluation
- Table 3.3.2-12 Control Building HVAC System—Summary of Aging Management Evaluation
- Table 3.3.2-13 Miscellaneous HVAC Systems—Summary of Aging Management Evaluation
- Table 3.3.2-14 Chilled Water System—Summary of Aging Management Evaluation
- Table 3.3.2-15 Fuel Pool Cooling and Cleanup—Summary of Aging Management Evaluation
- Table 3.3.2-16 Plant Drains—Summary of Aging Management Evaluation
- Table 3.3.2-17 Fuel Oil System—Summary of Aging Management Evaluation

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

- Table 3.3.2-18-1 Control Rod Drive Hydraulic System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-2 Fuel Transfer Equipment System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.3.2-18-3 Closed Cooling Water – Reactor Plant System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-4 Service Water – Normal System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-5 Compressed Air System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-6 Standby Liquid Control System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-7 Leak Detection System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-8 Main Steam Positive Leakage Control System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-9 Fire Protection – Water System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-10 Hydrogen Mixing, Purge and Recombiner System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-11 Service Water – Standby System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-12 Standby Diesel Generator System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-13 HPCS Diesel Generator System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.3.2-18-14 HVAC – Containment Cooling System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-15 HVAC – Aux Building System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-16 HVAC – Chilled Water System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-17 Radiation Monitoring System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-18 Containment Atmosphere and Leakage Monitoring System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-19 Reactor Water Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-20 Fuel Pool Cooling and Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-21 Radwaste – Liquid System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-22 Sampling System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-23 Drains – Floor and Equipment System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-24 Domestic Water System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation
- Table 3.3.2-18-25 Suppression Pool Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.3.2-18-26 Makeup Water System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

### 3.3.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the auxiliary systems. Programs are described in Appendix B. Further details are provided in the system tables.

3.3.2.1.1 Control Rod Drive System

**Materials**

Control rod drive system components are constructed of the following materials.

- Carbon steel
- Stainless steel

**Environments**

Control rod drive system components are exposed to the following environments.

- Air – indoor
- Gas
- Treated water
- Treated water > 140°F

**Aging Effects Requiring Management**

The following aging effects associated with the control rod drive system require management.

- Cracking
- Cracking – fatigue
- Loss of material
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the control rod drive system components.

- Bolting Integrity
- External Surfaces Monitoring

- One-Time Inspection
- Water Chemistry Control – BWR

3.3.2.1.2 Component Cooling Water System

**Materials**

Component cooling water system components are constructed of the following materials.

- Carbon steel
- Stainless steel

**Environments**

Component cooling water system components are exposed to the following environments.

- Air – indoor
- Treated water

**Aging Effects Requiring Management**

The following aging effects associated with the component cooling water system require management.

- Cracking – fatigue
- Loss of material
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the aging effects for component cooling water system components.

- Bolting Integrity
- External Surfaces Monitoring
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.3 Service Water Systems

**Materials**

Service water system components are constructed of the following materials.

- Carbon steel
- Carbon steel with internal coating
- Copper alloy
- Copper alloy > 15% zinc or > 8% aluminum
- Glass
- Gray cast iron
- Plastic
- Stainless steel
- Titanium

**Environments**

Service water system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Condensation
- Gas
- Lube oil
- Raw water
- Soil
- Steam
- Treated water

**Aging Effects Requiring Management**

The following aging effects associated with the service water systems require management.

- Change in material properties
- Cracking
- Cracking – fatigue
- Loss of coating integrity
- Loss of material
- Loss of material – erosion
- Loss of preload
- Reduction of heat transfer

**Aging Management Programs**

The following aging management programs manage the aging effects for the service water system components.

- Bolting Integrity
- Buried and Underground Piping and Tanks Inspection
- Coating Integrity
- Compressed Air Monitoring
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Service Water Integrity
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.4 Compressed Air System

**Materials**

Compressed air system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Copper alloy
- Stainless steel

**Environments**

Compressed air system components are exposed to the following environments.

- Air – indoor
- Condensation

**Aging Effects Requiring Management**

The following aging effects associated with the compressed air system require management.

- Cracking – fatigue

- Loss of material
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the compressed air system components.

- Bolting Integrity
- Compressed Air Monitoring
- External Surfaces Monitoring

3.3.2.1.5 Standby Liquid Control System

**Materials**

Standby liquid control system components are constructed of the following materials.

- Carbon steel
- Glass
- Stainless steel

**Environments**

Standby liquid control system components are exposed to the following environments.

- Air – indoor
- Concrete
- Lube oil
- Sodium pentaborate solution

**Aging Effects Requiring Management**

The following aging effects associated with the standby liquid control system require management.

- Loss of material
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the standby liquid control system components.

- Bolting Integrity
- External Surfaces Monitoring
- Oil Analysis
- One-Time Inspection
- Water Chemistry Control – BWR

3.3.2.1.6 Main Steam Positive Leakage Systems

**Materials**

Main steam positive leakage control system components are constructed of the following materials.

- Carbon steel
- Copper alloy
- Copper alloy > 15% zinc or > 8% aluminum
- Nickel alloy
- Stainless steel

**Environments**

Main steam positive leakage control system components are exposed to the following environments.

- Air – indoor
- Condensation
- Steam
- Treated water

**Aging Effects Requiring Management**

The following aging effects associated with the main steam positive leakage control systems require management.

- Cracking
- Cracking – fatigue
- Loss of material
- Loss of preload
- Reduction of heat transfer

**Aging Management Programs**

The following aging management programs manage the aging effects for the main steam positive leakage control system components.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- One-Time Inspection
- Service Water Integrity
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.7 Fire Protection – Water System

**Materials**

Fire protection – water system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Carbon steel with internal coating
- Copper alloy
- Copper alloy > 15% zinc or > 8% aluminum
- Gray cast iron
- Gray cast iron with internal coating
- Stainless steel

**Environments**

Fire protection – water system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Concrete
- Condensation
- Exhaust gas
- Fuel oil
- Raw water
- Soil
- Treated water

**Aging Effects Requiring Management**

The following aging effects associated with the fire protection – water system require management.

- Cracking
- Cracking – fatigue
- Loss of coating integrity
- Loss of material
- Loss of preload
- Reduction of heat transfer

**Aging Management Programs**

The following aging management programs manage the aging effects for the fire protection – water system components.

- Bolting Integrity
- Buried and Underground Piping and Tanks Inspection
- Diesel Fuel Monitoring
- External Surfaces Monitoring
- Fire Water System
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- One-Time Inspection
- Selective Leaching
- Water Chemistry Control – Closed Treated Water Systems

#### 3.3.2.1.8 Fire Protection – Halon System

**Materials**

Fire protection – Halon system components are constructed of the following materials.

- Carbon steel
- Copper alloy
- Stainless steel

**Environments**

Fire protection – Halon system components are exposed to the following environments.

- Air – indoor

- Gas

**Aging Effects Requiring Management**

The following aging effects associated with the fire protection – Halon system require management.

- Loss of material

**Aging Management Programs**

The following aging management programs manage the aging effects for the fire protection – Halon system components.

- Fire Protection

3.3.2.1.9 Combustible Gas Control System

**Materials**

Combustible gas control system components are constructed of the following materials.

- Carbon steel
- Stainless steel

**Environments**

Combustible gas control system components are exposed to the following environments.

- Air – indoor
- Condensation

**Aging Effects Requiring Management**

The following aging effects associated with the combustible gas control system require management.

- Cracking
- Cracking – fatigue
- Loss of material
- Loss of preload
- Reduction of heat transfer

**Aging Management Programs**

The following aging management programs manage the aging effects for the combustible gas control system components.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components

3.3.2.1.10 Standby Diesel Generator System

**Materials**

Standby diesel generator system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Carbon steel with internal coating
- Copper alloy
- Copper alloy > 15% zinc or > 8% aluminum
- Elastomer
- Glass
- Stainless steel
- Stainless steel with internal coating

**Environments**

Standby diesel generator system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Condensation
- Exhaust gas
- Lube oil
- Treated water

**Aging Effects Requiring Management**

The following aging effects associated with the standby diesel generator system require management.

- Change in material properties

- Cracking
- Cracking – fatigue
- Loss of coating integrity
- Loss of material
- Loss of preload
- Reduction of heat transfer

**Aging Management Programs**

The following aging management programs manage the aging effects for the standby diesel generator system components.

- Bolting Integrity
- Coating Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.11 HPCS Diesel Generator System

**Materials**

HPCS diesel generator system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Copper alloy
- Copper alloy > 15% zinc (inhibited)
- Copper alloy > 15% zinc or > 8% aluminum
- Elastomer
- Glass
- Nickel alloy
- Stainless steel

**Environments**

HPCS diesel generator system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Condensation
- Exhaust gas
- Lube oil
- Treated water

**Aging Effects Requiring Management**

The following aging effects associated with the HPCS diesel generator system require management.

- Change in material properties
- Cracking
- Cracking – fatigue
- Loss of material
- Loss of preload
- Reduction of heat transfer

**Aging Management Programs**

The following aging management programs manage the aging effects for the HPCS diesel generator system components.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Selective Leaching
- Water Chemistry Control – Closed Treated Water Systems

### 3.3.2.1.12 Control Building HVAC System

**Materials**

Control building HVAC system components are constructed of the following materials.

- Aluminum

- Carbon steel
- Copper alloy
- Elastomer
- Glass
- Stainless steel

**Environments**

Control building HVAC system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Condensation
- Soil
- Treated water

**Aging Effects Requiring Management**

The following aging effects associated with the control building HVAC system require management.

- Change in material properties
- Cracking
- Cracking - fatigue
- Loss of material
- Loss of material – wear
- Loss of preload
- Reduction of heat transfer

**Aging Management Programs**

The following aging management programs manage the aging effects for the control building HVAC system components.

- Bolting Integrity
- Buried and Underground Piping and Tanks Inspection
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.13 Miscellaneous HVAC Systems

**Materials**

Miscellaneous HVAC systems components are constructed of the following materials.

- Aluminum
- Carbon steel
- Copper alloy
- Elastomer
- Glass
- Stainless steel

**Environments**

Miscellaneous HVAC systems components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Condensation
- Gas
- Treated water

**Aging Effects Requiring Management**

The following aging effects associated with the miscellaneous HVAC systems require management.

- Change in material properties
- Cracking
- Loss of material
- Loss of material – wear
- Loss of preload
- Reduction of heat transfer

**Aging Management Programs**

The following aging management programs manage the aging effects for the miscellaneous HVAC systems components.

- Bolting Integrity
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components

- Service Water Integrity
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.14 Chilled Water System

**Materials**

Chilled water system components are constructed of the following materials.

- Carbon steel
- Carbon steel with internal coating
- Copper alloy
- Glass
- Stainless steel

**Environments**

Chilled water system components are exposed to the following environments.

- Air – indoor
- Condensation
- Gas
- Lube oil
- Treated water

**Aging Effects Requiring Management**

The following aging effects associated with the chilled water system require management.

- Cracking – fatigue
- Loss of coating integrity
- Loss of material
- Loss of preload
- Reduction of heat transfer

**Aging Management Programs**

The following aging management programs manage the aging effects for the chilled water system components.

- Bolting Integrity
- Coating Integrity
- External Surfaces Monitoring

- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Water Chemistry Control – Closed Treated Water Systems

#### 3.3.2.1.15 Fuel Pool Cooling and Cleanup

**Materials**

Fuel pool cooling and cleanup system components are constructed of the following materials.

- Aluminum
- Boron carbide/elastomer
- Carbon steel
- Stainless steel

**Environments**

Fuel pool cooling and cleanup system components are exposed to the following environments.

- Air – indoor
- Treated water
- Treated water > 140°F
- Waste water

**Aging Effects Requiring Management**

The following aging effects associated with the fuel pool cooling and cleanup system require management.

- Change in material properties
- Cracking
- Cracking – fatigue
- Loss of material
- Loss of preload
- Reduction in neutron absorption capacity
- Reduction of heat transfer

**Aging Management Programs**

The following aging management programs manage the aging effects for the fuel pool cooling and cleanup components.

- Bolting Integrity
- Boraflex Monitoring
- External Surfaces Monitoring
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- One-Time Inspection
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems

3.3.2.1.16 Plant Drains

**Materials**

Plant drains components are constructed of the following materials.

- Carbon steel
- Carbon steel (coated)
- Stainless steel

**Environments**

Plant drains components are exposed to the following environments.

- Air – indoor
- Concrete
- Waste water

**Aging Effects Requiring Management**

The following aging effects associated with the plant drains require management.

- Cracking
- Loss of material
- Loss of material – erosion
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the plant drains components.

- Bolting Integrity
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Periodic Surveillance and Preventive Maintenance

3.3.2.1.17 Fuel Oil Systems

**Materials**

Fuel oil system components are constructed of the following materials.

- Carbon steel
- Copper alloy
- Copper alloy > 15% zinc or > 8% aluminum
- Stainless steel

**Environments**

Fuel oil system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Fuel oil
- Soil

**Aging Effects Requiring Management**

The following aging effects associated with the fuel oil systems require management.

- Cracking – fatigue
- Loss of material
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the fuel oil system components.

- Bolting Integrity
- Buried and Underground Piping and Tanks Inspection
- Diesel Fuel Monitoring
- External Surfaces Monitoring
- One-Time Inspection

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

The following lists encompass materials, environments, aging effects requiring management, and aging management programs for the series 3.3.2-18-xx tables.

**Materials**

Nonsafety-related components affecting safety-related systems are constructed of the following materials.

- Aluminum
- Carbon steel
- Carbon steel with internal coating
- Copper alloy
- Copper alloy > 15% zinc or > 8% aluminum
- Fiberglass
- Glass
- Nickel alloy
- Stainless steel

**Environments**

Nonsafety-related components affecting safety-related systems are exposed to the following environments.

- Air – indoor
- Condensation
- Fuel oil
- Lube oil
- Raw water
- Treated water
- Treated water > 140°F
- Waste water

**Aging Effects Requiring Management**

The following aging effects associated with nonsafety-related components affecting safety-related systems require management.

- Change in material properties
- Cracking
- Cracking – fatigue
- Loss of coating integrity
- Loss of material
- Loss of material – erosion
- Loss of material – FAC
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the effects of aging on nonsafety-related components affecting safety-related systems.

- Bolting Integrity
- Coating Integrity
- Compressed Air Monitoring
- Diesel Fuel Monitoring
- External Surfaces Monitoring
- Fire Water System
- Flow-Accelerated Corrosion
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching
- Water Chemistry Control – BWR
- Water Chemistry Control – Closed Treated Water Systems

### 3.3.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.3.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the RBS approach to those areas requiring further evaluation. Programs are described in Appendix B.

3.3.2.2.1 Cumulative Fatigue Damage

Where cracking due to fatigue is identified as an aging effect requiring management for components, the analysis of fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). Evaluations of these TLAAs are addressed in Sections 4.3 and 4.7.

3.3.2.2.2 Cracking due to Stress Corrosion Cracking and Cyclic Loading

This paragraph in NUREG-1800 pertains to PWR non-regenerative heat exchanger components and is therefore not applicable to RBS.

3.3.2.2.3 Cracking due to Stress Corrosion Cracking

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Water in the RBS cooling towers is treated with chlorine compounds. Chloride contamination of components exposed to outdoor air may occur. Consistent with NUREG-1801 for outdoor air with a potential source of chloride contamination, cracking of stainless steel components directly exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. There are no stainless steel auxiliary systems components in the scope of license renewal that are located indoors near unducted air intakes.

3.3.2.2.4 Loss of Material due to Cladding Breach

This paragraph in NUREG-1800 pertains to PWR steel charging pump casings with stainless steel cladding exposed to treated borated water and is therefore not applicable to RBS, which is a BWR and has no components exposed to treated borated water.

3.3.2.2.5 Loss of Material due to Pitting and Crevice Corrosion

Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Water in the RBS cooling towers is treated with chlorine compounds. Chloride contamination of components exposed to outdoor air may occur. Consistent with NUREG-1801, loss of material for stainless steel components exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. There are no stainless steel auxiliary systems components in the scope of license renewal that are located indoors near unducted air intakes.

3.3.2.2.6 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of RBS quality assurance procedures and administrative controls for aging management programs.

3.3.2.2.7 Ongoing Review of Operating Experience

See Appendix B Section B.0.4 for discussion of RBS operating experience review programs.

3.3.2.2.8 Loss of Material due to Recurring Internal Corrosion

A review of 10 years of plant operating experience identified no conditions of recurring internal corrosion (RIC) as defined in LR-ISG 2012-02, Section A, in the piping components of the auxiliary systems in the scope of license renewal.

### 3.3.2.3 Time-Limited Aging Analysis

The only time-limited aging analysis identified for auxiliary systems components is metal fatigue. This is evaluated in Section 4.3.

## 3.3.3 Conclusion

The auxiliary system components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21. The aging management programs selected to manage the effects of aging on auxiliary system components are identified in Section 3.3.2.1 and in the following tables. A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the auxiliary system components will be managed such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

**Table 3.3.1**
**Summary of Aging Management Programs for the Auxiliary Systems Evaluated in Chapter VII of NUREG-1801**

| **Table 3.3.1: Auxiliary Systems** | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-1 | Steel cranes - structural girders exposed to air – indoor uncontrolled (external) | Cumulative fatigue damage due to fatigue | Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation for structural girders of cranes that fall within the scope of 10 CFR 54 (Standard Review Plan, Section 4.7, "Other Plant- Specific Time-Limited Aging Analyses," for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1)) | Yes, TLAA | Fatigue is a TLAA. Steel cranes are evaluated as structural components in Section 3.5.<br>See Section 3.3.2.2.1. |
| 3.3.1-2 | Stainless steel, steel heat exchanger components and tubes, piping, piping components, and piping elements exposed to treated borated water, air - indoor, uncontrolled, treated water | Cumulative fatigue damage due to fatigue | Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1). | Yes, TLAA | Fatigue is a TLAA.<br>See Section 3.3.2.2.1. |
| 3.3.1-3 | PWR only | | | | |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-4 | Stainless steel piping, piping components, and piping elements; tanks exposed to air – outdoor | Cracking due to stress corrosion cracking | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | Yes, environmental conditions need to be evaluated | Consistent with NUREG-1801. Cracking of stainless steel components exposed to outdoor air is managed by the External Surfaces Monitoring Program.<br>See Section 3.3.2.2.3. |
| 3.3.1-5 | PWR only | | | | |
| 3.3.1-6 | Stainless steel piping, piping components, and piping elements; tanks exposed to air – outdoor | Loss of material due to pitting and crevice corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | Yes, environmental conditions need to be evaluated | Consistent with NUREG-1801. Loss of material in stainless steel components exposed to outdoor air is managed by the External Surfaces Monitoring Program.<br>See Section 3.3.2.2.5. |
| 3.3.1-7 | PWR only | | | | |
| 3.3.1-8 | PWR only | | | | |
| 3.3.1-9 | PWR only | | | | |
| 3.3.1-10 | Steel, high-strength closure bolting exposed to air with steam or water leakage. | Cracking due to stress corrosion cracking; cyclic loading | Chapter XI.M18, "Bolting Integrity" | No | This item was not used. There is no high-strength steel closure bolting used in auxiliary systems within the scope of license renewal. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-11 | Steel, high-strength high-pressure pump, closure bolting exposed to air with steam or water leakage | Cracking due to stress corrosion cracking; cyclic loading | Chapter XI.M18, "Bolting Integrity" | No | This item was not used. There is no high-strength steel closure bolting used in auxiliary systems within the scope of license renewal. |
| 3.3.1-12 | Steel; stainless steel closure bolting, bolting exposed to condensation, air – indoor, uncontrolled (external), air – outdoor (external) | Loss of material due to general (steel only), pitting, and crevice corrosion | Chapter XI.M18, "Bolting Integrity" | No | Consistent with NUREG-1801. Loss of material for steel and stainless steel bolting is managed by the Bolting Integrity Program. |
| 3.3.1-13 | Steel closure bolting exposed to air with steam or water leakage | Loss of material due to general corrosion | Chapter XI.M18, "Bolting Integrity" | No | This item was not used. As stated in Item 3.3.1-12, loss of material of steel bolting exposed to air in the auxiliary systems is managed by the Bolting Integrity Program. However, steam or water leakage is not considered as a separate aspect of the indoor air environment. |
| 3.3.1-14 | Steel, stainless steel bolting exposed to soil | Loss of preload | Chapter XI.M18, "Bolting Integrity" | No | Consistent with NUREG-1801. Loss of preload for steel bolting exposed to soil is managed by the Bolting Integrity Program. There is no stainless steel bolting exposed to soil in the auxiliary systems in scope for license renewal. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-15 | Steel; stainless steel, copper alloy, nickel alloy, stainless steel closure bolting, bolting exposed to air – indoor, uncontrolled (external), any environment, air – outdoor (external), raw water, treated borated water, fuel oil, treated water | Loss of preload due to thermal effects, gasket creep, and self-loosening | Chapter XI.M18, "Bolting Integrity" | No | Consistent with NUREG-1801. Loss of preload for steel and stainless steel bolting is managed by the Bolting Integrity Program. There is no copper alloy or nickel alloy bolting in the auxiliary systems in scope for license renewal. |
| 3.3.1-16 | Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (> 140°F) | Cracking due to stress corrosion cracking, intergranular stress corrosion cracking | Chapter XI.M2, "Water Chemistry," and Chapter XI.M25, "BWR Reactor Water Cleanup System" | No | This item was not used. Reactor water cleanup system piping downstream of the second containment isolation valve, 4" NPS or greater that is above 200°F during power operation, is carbon steel and is not subject to NRC Generic Letter (GL) 88-01 requirements. |
| 3.3.1-17 | Stainless steel heat exchanger tubes exposed to treated water, treated borated water | Reduction of heat transfer due to fouling | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Reduction of heat transfer for stainless steel heat exchanger tubes exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage reduction of heat transfer. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-18 | Stainless steel high-pressure pump, casing, piping, piping components, and piping elements exposed to treated borated water >60°C (> 140°F), sodium pentaborate solution >60°C (> 140°F) | Cracking due to stress corrosion cracking | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | This item was not used. The operating temperature of the standby liquid control system is below the 140°F threshold for cracking in stainless steel. |
| 3.3.1-19 | Stainless steel regenerative heat exchanger components exposed to treated water >60°C (> 140°F) | Cracking due to stress corrosion cracking | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | This item was not used. Regenerative heat exchanger components with an intended function for license renewal are made of carbon steel. |
| 3.3.1-20 | Stainless steel, steel with stainless steel cladding heat exchanger components exposed to treated borated water >60°C (> 140°F), treated water >60°C (> 140°F) | Cracking due to stress corrosion cracking | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Cracking of stainless steel components exposed to treated water > 60°C (> 140°F) is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage cracking. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-21 | Steel piping, piping components, and piping elements exposed to treated water | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for steel components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material. |
| 3.3.1-22 | Copper alloy piping, piping components, and piping elements exposed to treated water | Loss of material due to general, pitting, crevice, and galvanic corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for copper alloy components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material. This item applies to aging management review results presented in Table 3.2.2-3. |
| 3.3.1-23 | Aluminum piping, piping components, and piping elements exposed to treated water | Loss of material due to pitting and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | This item was not used. Loss of material for aluminum components exposed to treated water is addressed in Item 3.3.1-25. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-24 | Aluminum piping, piping components, and piping elements exposed to treated water | Loss of material due to pitting and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | This item was not used. Loss of material for aluminum components exposed to treated water is addressed in Item 3.3.1-25. |
| 3.3.1-25 | Stainless steel, steel with stainless steel cladding, aluminum piping, piping components, and piping elements, heat exchanger components exposed to treated water, sodium pentaborate solution | Loss of material due to pitting and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for stainless steel and aluminum components exposed to treated water or sodium pentaborate is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material. |
| 3.3.1-26 | Steel with stainless steel cladding piping, piping components, and piping elements exposed to treated water | Loss of material due to pitting and crevice corrosion (only after cladding degradation) | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | This item was not used. There are no steel clad with stainless steel piping components in the RBS fuel pool cooling system exposed to treated water within the scope of license renewal. |
| 3.3.1-27 | Stainless steel heat exchanger tubes exposed to treated water | Reduction of heat transfer due to fouling | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | This item was not used. Reduction of heat transfer for stainless steel heat exchanger tubes exposed to treated water is addressed in Item 3.3.1-17. |
| 3.3.1-28 | PWR only | | | | |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-29 | PWR only | | | | |
| 3.3.1-30 | Concrete; cementitious material piping, piping components, and piping elements exposed to raw water | Changes in material properties due to aggressive chemical attack | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. There are no concrete components exposed to raw water in the auxiliary systems in the scope of license renewal. |
| 3.3.1-30.5 | Fiberglass, HDPE [high density polyethylene] piping, piping components, and piping elements exposed to raw water (internal) | Cracking, blistering, change in color due to water absorption | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. There are no fiberglass or HDPE components exposed to raw water in the auxiliary systems in the scope of license renewal. |
| 3.3.1-31 | Concrete; cementitious material piping, piping components, and piping elements exposed to raw water | Cracking due to settling | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. There are no concrete components exposed to raw water in the auxiliary systems in the scope of license renewal. |
| 3.3.1-32 | Reinforced concrete, asbestos cement piping, piping components, and piping elements exposed to raw water | Cracking due to aggressive chemical attack and leaching; Changes in material properties due to aggressive chemical attack | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. There are no reinforced concrete or asbestos cement components exposed to raw water in the auxiliary systems in the scope of license renewal. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-32.5 | Elastomer seals and components exposed to raw water | Hardening and loss of strength due to elastomer degradation; loss of material due to erosion | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. There are no elastomer components exposed to raw water in the auxiliary systems in the scope of license renewal. |
| 3.3.1-33 | Concrete; cementitious material piping, piping components, and piping elements exposed to raw water | Loss of material due to abrasion, cavitation, aggressive chemical attack, and leaching | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. There are no concrete components exposed to raw water in the auxiliary systems in the scope of license renewal. |
| 3.3.1-34 | Nickel alloy, copper alloy piping, piping components, and piping elements exposed to raw water | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. The portions of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water. |
| 3.3.1-35 | Copper alloy piping, piping components, and piping elements exposed to raw water | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. The portions of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-36 | Copper alloy piping, piping components, and piping elements exposed to raw water | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. The portions of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water. |
| 3.3.1-37 | Steel piping, piping components, and piping elements exposed to raw water | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. The portions of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water. |
| 3.3.1-38 | Copper alloy, steel heat exchanger components exposed to raw water | Loss of material due to general, pitting, crevice, galvanic, and microbiologically influenced corrosion; fouling that leads to corrosion | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. The portions of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-39 | Stainless steel piping, piping components, and piping elements exposed to raw water | Loss of material due to pitting and crevice corrosion | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. The portions of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water. |
| 3.3.1-40 | Stainless steel piping, piping components, and piping elements exposed to raw water | Loss of material due to pitting and crevice corrosion; fouling that leads to corrosion | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. The portions of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water. |
| 3.3.1-41 | Stainless steel piping, piping components, and piping elements exposed to raw water | Loss of material due to pitting, crevice, and microbiologically influenced corrosion | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. The portions of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-42 | Copper alloy, titanium, stainless steel heat exchanger tubes exposed to raw water | Reduction of heat transfer due to fouling | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | The portions of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water. Reduction of heat transfer for stainless steel and copper alloy heat exchanger tubes in the fire protection system and portions of the service water system not covered by NRC GL 89-13 is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. There are no titanium heat exchanger tubes exposed to raw water in the auxiliary systems in the scope of license renewal. |
| 3.3.1-43 | Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water >60°C (> 140°F) | Cracking due to stress corrosion cracking | Chapter XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-1801. Cracking of stainless steel components exposed to closed-cycle cooling water > 60°C (> 140°F) is managed by the Water Chemistry Control – Closed Treated Water Systems Program. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-44 | Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water >60°C (> 140°F) | Cracking due to stress corrosion cracking | Chapter XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-1801. Cracking of stainless steel heat exchanger components exposed to closed-cycle cooling water > 60°C (> 140°F) is managed by the Water Chemistry Control – Closed Treated Water Systems Program. |
| 3.3.1-45 | Steel piping, piping components, and piping elements; tanks exposed to closed-cycle cooling water | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-1801. Loss of material for steel components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program. |
| 3.3.1-46 | Steel, copper alloy heat exchanger components, piping, piping components, and piping elements exposed to closed-cycle cooling water | Loss of material due to general, pitting, and crevice, and galvanic corrosion | Chapter XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-1801 for most components. Loss of material for steel and copper alloy components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program. In the portions of the RBS service water system covered by NRC GL 89-13, loss of material is managed by the Service Water Integrity Program. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-47 | Stainless steel; steel with stainless steel cladding heat exchanger components exposed to closed-cycle cooling water | Loss of material due to microbiologically influenced corrosion | Chapter XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-1801 for most components. Loss of material for stainless steel components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program. In the portions of the RBS service water system covered by NRC GL 89-13, loss of material is managed by the Service Water Integrity Program. |
| 3.3.1-48 | Aluminum piping, piping components, and piping elements exposed to closed-cycle cooling water | Loss of material due to pitting and crevice corrosion | Chapter XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-1801. Loss of material for aluminum components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program. |
| 3.3.1-49 | Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water | Loss of material due to pitting and crevice corrosion | Chapter XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-1801. Loss of material for stainless steel components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-50 | Stainless steel, copper alloy, steel heat exchanger tubes exposed to closed-cycle cooling water | Reduction of heat transfer due to fouling | Chapter XI.M21A, "Closed Treated Water Systems" | No | Consistent with NUREG-1801 for most components. Reduction of heat transfer of stainless steel and copper alloy heat exchanger tubes exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program. In the portions of the RBS service water system covered by NRC GL 89-13, reduction of heat transfer is managed by the Service Water Integrity Program. There are no steel heat exchanger tubes exposed to closed-cycle cooling water in the scope of license renewal. |
| 3.3.1-51 | Boraflex spent fuel storage racks: neutron-absorbing sheets (PWR), spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to treated borated water, treated water | Reduction of neutron-absorbing capacity due to boraflex degradation | Chapter XI.M22, "Boraflex Monitoring" | No | Consistent with NUREG-1801. The change in material properties and reduction of neutron-absorbing capacity of the Boraflex spent fuel storage rack neutron-absorbing sheets exposed to treated water will be managed by the Boraflex Monitoring Program. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-52 | Steel cranes: rails and structural girders exposed to air – indoor, uncontrolled (external) | Loss of material due to general corrosion | Chapter XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems" | No | Consistent with NUREG-1801. Loss of material for steel crane rails and structural girders exposed to indoor air is managed by the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. This item applies to aging management review results presented in Table 3.5.2-1. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-53 | Steel cranes – rails exposed to air – indoor, uncontrolled (external) | Loss of material due to wear | Chapter XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems" | No | This item was not used. Loss of material due to wear is the result of relative movement between two surfaces in contact with each other. General wear of crane rails may occur during the performance of the active function; as a result of improper design, application, or operation; or to a very small degree with insignificant consequences. Additionally, wear of crane rails due to rolling or sliding wheels is not expected in any measurable amount owing to infrequent crane use. Therefore, loss of material due to wear is not an aging effect requiring management for crane rails exposed to air-indoor, uncontrolled. However, the condition of steel crane rails is monitored by the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program under item 3.3.1-52. |
| 3.3.1-54 | Copper alloy piping, piping components, and piping elements exposed to condensation | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M24, "Compressed Air Monitoring" | No | Consistent with NUREG-1801. Loss of material for copper alloy components exposed to condensation is managed by the Compressed Air Monitoring Program. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-55 | Steel piping, piping components, and piping elements: compressed air system exposed to condensation (internal) | Loss of material due to general and pitting corrosion | Chapter XI.M24, "Compressed Air Monitoring" | No | Consistent with NUREG-1801. Loss of material for steel components exposed to condensation is managed by the Compressed Air Monitoring Program. |
| 3.3.1-56 | Stainless steel piping, piping components, and piping elements exposed to condensation (internal) | Loss of material due to pitting and crevice corrosion | Chapter XI.M24, "Compressed Air Monitoring" | No | Consistent with NUREG-1801. Loss of material for stainless steel components exposed to condensation is managed by the Compressed Air Monitoring Program. |
| 3.3.1-57 | Elastomers fire barrier penetration seals exposed to air - indoor, uncontrolled, air – outdoor | Increased hardness; shrinkage; loss of strength due to weathering | Chapter XI.M26, "Fire Protection" | No | Consistent with NUREG-1801. Increased hardness, shrinkage and loss of strength of elastomer fire barrier seals exposed to indoor air are managed by the Fire Protection Program. This item applies to aging management review results presented in Table 3.5.2-4. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-58 | Steel Halon/carbon dioxide fire suppression system piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external) | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M26, "Fire Protection" | No | Consistent with NUREG-1801. Loss of material for steel fire protection components exposed to indoor air is managed by the Fire Protection Program. |
| 3.3.1-59 | Steel fire rated doors exposed to air - indoor, uncontrolled, air – outdoor | Loss of material due to wear | Chapter XI.M26, "Fire Protection" | No | Consistent with NUREG-1801. Loss of material for steel fire barrier components is monitored by the Fire Protection Program. This item applies to aging management review results presented in Tables 3.5.2-x. |
| 3.3.1-60 | Reinforced concrete structural fire barriers: walls, ceilings and floors exposed to air - indoor, uncontrolled | Concrete cracking and spalling due to aggressive chemical attack, and reaction with aggregates | Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring" | No | Consistent with NUREG-1801. Cracking of concrete fire barriers exposed to indoor air is managed by the Fire Protection and Structures Monitoring Programs. This item applies to aging management review results presented in Tables 3.5.2-x. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-61 | Reinforced concrete structural fire barriers: walls, ceilings and floors exposed to air – outdoor | Cracking, loss of material due to freeze-thaw, aggressive chemical attack, and reaction with aggregates | Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring" | No | Consistent with NUREG-1801. Cracking and loss of material of concrete fire barriers exposed to outdoor air are managed by the Fire Protection and Structures Monitoring Programs. This item applies to aging management review results presented in Tables 3.5.2-x. |
| 3.3.1-62 | Reinforced concrete structural fire barriers: walls, ceilings and floors exposed to air - indoor, uncontrolled, air – outdoor | Loss of material due to corrosion of embedded steel | Chapter XI.M26, "Fire Protection," and Chapter XI.S6, "Structures Monitoring" | No | Consistent with NUREG-1801. Loss of material of concrete fire barriers exposed to indoor or outdoor air is managed by the Fire Protection and Structures Monitoring Programs. This item applies to aging management review results presented in Tables 3.5.2-x. |
| 3.3.1-63 | Steel fire hydrants exposed to air – outdoor | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M27, "Fire Water System" | No | Consistent with NUREG-1801. Loss of material for steel fire hydrants exposed to outdoor air is managed by the Fire Water System Program. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-64 | Steel, copper alloy piping, piping components, and piping elements exposed to raw water | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion; flow blockage due to fouling | Chapter XI.M27, "Fire Water System" | No | Consistent with NUREG-1801. Loss of material for steel and copper alloy fire protection system components exposed to raw water is managed by the Fire Water System Program. |
| 3.3.1-65 | Aluminum piping, piping components, and piping elements exposed to raw water | Loss of material due to pitting and crevice corrosion; fouling that leads to corrosion; flow blockage due to fouling | Chapter XI.M27, "Fire Water System" | No | This item was not used. There are no aluminum auxiliary system components exposed to raw water in the scope of license renewal. |
| 3.3.1-66 | Stainless steel piping, piping components, and piping elements exposed to raw water | Loss of material due to pitting and crevice corrosion; fouling that leads to corrosion; flow blockage due to fouling | Chapter XI.M27, "Fire Water System" | No | Consistent with NUREG-1801. Loss of material for stainless steel fire protection system components exposed to raw water is managed by the Fire Water System Program. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-67 | Steel tanks exposed to air – outdoor (external) | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M29, "Aboveground Metallic Tanks" | No | This item was not used. There are no steel tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the auxiliary systems. Loss of material for steel fire water storage tanks in outdoor air is addressed in Item 3.3.1-136. |
| 3.3.1-68 | Steel piping, piping components, and piping elements exposed to fuel oil | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M30, "Fuel Oil Chemistry", and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for steel components exposed to fuel oil is managed by the Diesel Fuel Monitoring Program. The One-Time Inspection Program will verify the effectiveness of the Diesel Fuel Monitoring Program to manage loss of material. |
| 3.3.1-69 | Copper alloy piping, piping components, and piping elements exposed to fuel oil | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion | Chapter XI.M30, "Fuel Oil Chemistry", and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for copper alloy components exposed to fuel oil is managed by the Diesel Fuel Monitoring Program. The One-Time Inspection Program will verify the effectiveness of the Diesel Fuel Monitoring Program to manage loss of material. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-70 | Steel piping, piping components, and piping elements; tanks exposed to fuel oil | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion | Chapter XI.M30, "Fuel Oil Chemistry", and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for steel components exposed to fuel oil is managed by the Diesel Fuel Monitoring Program. The One-Time Inspection Program will verify the effectiveness of the Diesel Fuel Monitoring Program to manage loss of material. |
| 3.3.1-71 | Stainless steel, aluminum piping, piping components, and piping elements exposed to fuel oil | Loss of material due to pitting, crevice, and microbiologically influenced corrosion | Chapter XI.M30, "Fuel Oil Chemistry", and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for stainless steel components exposed to fuel oil is managed by the Diesel Fuel Monitoring Program. The One-Time Inspection Program will verify the effectiveness of the Diesel Fuel Monitoring Program to manage loss of material. There are no aluminum components exposed to fuel oil in the auxiliary systems in the scope of license renewal. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-72 | Gray cast iron, copper alloy (>15% Zn or >8% Al) piping, piping components, and piping elements, heat exchanger components exposed to treated water, closed-cycle cooling water, soil, raw water, waste water | Loss of material due to selective leaching | Chapter XI.M33, "Selective Leaching" | No | Consistent with NUREG-1801. Loss of material due to selective leaching for gray cast iron and copper alloy (> 15% Zn or > 8% Al) components is managed by the Selective Leaching Program. |
| 3.3.1-73 | Concrete; cementitious material piping, piping components, and piping elements exposed to air – outdoor | Changes in material properties due to aggressive chemical attack | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | This item was not used. There are no concrete piping components in the auxiliary systems in the scope of license renewal. |
| 3.3.1-74 | Concrete; cementitious material piping, piping components, and piping elements exposed to air – outdoor | Cracking due to settling | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | This item was not used. There are no concrete piping components in the auxiliary systems in the scope of license renewal. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-75 | Reinforced concrete, asbestos cement piping, piping components, and piping elements exposed to air – outdoor | Cracking due to aggressive chemical attack and leaching; Changes in material properties due to aggressive chemical attack | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | This item was not used. There are no concrete piping components in the auxiliary systems in the scope of license renewal. |
| 3.3.1-76 | Elastomers elastomer: seals and components exposed to air – indoor, uncontrolled (internal/external) | Hardening and loss of strength due to elastomer degradation | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | Consistent with NUREG-1801. Cracking and change in material properties of elastomer components exposed to indoor air are managed by the External Surfaces Monitoring Program. |
| 3.3.1-77 | Concrete; cementitious material piping, piping components, and piping elements exposed to air – outdoor | Loss of material due to abrasion, cavitation, aggressive chemical attack, and leaching | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | This item was not used. There are no concrete piping components in the auxiliary systems in the scope of license renewal. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-78 | Steel piping and components (external surfaces), ducting and components (external surfaces), ducting; closure bolting exposed to air – indoor, uncontrolled (external), air – indoor, uncontrolled (external), air – outdoor (external), condensation (external) | Loss of material due to general corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | Consistent with NUREG-1801. Loss of material for steel components exposed to indoor air, outdoor air or condensation is managed by the External Surfaces Monitoring Program. |
| 3.3.1-79 | Copper alloy piping, piping components, and piping elements exposed to condensation (external) | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | Consistent with NUREG-1801. Loss of material for copper alloy components exposed to condensation is managed by the External Surfaces Monitoring Program. |
| 3.3.1-80 | Steel heat exchanger components, piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), air – outdoor (external) | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | Consistent with NUREG-1801. Loss of material for steel heat exchanger components exposed to indoor or outdoor air is managed by the External Surfaces Monitoring Program. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-81 | Copper alloy, aluminum piping, piping components, and piping elements exposed to air – outdoor (external), air – outdoor | Loss of material due to pitting and crevice corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | Loss of material for copper alloy components exposed to outdoor air is managed by the External Surfaces Monitoring Program. There are no aluminum components exposed externally to outdoor air in the auxiliary systems in the scope of license renewal. Loss of material for aluminum components internally exposed to outdoor air is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. |
| 3.3.1-82 | Elastomers elastomer: seals and components exposed to air – indoor, uncontrolled (external) | Loss of material due to wear | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | Consistent with NUREG-1801. Loss of material due to wear of elastomer components exposed to air is managed by the External Surfaces Monitoring Program. |
| 3.3.1-83 | Stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust | Cracking due to stress corrosion cracking | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | Consistent with NUREG-1801. Cracking of stainless steel diesel engine exhaust components is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. |
| 3.3.1-84 | [There is no 3.3.1-84 in NUREG-1800.] | | | | |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-85 | Elastomers elastomer seals and components exposed to closed-cycle cooling water | Hardening and loss of strength due to elastomer degradation | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | This item was not used. There are no elastomer components exposed to closed-cycle cooling water in the auxiliary systems in the scope of license renewal. |
| 3.3.1-86 | Elastomers elastomers, linings, elastomer: seals and components exposed to treated borated water, treated water, raw water | Hardening and loss of strength due to elastomer degradation | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | This item was not used. There are no elastomer components exposed to treated water in the auxiliary systems in the scope of license renewal. Elastomer components exposed to raw water are addressed in Item 3.3.1-32.5. |
| 3.3.1-87 | [There is no 3.3.1-87 in NUREG-1800.] | | | | |
| 3.3.1-88 | Steel; stainless steel piping, piping components, and piping elements, piping, piping components, and piping elements, diesel engine exhaust exposed to raw water (potable), diesel exhaust | Loss of material due to general (steel only), pitting, and crevice corrosion | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | Consistent with NUREG-1801. Loss of material for steel and stainless steel components exposed to raw water (potable) or diesel exhaust is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-89 | Steel, copper alloy piping, piping components, and piping elements exposed to moist air or condensation (internal) | Loss of material due to general, pitting, and crevice corrosion | For fire water system components: Chapter XI.M27, "Fire Water System," or for other components: Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | Consistent with NUREG-1801. Loss of material for steel and copper alloy components exposed to condensation is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. |
| 3.3.1-90 | Steel ducting and components (internal surfaces) exposed to condensation (internal) | Loss of material due to general, pitting, crevice, and (for drip pans and drain lines) microbiologically influenced corrosion | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | Consistent with NUREG-1801. Loss of material for steel components exposed to condensation is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. |
| 3.3.1-91 | Steel piping, piping components, and piping elements; tanks exposed to waste water | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | Loss of material for most steel components exposed to waste water is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The Periodic Surveillance and Preventive Maintenance Program uses periodic visual inspections or other NDE techniques to manage loss of material for other steel components exposed to waste water. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-92 | Aluminum piping, piping components, and piping elements exposed to condensation (internal) | Loss of material due to pitting and crevice corrosion | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | Consistent with NUREG-1801 for some components. Loss of material for aluminum components exposed to condensation is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. For other aluminum components potentially exposed to condensation, loss of material is managed by the Compressed Air Monitoring Program which minimizes the exposure. |
| 3.3.1-93 | Copper alloy piping, piping components, and piping elements exposed to raw water (potable) | Loss of material due to pitting and crevice corrosion | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | This item was not used. There are no copper alloy components exposed to raw water (potable) in the auxiliary systems in the scope of license renewal. |
| 3.3.1-94 | Stainless steel ducting and components exposed to condensation | Loss of material due to pitting and crevice corrosion | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | Consistent with NUREG-1801. Loss of material for stainless steel components exposed to condensation is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-95 | Copper alloy, stainless steel, nickel alloy, steel piping, piping components, and piping elements, heat exchanger components, piping, piping components, and piping elements; tanks exposed to waste water, condensation (internal) | Loss of material due to pitting, crevice, and microbiologically influenced corrosion | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | Consistent with NUREG-1801 for most components. Loss of material for steel, nickel alloy, copper alloy and stainless steel components exposed to waste water or condensation is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The Periodic Surveillance and Preventive Maintenance Program uses periodic visual inspections or other NDE techniques to manage loss of material for other components exposed to waste water. |
| 3.3.1-96 | Elastomers elastomer: seals and components exposed to air – indoor, uncontrolled (internal) | Loss of material due to wear | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | Consistent with NUREG-1801. Loss of material due to wear of elastomer components exposed to air is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-97 | Steel piping, piping components, and piping elements, reactor coolant pump oil collection system: tanks, reactor coolant pump oil collection system: piping, tubing, valve bodies exposed to lubricating oil | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for steel components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material. RBS has no reactor coolant pump oil collection system. |
| 3.3.1-98 | Steel heat exchanger components exposed to lubricating oil | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion | Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for steel heat exchanger components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material. |
| 3.3.1-99 | Copper alloy, aluminum piping, piping components, and piping elements exposed to lubricating oil | Loss of material due to pitting and crevice corrosion | Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for copper alloy and aluminum components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-100 | Stainless steel piping, piping components, and piping elements exposed to lubricating oil | Loss of material due to pitting, crevice, and microbiologically influenced corrosion | Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for stainless steel components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material. |
| 3.3.1-101 | Aluminum heat exchanger tubes exposed to lubricating oil | Reduction of heat transfer due to fouling | Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Reduction of heat transfer for aluminum heat exchanger tubes exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage reduction of heat transfer. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-102 | Boral®; boron steel, and other materials (excluding Boraflex) spent fuel storage racks: neutron-absorbing sheets (PWR), spent fuel storage racks: neutron-absorbing sheets (BWR) exposed to treated borated water, treated water | Reduction of neutron-absorbing capacity; change in dimensions and loss of material due to effects of SFP environment | Chapter XI.M40, "Monitoring of Neutron-Absorbing Materials other than Boraflex" | No | This item was not used. There are no aluminum/boron carbide spent fuel storage rack neutron-absorbing sheets in the auxiliary systems in the scope of license renewal. |
| 3.3.1-103 | Reinforced concrete, asbestos cement piping, piping components, and piping elements exposed to soil or concrete | Cracking due to aggressive chemical attack and leaching; Changes in material properties due to aggressive chemical attack | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. There are no buried concrete components in the auxiliary systems in the scope of license renewal. |
| 3.3.1-104 | HDPE, fiberglass piping, piping components, and piping elements exposed to soil or concrete | Cracking, blistering, change in color due to water absorption | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. There are no fiberglass or HDPE components exposed to soil or concrete in the systems in the scope of license renewal. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-105 | Concrete cylinder piping, asbestos cement pipe piping, piping components, and piping elements exposed to soil or concrete | Cracking, spalling, corrosion of rebar due to exposure of rebar | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. There are no concrete or asbestos cement components exposed to soil or concrete in the systems in the scope of license renewal. |
| 3.3.1-106 | Steel (with coating or wrapping) piping, piping components, and piping elements exposed to soil or concrete | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | Consistent with NUREG-1801. Loss of material for steel components exposed to soil is managed by the Buried and Underground Piping and Tanks Inspection Program. There are no buried or underground steel components exposed to concrete in the auxiliary systems in the scope of license renewal. |
| 3.3.1-107 | Stainless steel, nickel alloy piping, piping components, and piping elements exposed to soil or concrete | Loss of material due to pitting and crevice corrosion | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. None of the component type, material and environment combinations represented by this item, apply to components in auxiliary systems included in the scope of license renewal. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-108 | Titanium, super austenitic, aluminum, copper alloy, stainless steel, nickel alloy piping, piping components, and piping elements, bolting exposed to soil or concrete | Loss of material due to pitting and crevice corrosion | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. None of the component type, material and environment combinations represented by this item apply to components in auxiliary systems included in the scope of license renewal. |
| 3.3.1-109 | Steel bolting exposed to soil or concrete | Loss of material due to general, pitting and crevice corrosion | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | Consistent with NUREG-1801. Loss of material for steel bolting exposed to soil is managed by the Buried and Underground Piping and Tanks Inspection Program. There is no steel bolting embedded in concrete in systems in the scope of license renewal. |
| 3.3.1-109.5 | Underground aluminum, copper alloy, stainless steel, nickel alloy and steel piping, piping components, and piping elements | Loss of material due to general (steel only), pitting and crevice corrosion | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. There are no underground aluminum, copper alloy, nickel alloy, stainless steel or steel components exposed to air or condensation in auxiliary systems in the scope of license renewal. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-110 | Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (> 140°F) | Cracking due to stress corrosion cracking | Chapter XI.M7, "BWR Stress Corrosion Cracking," and Chapter XI.M2, "Water Chemistry" | No | This item was not used. Stainless steel components of the auxiliary systems subject to evaluation under the BWR Stress Corrosion Cracking Program were reviewed as part of the Class 1 reactor coolant pressure boundary. |
| 3.3.1-111 | Steel structural steel exposed to air – indoor, uncontrolled (external) | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.S6, "Structures Monitoring" | No | This item was not used. Aging management review results for structural steel components are presented in and compared to NUREG-1801 items in Section 3.5. |
| 3.3.1-112 | Steel piping, piping components, and piping elements exposed to concrete | None | None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete | No, if conditions are met. | Consistent with NUREG-1801. Embedded steel components are in concrete that is designed and constructed in accordance with American Concrete Institute (ACI) and American Society for Testing and Materials (ASTM) standards, which provide a good-quality, relatively high strength, dense, low-permeability concrete. This design is sufficient to preclude embedded steel corrosion for concrete not exposed to an aggressive environment. Operating experience indicates no significant aging related degradation of this concrete. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-113 | Aluminum piping, piping components, and piping elements exposed to air – dry (internal/external), air – indoor, uncontrolled (internal/external), air – indoor, controlled (external), gas | None | None | NA – No AEM or AMP | Consistent with NUREG-1801 for aluminum components exposed to air. There are no aluminum components exposed to gas in the auxiliary systems in the scope of license renewal. |
| 3.3.1-114 | Copper alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (internal/external), air – dry, gas | None | None | NA – No AEM or AMP | Consistent with NUREG-1801. |
| 3.3.1-115 | PWR only | | | | |
| 3.3.1-116 | Galvanized steel piping, piping components, and piping elements exposed to air - indoor, uncontrolled | None | None | NA – No AEM or AMP | This item was not used. Galvanized (zinc) coating applied to some steel components is not credited for corrosion protection for license renewal. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-117 | Glass piping elements exposed to air – indoor, uncontrolled (external), lubricating oil, closed-cycle cooling water, air – outdoor, fuel oil, raw water, treated water, treated borated water, air with borated water leakage, condensation (internal/external) gas | None | None | NA – No AEM or AMP | Consistent with NUREG-1801. |
| 3.3.1-118 | Nickel alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external) | None | None | NA – No AEM or AMP | Consistent with NUREG-1801. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-119 | Nickel alloy, [polyvinyl chloride] PVC, glass piping, piping components, and piping elements exposed to air with borated water leakage, air – indoor, uncontrolled, condensation (internal), waste water | None | None | NA – No AEM or AMP | Consistent with NUREG-1801 for glass components exposed to waste water. Other material-environment combinations encompassed by this item are not applicable to auxiliary system components in the scope of license renewal. |
| 3.3.1-120 | Stainless steel piping, piping components, and piping elements exposed to air – indoor, uncontrolled (internal/external), air – indoor, uncontrolled (external), air with borated water leakage, concrete, air – dry, gas | None | None | NA – No AEM or AMP | Consistent with NUREG-1801. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-121 | Steel piping, piping components, and piping elements exposed to air – indoor, controlled (external), air – dry, gas | None | None | NA – No AEM or AMP | Consistent with NUREG-1801 for steel components exposed to gas. There are no steel auxiliary system components exposed to other environments represented by this item in the scope of license renewal. |
| 3.3.1-122 | Titanium heat exchanger components, piping, piping components, and piping elements exposed to air – indoor, uncontrolled or air – outdoor | None | None | NA – No AEM or AMP | This item was not used. There are no titanium heat exchanger components exposed to indoor or outdoor air included in systems in the scope of license renewal. |
| 3.3.1-123 | Titanium (ASTM Grades 1,2, 7, 11, or 12 that contains > 5% aluminum or more than 0.20% oxygen or any amount of tin) heat exchanger components other than tubes, piping, piping components, and piping elements exposed to raw water | None | None | NA – No AEM or AMP | This item was not used. There are no titanium components exposed to raw water included in systems in the scope of license renewal. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-124 | Stainless steel, steel (with stainless steel or nickel-alloy cladding) spent fuel storage racks (BWR), spent fuel storage racks (PWR), piping, piping components, and piping elements; exposed to treated water > 60°C (> 140°F), treated borated water > 60°C (> 140°F) | Cracking due to stress corrosion cracking | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | This item was not used. The spent fuel pool is normally maintained at a temperature below 140°F, consequently, cracking is not a significant aging effect for the stainless steel spent fuel pool components. |
| 3.3.1-125 | Steel (with stainless steel cladding) stainless steel spent fuel storage racks (BWR), spent fuel storage racks (PWR), piping, piping components, and piping elements; exposed to treated water, treated borated water | Loss of material due to pitting and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for stainless steel fuel storage rack components exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-126 | Any material, piping, piping components, and piping elements exposed to treated water, treated water (borated), raw water | Wall thinning due to erosion | Chapter XI.M17, "Flow-Accelerated Corrosion" | No | Consistent with NUREG-1801. Loss of material due to erosion is managed by the Flow-Accelerated Corrosion Program for components exposed to treated water and raw water. |
| 3.3.1-127 | Metallic piping, piping components, and tanks exposed to raw water or waste water | Loss of material due to recurring internal corrosion | A plant-specific aging management program is to be evaluated to address recurring internal corrosion | Yes, plant-specific | Recurring internal corrosion was not identified in the RBS auxiliary systems in the scope of license renewal. (See Section 3.3.2.2.8) |
| 3.3.1-128 | Steel, stainless steel, or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation | Loss of material due to general (steel only), pitting, or crevice corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only) | Chapter XI.M29, "Aboveground Metallic Tanks" | No | This item was not used. There are no stainless steel or aluminum tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the auxiliary systems. Loss of material for steel fire water storage tanks in outdoor air is addressed in Item 3.3.1-136. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-129 | Steel tanks exposed to soil or concrete; air-indoor uncontrolled, raw water, treated water, waste water, condensation | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M29, "Aboveground Metallic Tanks" | No | Loss of material for steel fire water storage tanks exposed to soil and concrete is managed by the Fire Water System Program. There are no steel tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the auxiliary systems exposed to other environments listed for this item. |
| 3.3.1-130 | Metallic sprinklers exposed to air-indoor controlled, air-indoor uncontrolled, air-outdoor, moist air, condensation, raw water, treated water | Loss of material due to general (where applicable), pitting, crevice, and microbiologically-influenced corrosion, fouling that leads to corrosion; flow blockage due to fouling | Chapter XI.M27, "Fire Water System" | No | Consistent with NUREG-1801. Loss of material and fouling of sprinklers internally exposed to raw water is managed by the Fire Water System Program. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-131 | Steel, stainless steel, copper alloy, or aluminum fire water system piping, piping components and piping elements exposed to air-indoor uncontrolled (internal), air-outdoor (internal), or condensation (internal) | Loss of material due to general (steel, and copper alloy only), pitting, crevice, and microbiologically-influenced corrosion, fouling that leads to corrosion; flow blockage due to fouling | Chapter XI.M27, "Fire Water System" | No | Consistent with NUREG-1801 for fire water system piping. Loss of material for steel fire water system piping internally exposed to condensation is managed by the Fire Water System Program. Loss of material for steel halon system piping internally exposed to indoor air is managed by the Fire Protection Program. Loss of material for copper alloy flame arrestors internally exposed to outdoor air is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. |
| 3.3.1-132 | Insulated steel, stainless steel, copper alloy, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor | Loss of material due to general (steel, and copper alloy only), pitting, and crevice corrosion; cracking due to stress corrosion cracking (aluminum, stainless steel and copper alloy (>15% Zn) only) | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, "Aboveground Metallic Tanks" (for tanks only) | No | Consistent with NUREG-1801. Cracking of stainless steel and loss of material for steel and stainless steel insulated piping components exposed to condensation or outdoor air is managed by the External Surfaces Monitoring Program. There is no insulated aluminum or copper alloy (> 15% zinc) piping in the auxiliary systems in the scope of license renewal. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-133 | Underground HDPE piping, piping components, and piping elements in an air-indoor uncontrolled or condensation (external) environment | Cracking, blistering, change in color due to water absorption | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. There are no underground HDPE piping components in the auxiliary systems in the scope of license renewal. |
| 3.3.1-134 | Steel, stainless steel, or copper alloy piping, piping components, and piping elements, and heat exchanger components exposed to a raw water environment (for nonsafety-related components not covered by NRC GL 89-13) | Loss of material due to general (steel and copper alloy only), pitting, crevice, and microbiologically influenced corrosion, fouling that leads to corrosion | Chapter XI.MI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | Consistent with NUREG-1801. Loss of material for steel, stainless steel and copper alloy components (nonsafety-related components not covered by NRC GL 89-13) exposed to raw water is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The Periodic Surveillance and Preventive Maintenance Program uses periodic visual inspections or other NDE techniques to manage loss of material for steel components externally exposed to raw water. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-135 | Steel or stainless steel pump casings submerged in a waste water (internal and external) environment | Loss of material due to general (steel only), pitting, crevice, and microbiologically influenced corrosion | Chapter XI.MI.M36, "External Surfaces Monitoring of Mechanical Components" | No | For stainless steel pump casings exposed to waste water that are not directly accessible for inspection, loss of material is managed by the Periodic Surveillance and Preventive Maintenance Program. The program uses periodic visual inspections or other NDE techniques to manage loss of material. There are no steel sump pump casings in the auxiliary systems in the scope of license renewal. |
| 3.3.1-136 | Steel, stainless steel or aluminum fire water storage tanks exposed to air-indoor uncontrolled, air-outdoor, condensation, moist air, raw water, treated water | Loss of material due to general (steel only), pitting, crevice, and microbiologically-influenced corrosion, fouling that leads to corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only) | Chapter XI.M27, "Fire Water System" | No | Consistent with NUREG-1801. Loss of material for steel fire water storage tanks exposed to outdoor air and condensation is managed by the Fire Water System Program. The steel fire water storage tanks are internally coated and are further addressed in Item 3.3.1-138. |

| Table 3.3.1: Auxiliary Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.3.1-137 | Steel, stainless steel or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to treated water, treated borated water | Loss of material due to general (steel only) pitting and crevice corrosion | Chapter XI.M29, "Aboveground Metallic Tanks" | No | This item was not used. There are no steel, stainless steel or aluminum tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") exposed to treated water in the auxiliary systems. |
| 3.3.1-138 | Metallic piping, piping components, heat exchangers, tanks with internal coatings/ linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, waste water, lubricating oil, or fuel oil | Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings | Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks" | No | Consistent with NUREG-1801 for most components. Loss of coating or lining integrity for metallic components with internal coating or linings is managed by the Coating Integrity Program. Loss of coating integrity for fire protection – water system components is managed by the Fire Water System Program. |

**Table 3.3.1: Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-139 | Metallic piping, piping components, heat exchangers, tanks with internal coatings/ linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion | Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks" | No | Consistent with NUREG-1801 for most components. Loss of material for metallic components with internal coating or linings is managed by the Coating Integrity Program. Loss of material for fire protection – water system components is managed by the Fire Water System Program. |
| 3.3.1-140 | Gray cast iron piping components with internal coatings/ linings exposed to closed-cycle cooling water, raw water, or treated water | Loss of material due to selective leaching | Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks" | No | This item was not used. There are no gray cast iron components with internal coating or linings in the auxiliary systems in the scope of license renewal. |

**Notes for Tables 3.3.2-1 through 3.3.2-18-26**

Generic Notes

A. Consistent with component, material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different AMP is credited or NUREG-1801 identifies a plant-specific AMP.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

301. The One-Time Inspection Program will verify effectiveness of the Water Chemistry Control – BWR Program.

302. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program.

303. The One-Time Inspection Program will verify the effectiveness of the Diesel Fuel Monitoring Program.

304. For the purposes of evaluating loss of material due to flow accelerated corrosion or erosion, this environment can be considered equivalent to the NUREG-1801 environment.

305. For the purposes of evaluating loss of material, this environment can be considered equivalent to the NUREG-1801 environment.

306. The (int) and (ext) environment designations refer to the nominal internal and external surfaces of the component and may not be consistent with the internal and external environment designations used in NUREG-1801. For example, an air or condensation (ext) environment for a component contained within a duct or other enclosure can correspond directly to a NUREG-1801 air or condensation (internal) environment.

307. These components have openings that expose the internal surfaces to outdoor air. Because the internal and external surfaces are exposed to the same environments, aging effects of the internal surfaces can be inferred from external surface conditions.

308. For the purposes of evaluating cracking due to fatigue, this environment can be considered equivalent to the NUREG-1801 environment.

**Table 3.3.2-1**
**Control Rod Drive System**
**Summary of Aging Management Evaluation**

| **Table 3.3.2-1: Control Rod Drive System** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Accumulator | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Accumulator | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Accumulator | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Accumulator | Pressure boundary | Stainless steel | Gas (int) | None | None | VII.J.AP-22 | 3.3.1-120 | A |
| Accumulator | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Accumulator | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | C, 301 |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Filter | Filtration | Stainless steel | Treated water > 140°F (ext) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |

| Table 3.3.2-1: Control Rod Drive System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Filter | Filtration | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | C, 301 |
| Filter housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Filter housing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Filter housing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | C, 301 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | V.D2.E-10 | 3.2.1-1 | C |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | C, 301 |

| Table 3.3.2-1: Control Rod Drive System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Rupture disc | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Rupture disc | Pressure boundary | Stainless steel | Gas (int) | None | None | VII.J.AP-22 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Gas (int) | None | None | VII.J.AP-22 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | C, 301 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | V.D2.E-10 | 3.2.1-1 | C |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

**Table 3.3.2-1: Control Rod Drive System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve body | Pressure boundary | Stainless steel | Gas (int) | None | None | VII.J.AP-22 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | C, 301 |

**Table 3.3.2-2**
**Component Cooling Water System**
**Summary of Aging Management Evaluation**

| **Table 3.3.2-2: Component Cooling Water System** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flex hose | Pressure boundary | Stainless steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Flex hose | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Flow element | Pressure boundary<br>Flow control | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flow element | Pressure boundary<br>Flow control | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-2: Component Cooling Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Thermowell | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Thermowell | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-2: Component Cooling Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |

# Table 3.3.2-3
# Service Water System
# Summary of Aging Management Evaluation

**Table 3.3.2-3: Service Water System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Accumulator | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Accumulator | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Accumulator | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Accumulator | Pressure boundary | Carbon steel with internal coating | Treated water (int) | Loss of coating integrity | Coating Integrity | VII.C1.A-416 | 3.3.1-138 | A |
| Accumulator | Pressure boundary | Carbon steel with internal coating | Treated water (int) | Loss of material | Coating Integrity | VII.C1.A-414 | 3.3.1-139 | A |
| Bolting | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-126 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-263 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | Bolting Integrity | VII.D.AP-121 | 3.3.1-12 | D |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Condensation (ext) | Loss of preload | Bolting Integrity | -- | -- | H |
| Bolting | Pressure boundary | Carbon steel | Raw water (ext) | Loss of material | Bolting Integrity | -- | -- | H |
| Bolting | Pressure boundary | Carbon steel | Raw water (ext) | Loss of preload | Bolting Integrity | VII.I.AP-264 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-126 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-263 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | Bolting Integrity | VII.D.AP-121 | 3.3.1-12 | D |
| Bolting | Pressure boundary | Stainless steel | Condensation (ext) | Loss of preload | Bolting Integrity | -- | -- | H |
| Bolting | Pressure boundary | Stainless steel | Raw water (ext) | Loss of material | Bolting Integrity | -- | -- | H |
| Bolting | Pressure boundary | Stainless steel | Raw water (ext) | Loss of preload | Bolting Integrity | VII.I.AP-264 | 3.3.1-15 | B |
| Coil | Pressure boundary | Copper alloy | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.AP-159 | 3.3.1-81 | C |
| Coil | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | C |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Expansion joint | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VII.E4.AP-209 | 3.3.1-4 | C |
| Expansion joint | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.E4.AP-221 | 3.3.1-6 | C |
| Expansion joint | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Expansion joint | Pressure boundary | Stainless steel | Raw water (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Expansion joint | Pressure boundary | Stainless steel | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-409 | 3.3.1-134 | A |
| Expansion joint | Pressure boundary | Stainless steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Expansion joint | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Flex hose | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Flex hose | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | V.D2.E-10 | 3.2.1-1 | C, 308 |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flex hose | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Flex hose | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Flex hose | Pressure boundary | Stainless steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Flex hose | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Flow element | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VII.E4.AP-209 | 3.3.1-4 | C |
| Flow element | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.E4.AP-221 | 3.3.1-6 | C |
| Flow element | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Flow element | Pressure boundary | Stainless steel | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-409 | 3.3.1-134 | A |

**Table 3.3.2-3: Service Water System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Flow element | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-189 | 3.3.1-46 | A |
| Heat exchanger (channel head) | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Heat exchanger (channel head) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Service Water Integrity | VII.E3.AP-191 | 3.3.1-47 | E |
| Heat exchanger (channel head) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | C |
| Heat exchanger (channel head) | Pressure boundary | Titanium | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | -- | -- | G |
| Heat exchanger (end cover) | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (end cover) | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Heat exchanger (end cover) | Pressure boundary | Carbon steel | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-408 | 3.3.1-134 | A |
| Heat exchanger (end cover) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-189 | 3.3.1-46 | A |
| Heat exchanger (plates) | Pressure boundary | Stainless steel | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-409 | 3.3.1-134 | A |
| Heat exchanger (plates) | Heat transfer | Stainless steel | Raw water (int) | Reduction of heat transfer | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.AP-187 | 3.3.1-42 | E |
| Heat exchanger (plates) | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | C |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (plates) | Heat transfer | Stainless steel | Treated water (ext) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-188 | 3.3.1-50 | A |
| Heat exchanger (plates) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | C |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-189 | 3.3.1-46 | A |
| Heat exchanger (shell) | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Heat exchanger (shell) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Service Water Integrity | VII.E3.AP-191 | 3.3.1-47 | E |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.F1.AP-109 | 3.3.1-79 | C |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Gas (ext) | None | None | VII.J.AP-9 | 3.3.1-114 | C |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Lube oil (ext) | Loss of material | Oil Analysis | VII.C1.AP-133 | 3.3.1-99 | C, 302 |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Steam (ext) | Cracking | Water Chemistry Control – BWR | VIII.A.SP-98 | 3.4.1-11 | C, 301 |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Steam (ext) | Loss of material | Water Chemistry Control – BWR | VIII.A.SP-155 | 3.4.1-16 | C, 301 |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Service Water Integrity | VII.E3.AP-191 | 3.3.1-47 | E |
| Heat exchanger (tubes) | Heat transfer | Stainless steel | Treated water (ext) | Reduction of heat transfer | Service Water Integrity | VII.C2.AP-188 | 3.3.1-50 | E |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Service Water Integrity | VII.E3.AP-191 | 3.3.1-47 | E |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | C |
| Heat exchanger (tubes) | Heat transfer | Stainless steel | Treated water (int) | Reduction of heat transfer | Service Water Integrity | VII.C2.AP-188 | 3.3.1-50 | E |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (tubes) | Pressure boundary | Titanium | Lube oil (ext) | Loss of material | Oil Analysis | -- | -- | G |
| Heat exchanger (tubes) | Pressure boundary | Titanium | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | -- | -- | G |
| Heat exchanger (tubesheet) | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Heat exchanger (tubesheet) | Pressure boundary | Carbon steel | Gas (int) | None | None | VII.J.AP-6 | 3.3.1-121 | C |
| Heat exchanger (tubesheet) | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-127 | 3.3.1-97 | C, 302 |
| Heat exchanger (tubesheet) | Pressure boundary | Carbon steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.A.SP-71 | 3.4.1-14 | C, 301 |
| Heat exchanger (tubesheet) | Pressure boundary | Carbon steel | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-189 | 3.3.1-46 | A |
| Heat exchanger (tubesheet) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-189 | 3.3.1-46 | A |
| Heat exchanger (tubesheet) | Pressure boundary | Copper alloy | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-133 | 3.3.1-99 | C, 302 |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (tubesheet) | Pressure boundary | Copper alloy | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubesheet) | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Condensation (int) | Loss of material | External Surfaces Monitoring | VII.F1.AP-109 | 3.3.1-79 | C, 306 |
| Heat exchanger (tubesheet) | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Treated water (ext) | Loss of material | Selective Leaching | VII.C2.AP-43 | 3.3.1-72 | C |
| Heat exchanger (tubesheet) | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubesheet) | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Service Water Integrity | VII.E3.AP-191 | 3.3.1-47 | E |
| Heat exchanger (tubesheet) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Service Water Integrity | VII.E3.AP-191 | 3.3.1-47 | E |
| Heat exchanger (tubesheet) | Pressure boundary | Titanium | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | -- | -- | G |
| Insulated piping components | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.C2.A-405 | 3.3.1-132 | A |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Insulated piping components | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VII.C2.A-405 | 3.3.1-132 | A |
| Insulated piping components | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.C2.A-405 | 3.3.1-132 | A |
| Nozzle | Pressure boundary | Copper alloy | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.AP-159 | 3.3.1-81 | A |
| Nozzle | Pressure boundary | Copper alloy | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-408 | 3.3.1-134 | A |
| Orifice | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Orifice | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VII.E4.AP-209 | 3.3.1-4 | C |
| Orifice | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.E4.AP-221 | 3.3.1-6 | C |
| Orifice | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Orifice | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | D |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Orifice | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-127 | 3.3.1-97 | A, 302 |
| Piping | Pressure boundary | Carbon steel | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-408 | 3.3.1-134 | A |
| Piping | Pressure boundary | Carbon steel | Raw water (int) | Loss of material – erosion | Flow-Accelerated Corrosion | VII.C1.A-409 | 3.3.1-126 | C |
| Piping | Pressure boundary | Carbon steel | Soil (ext) | Loss of material | Buried and Underground Piping and Tanks Inspection | VII.C1.AP-198 | 3.3.1-106 | A |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – erosion | Flow-Accelerated Corrosion | VII.E3.A-408 | 3.3.1-126 | C, 304 |
| Piping | Pressure boundary | Copper alloy | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.AP-159 | 3.3.1-81 | A |
| Piping | Pressure boundary | Copper alloy | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-408 | 3.3.1-134 | A |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VII.E4.AP-209 | 3.3.1-4 | C |
| Piping | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.E4.AP-221 | 3.3.1-6 | C |
| Piping | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Piping | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | D |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Stainless steel | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-409 | 3.3.1-134 | A |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Pump casing | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Carbon steel | Raw water (ext) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.C1.A-408 | 3.3.1-134 | E |
| Pump casing | Pressure boundary | Carbon steel | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-408 | 3.3.1-134 | A |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Pump casing | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Pump casing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Sight glass | Pressure boundary | Copper alloy | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.AP-159 | 3.3.1-81 | A |
| Sight glass | Pressure boundary | Copper alloy | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-133 | 3.3.1-99 | A, 302 |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-14 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Air – outdoor (ext) | None | None | VII.J.AP-167 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Condensation (ext) | None | None | VII.J.AP-97 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Lube oil (int) | None | None | VII.J.AP-15 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Treated water (int) | None | None | VII.J.AP-166 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Sight glass | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Strainer | Filtration | Stainless steel | Raw water (ext) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-409 | 3.3.1-134 | A, 306 |
| Strainer | Filtration | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Strainer housing | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Strainer housing | Pressure boundary | Carbon steel with internal coating | Raw water (int) | Loss of coating integrity | Coating Integrity | VII.C1.A-416 | 3.3.1-138 | A |
| Strainer housing | Pressure boundary | Carbon steel with internal coating | Raw water (int) | Loss of material | Coating Integrity | VII.C1.A-414 | 3.3.1-139 | A |
| Strainer housing | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VII.E4.AP-209 | 3.3.1-4 | C |
| Strainer housing | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.E4.AP-221 | 3.3.1-6 | C |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Strainer housing | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Strainer housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Thermowell | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Thermowell | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Thermowell | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Thermowell | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Tubing | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VII.E4.AP-209 | 3.3.1-4 | C |
| Tubing | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.E4.AP-221 | 3.3.1-6 | C |
| Tubing | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tubing | Pressure boundary | Stainless steel | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-409 | 3.3.1-134 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | D |
| Valve body | Pressure boundary | Carbon steel | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-408 | 3.3.1-134 | A |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Soil (ext) | Loss of material | Buried and Underground Piping and Tanks Inspection | VII.C1.AP-198 | 3.3.1-106 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.AP-159 | 3.3.1-81 | A |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.F1.AP-109 | 3.3.1-79 | C |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-133 | 3.3.1-99 | A, 302 |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Treated water (int) | Loss of material | Selective Leaching | VII.C2.AP-43 | 3.3.1-72 | A |

| Table 3.3.2-3: Service Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | A |
| Valve body | Pressure boundary | Gray cast iron | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Gray cast iron | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Gray cast iron | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-408 | 3.3.1-134 | A |
| Valve body | Pressure boundary | Gray cast iron | Raw water (int) | Loss of material | Selective Leaching | VII.C1.A-51 | 3.3.1-72 | A |
| Valve body | Pressure boundary | Gray cast iron | Treated water (int) | Loss of material | Selective Leaching | VII.C2.A-50 | 3.3.1-72 | A |
| Valve body | Pressure boundary | Gray cast iron | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Valve body | Pressure boundary | Plastic (PVDF) | Air – outdoor (ext) | Change in material properties | External Surfaces Monitoring | -- | -- | F |

**Table 3.3.2-3: Service Water System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve body | Pressure boundary | Plastic (PVDF) | Treated water (int) | None | None | -- | -- | F |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VII.E4.AP-209 | 3.3.1-4 | C |
| Valve body | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.E4.AP-221 | 3.3.1-6 | C |
| Valve body | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Valve body | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | D |
| Valve body | Pressure boundary | Stainless steel | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-409 | 3.3.1-134 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |

**Table 3.3.2-4**
**Compressed Air System**
**Summary of Aging Management Evaluation**

**Table 3.3.2-4: Compressed Air System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Accumulator | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.D.A-80 | 3.3.1-78 | A |
| Accumulator | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | B |
| Accumulator | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Accumulator | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flex hose | Pressure boundary | Stainless steel | Condensation (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Flex hose | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | B |

**Table 3.3.2-4: Compressed Air System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Orifice | Flow control | Copper alloy | Condensation (ext) | Loss of material | Compressed Air Monitoring | VII.D.AP-240 | 3.3.1-54 | D, 306 |
| Orifice | Flow control | Stainless steel | Condensation (ext) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | B, 306 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.D.A-80 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | B |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | B |
| Strainer | Filtration | Stainless steel | Condensation (ext) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | B, 306 |
| Strainer housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Strainer housing | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | B |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | B |

| Table 3.3.2-4: Compressed Air System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Aluminum | Air – indoor (ext) | None | None | VII.J.AP-135 | 3.3.1-113 | A |
| Valve body | Pressure boundary | Aluminum | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.F2.AP-142 | 3.3.1-92 | E |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.D.A-80 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | B |
| Valve body | Pressure boundary<br>Flow control | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | B |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | B |

**Table 3.3.2-5**
**Standby Liquid Control System**
**Summary of Aging Management Evaluation**

| Table 3.3.2-5: Standby Liquid Control System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Gear box housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Gear box housing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-127 | 3.3.1-97 | C, 302 |
| Heater housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Heater housing | Pressure boundary | Stainless steel | Sodium pentaborate solution (int) | Loss of material | Water Chemistry Control – BWR | VII.E2.AP-141 | 3.3.1-25 | C, 301 |
| Orifice | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Sodium pentaborate solution (int) | Loss of material | Water Chemistry Control – BWR | VII.E2.AP-141 | 3.3.1-25 | A, 301 |

| Table 3.3.2-5: Standby Liquid Control System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-127 | 3.3.1-97 | C, 302 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Sodium pentaborate solution (int) | Loss of material | Water Chemistry Control – BWR | VII.E2.AP-141 | 3.3.1-25 | A, 301 |
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Pump casing | Pressure boundary | Stainless steel | Sodium pentaborate solution (int) | Loss of material | Water Chemistry Control – BWR | VII.E2.AP-141 | 3.3.1-25 | A, 301 |
| Sight glass | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Sight glass | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-127 | 3.3.1-97 | C, 302 |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-14 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Lube oil (int) | None | None | VII.J.AP-15 | 3.3.1-117 | A |
| Strainer housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-5: Standby Liquid Control System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Strainer housing | Pressure boundary | Stainless steel | Sodium pentaborate solution (int) | Loss of material | Water Chemistry Control – BWR | VII.E2.AP-141 | 3.3.1-25 | A, 301 |
| Tank | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Tank | Pressure boundary | Stainless steel | Concrete (ext) | None | None | VII.J.AP-19 | 3.3.1-120 | C |
| Tank | Pressure boundary | Stainless steel | Sodium pentaborate solution (int) | Loss of material | Water Chemistry Control – BWR | VII.E2.AP-141 | 3.3.1-25 | C, 301 |
| Thermowell | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Thermowell | Pressure boundary | Stainless steel | Sodium pentaborate solution (int) | Loss of material | Water Chemistry Control – BWR | VII.E2.AP-141 | 3.3.1-25 | A, 301 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Sodium pentaborate solution (int) | Loss of material | Water Chemistry Control – BWR | VII.E2.AP-141 | 3.3.1-25 | A, 301 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-5: Standby Liquid Control System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Sodium pentaborate solution (int) | Loss of material | Water Chemistry Control – BWR | VII.E2.AP-141 | 3.3.1-25 | A, 301 |

## Table 3.3.2-6
## Main Steam Positive Leakage Control System
## Summary of Aging Management Evaluation

**Table 3.3.2-6: Main Steam Positive Leakage Control System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Accumulator | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.D.A-80 | 3.3.1-78 | A |
| Accumulator | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Accumulator | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-280 | 3.3.1-95 | C |
| Accumulator | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | C |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Compressor housing | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |

**Table 3.3.2-6: Main Steam Positive Leakage Control System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Compressor housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Flex hose | Pressure boundary | Nickel alloy | Air – indoor (ext) | None | None | VII.J.AP-16 | 3.3.1-118 | A |
| Flex hose | Pressure boundary | Nickel alloy | Steam (int) | Cracking | Water Chemistry Control – BWR | -- | -- | G |
| Flex hose | Pressure boundary | Nickel alloy | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | IV.C1.R-220 | 3.1.1-6 | C |
| Flex hose | Pressure boundary | Nickel alloy | Steam (int) | Loss of material | Water Chemistry Control – BWR | -- | -- | G |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flex hose | Pressure boundary | Stainless steel | Steam (int) | Cracking | Water Chemistry Control – BWR | VIII.B2.SP-98 | 3.4.1-11 | C, 301 |
| Flex hose | Pressure boundary | Stainless steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Flex hose | Pressure boundary | Stainless steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-155 | 3.4.1-16 | C, 301 |
| Flow element | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

**Table 3.3.2-6: Main Steam Positive Leakage Control System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Flow element | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-189 | 3.3.1-46 | C |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-189 | 3.3.1-46 | C |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Treated water (ext) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-205 | 3.3.1-50 | C |

**Table 3.3.2-6: Main Steam Positive Leakage Control System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Service Water Integrity | VII.F3.AP-203 | 3.3.1-46 | E |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Treated water (int) | Reduction of heat transfer | Service Water Integrity | VII.C2.AP-205 | 3.3.1-50 | E |
| Heat exchanger (tubesheet) | Pressure boundary | Copper alloy | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubesheet) | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | C |
| Orifice | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Orifice | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Orifice | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Orifice | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |

| Table 3.3.2-6: Main Steam Positive Leakage Control System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Orifice | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.D.A-80 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-280 | 3.3.1-95 | C |
| Piping | Pressure boundary | Carbon steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VIII.B2.S-08 | 3.4.1-1 | C |
| Piping | Pressure boundary | Carbon steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301, 305 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |

**Table 3.3.2-6: Main Steam Positive Leakage Control System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Strainer | Filtration | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Strainer housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Strainer housing | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Strainer housing | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Strainer housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Thermowell | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Thermowell | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-6: Main Steam Positive Leakage Control System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tubing | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Tubing | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.D.A-80 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | C |
| Valve body | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-280 | 3.3.1-95 | C |
| Valve body | Pressure boundary | Carbon steel | Steam (int) | Cracking – fatigue | TLAA – metal fatigue | VIII.B2.S-08 | 3.4.1-1 | C |

| Table 3.3.2-6: Main Steam Positive Leakage Control System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Steam (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301, 305 |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.G.AP-143 | 3.3.1-89 | C |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Valve body | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |

**Table 3.3.2-7**
**Fire Protection – Water System**
**Summary of Aging Management Evaluation**

| Table 3.3.2-7: Fire Protection – Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-126 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-263 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Carbon steel | Soil (ext) | Loss of material | Buried and Underground Piping and Tanks Inspection | VII.I.AP-241 | 3.3.1-109 | A |
| Bolting | Pressure boundary | Carbon steel | Soil (ext) | Loss of preload | Bolting Integrity | VII.I.AP-242 | 3.3.1-14 | B |
| Expansion joint | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Expansion joint | Pressure boundary | Carbon steel | Exhaust gas (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-104 | 3.3.1-88 | C |

| Table 3.3.2-7: Fire Protection – Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Fire hydrant | Pressure boundary | Gray cast iron | Air – outdoor (ext) | Loss of material | Fire Water System | VII.G.AP-149 | 3.3.1-63 | B |
| Fire hydrant | Pressure boundary | Gray cast iron | Raw water (int) | Loss of material | Fire Water System | VII.G.A-33 | 3.3.1-64 | B |
| Fire hydrant | Pressure boundary | Gray cast iron | Raw water (int) | Loss of material | Selective Leaching | VII.G.A-51 | 3.3.1-72 | A |
| Fire hydrant | Pressure boundary | Gray cast iron | Soil (ext) | Loss of material | Buried and Underground Piping and Tanks Inspection | VII.G.AP-198 | 3.3.1-106 | A |
| Fire hydrant | Pressure boundary | Gray cast iron | Soil (ext) | Loss of material | Selective Leaching | VII.G.A-02 | 3.3.1-72 | A |
| Flame arrestor | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.AP-159 | 3.3.1-81 | A |
| Flame arrestor | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.G.A-404 | 3.3.1-131 | E |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flex hose | Pressure boundary | Stainless steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.G.AP-136 | 3.3.1-71 | A, 303 |

**Table 3.3.2-7: Fire Protection – Water System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Flow element | Pressure boundary<br>Flow control | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flow element | Pressure boundary<br>Flow control | Stainless steel | Raw water (ext) | Loss of material | Fire Water System | VII.G.A-55 | 3.3.1-66 | B |
| Heat exchanger (channel head) | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | C |
| Heat exchanger (channel head) | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.G.AP-41 | 3.3.1-80 | A |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Raw water (int) | Loss of material | Fire Water System | VII.G.A-33 | 3.3.1-64 | D |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Raw water (ext) | Loss of material | Fire Water System | VII.G.AP-197 | 3.3.1-64 | D |

| Table 3.3.2-7: Fire Protection – Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Raw water (ext) | Reduction of heat transfer | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.C1.A-72 | 3.3.1-42 | E |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Treated water (int) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-205 | 3.3.1-50 | C |
| Heater housing | Pressure boundary | Aluminum | Air – indoor (ext) | None | None | VII.J.AP-135 | 3.3.1-113 | C |
| Heater housing | Pressure boundary | Aluminum | Treated water (int) | Cracking | Water Chemistry Control – Closed Treated Water Systems | -- | -- | H |
| Heater housing | Pressure boundary | Aluminum | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-254 | 3.3.1-48 | C |
| Insulated piping components | Pressure boundary | Gray cast iron | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.G.A-405 | 3.3.1-132 | A |

| Table 3.3.2-7: Fire Protection – Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Insulated piping components | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.G.A-405 | 3.3.1-132 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Fire Water System | VII.G.A-404 | 3.3.1-131 | B |
| Piping | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | Fire Water System | VII.G.A-404 | 3.3.1-131 | B |
| Piping | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Fire Water System | VII.G.A-404 | 3.3.1-131 | B |
| Piping | Pressure boundary | Carbon steel | Exhaust gas (int) | Cracking – fatigue | TLAA – metal fatigue | V.D2.E-10 | 3.2.1-1 | C, 308 |
| Piping | Pressure boundary | Carbon steel | Exhaust gas (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-104 | 3.3.1-88 | C |
| Piping | Pressure boundary | Carbon steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.G.AP-234 | 3.3.1-68 | A, 303 |
| Piping | Pressure boundary | Carbon steel | Raw water (ext) | Loss of material | Fire Water System | VII.G.A-33 | 3.3.1-64 | B |

| Table 3.3.2-7: Fire Protection – Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Raw water (int) | Loss of material | Fire Water System | VII.G.A-33 | 3.3.1-64 | B |
| Piping | Pressure boundary | Carbon steel | Soil (ext) | Loss of material | Buried and Underground Piping and Tanks Inspection | VII.G.AP-198 | 3.3.1-106 | A |
| Piping | Pressure boundary | Carbon steel with internal coating | Raw water (int) | Loss of coating integrity | Fire Water System | VII.G.A-416 | 3.3.1-138 | E |
| Piping | Pressure boundary | Carbon steel with internal coating | Raw water (int) | Loss of material | Fire Water System | VII.G.A-414 | 3.3.1-139 | E |
| Piping | Pressure boundary | Gray cast iron | Raw water (int) | Loss of material | Fire Water System | VII.G.A-33 | 3.3.1-64 | B |
| Piping | Pressure boundary | Gray cast iron | Raw water (int) | Loss of material | Selective Leaching | VII.G.A-51 | 3.3.1-72 | A |
| Piping | Pressure boundary | Gray cast iron | Soil (ext) | Loss of material | Buried and Underground Piping and Tanks Inspection | VII.G.AP-198 | 3.3.1-106 | A |
| Piping | Pressure boundary | Gray cast iron | Soil (ext) | Loss of material | Selective Leaching | VII.G.A-02 | 3.3.1-72 | A |
| Pump casing | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |

**Table 3.3.2-7: Fire Protection – Water System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pump casing | Pressure boundary | Carbon steel | Raw water (int) | Loss of material | Fire Water System | VII.G.A-33 | 3.3.1-64 | B |
| Pump casing | Pressure boundary | Gray cast iron | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Gray cast iron | Raw water (int) | Loss of material | Fire Water System | VII.G.A-33 | 3.3.1-64 | B |
| Pump casing | Pressure boundary | Gray cast iron | Raw water (int) | Loss of material | Selective Leaching | VII.G.A-51 | 3.3.1-72 | A |
| Silencer | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Silencer | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-280 | 3.3.1-95 | C |
| Silencer | Pressure boundary | Carbon steel | Exhaust gas (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-104 | 3.3.1-88 | C |
| Sprinkler | Pressure boundary<br>Flow control | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |

| Table 3.3.2-7: Fire Protection – Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Sprinkler | Pressure boundary<br>Flow control | Copper alloy > 15% Zn or > 8% Al | Air – indoor (int) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Sprinkler | Pressure boundary<br>Flow control | Copper alloy > 15% Zn or > 8% Al | Raw water (int) | Loss of material | Fire Water System | VII.G.A-403 | 3.3.1-130 | B |
| Sprinkler | Pressure boundary<br>Flow control | Copper alloy > 15% Zn or > 8% Al | Raw water (int) | Loss of material | Selective Leaching | VII.G.A-47 | 3.3.1-72 | A |
| Strainer | Filtration | Carbon steel | Raw water (ext) | Loss of material | Fire Water System | VII.G.A-33 | 3.3.1-64 | B |
| Strainer | Filtration | Stainless steel | Raw water (ext) | Loss of material | Fire Water System | VII.G.A-55 | 3.3.1-66 | B |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Strainer housing | Pressure boundary | Carbon steel | Raw water (int) | Loss of material | Fire Water System | VII.G.A-33 | 3.3.1-64 | B |
| Strainer housing | Pressure boundary | Carbon steel with internal coating | Raw water (int) | Loss of coating integrity | Fire Water System | VII.G.A-416 | 3.3.1-138 | E |
| Strainer housing | Pressure boundary | Carbon steel with internal coating | Raw water (int) | Loss of material | Fire Water System | VII.G.A-414 | 3.3.1-139 | E |

| Table 3.3.2-7: Fire Protection – Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tank | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Tank | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | Fire Water System | VII.G.A-412 | 3.3.1-136 | B |
| Tank | Pressure boundary | Carbon steel | Concrete (ext) | Loss of material | Fire Water System | VII.G.A-402 | 3.3.1-129 | E |
| Tank | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Fire Water System | VII.G.A-412 | 3.3.1-136 | B |
| Tank | Pressure boundary | Carbon steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-105 | 3.3.1-70 | C, 303 |
| Tank | Pressure boundary | Carbon steel | Soil (ext) | Loss of material | Fire Water System | VII.G.A-402 | 3.3.1-129 | E |
| Tank | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | C |
| Tank | Pressure boundary | Carbon steel with internal coating | Raw water (int) | Loss of coating integrity | Fire Water System | VII.G.A-416 | 3.3.1-138 | E |
| Tank | Pressure boundary | Carbon steel with internal coating | Raw water (int) | Loss of material | Fire Water System | VII.G.A-414 | 3.3.1-139 | E |
| Tubing | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |

**Table 3.3.2-7: Fire Protection – Water System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Tubing | Pressure boundary | Copper alloy | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.G.AP-132 | 3.3.1-69 | A, 303 |
| Tubing | Pressure boundary | Copper alloy | Raw water (int) | Loss of material | Fire Water System | VII.G.AP-197 | 3.3.1-64 | B |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.G.AP-234 | 3.3.1-68 | A, 303 |
| Valve body | Pressure boundary | Carbon steel | Raw water (int) | Loss of material | Fire Water System | VII.G.A-33 | 3.3.1-64 | B |
| Valve body | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.AP-159 | 3.3.1-81 | A |
| Valve body | Pressure boundary | Copper alloy | Raw water (ext) | Loss of material | Fire Water System | VII.G.AP-197 | 3.3.1-64 | B |
| Valve body | Pressure boundary | Copper alloy | Raw water (int) | Loss of material | Fire Water System | VII.G.AP-197 | 3.3.1-64 | B |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |

| Table 3.3.2-7: Fire Protection – Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.AP-159 | 3.3.1-81 | A |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Raw water (int) | Loss of material | Fire Water System | VII.G.AP-197 | 3.3.1-64 | B |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Raw water (int) | Loss of material | Selective Leaching | VII.G.A-47 | 3.3.1-72 | A |
| Valve body | Pressure boundary | Gray cast iron | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Gray cast iron | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Gray cast iron | Raw water (int) | Loss of material | Fire Water System | VII.G.A-33 | 3.3.1-64 | B |
| Valve body | Pressure boundary | Gray cast iron | Raw water (int) | Loss of material | Selective Leaching | VII.G.A-51 | 3.3.1-72 | A |
| Valve body | Pressure boundary | Gray cast iron with internal coating | Raw water (int) | Loss of coating integrity | Fire Water System | VII.G.A-416 | 3.3.1-138 | E |
| Valve body | Pressure boundary | Gray cast iron with internal coating | Raw water (int) | Loss of material | Fire Water System | VII.G.A-414 | 3.3.1-139 | E |

| Table 3.3.2-7: Fire Protection – Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Gray cast iron | Soil (ext) | Loss of material | Buried and Underground Piping and Tanks Inspection | VII.G.AP-198 | 3.3.1-106 | A |
| Valve body | Pressure boundary | Gray cast iron | Soil (ext) | Loss of material | Selective Leaching | VII.G.A-02 | 3.3.1-72 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Raw water (int) | Loss of material | Fire Water System | VII.G.A-55 | 3.3.1-66 | B |
| Vortex breaker | Flow control | Carbon steel with internal coating | Raw water (ext) | Loss of coating integrity | Fire Water System | VII.G.A-416 | 3.3.1-138 | E |
| Vortex breaker | Flow control | Carbon steel with internal coating | Raw water (ext) | Loss of material | Fire Water System | VII.G.A-414 | 3.3.1-139 | E |

# Table 3.3.2-8
## Fire Protection – Halon System
## Summary of Aging Management Evaluation

**Table 3.3.2-8: Fire Protection – Halon System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Nozzle | Pressure boundary<br>Flow control | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Nozzle | Pressure boundary<br>Flow control | Copper alloy | Air – indoor (int) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Nozzle | Pressure boundary<br>Flow control | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Nozzle | Pressure boundary<br>Flow control | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Fire Protection | VII.G.AP-150 | 3.3.1-58 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Fire Protection | VII.G.A-404 | 3.3.1-131 | E |
| Piping | Pressure boundary | Carbon steel | Gas (int) | None | None | VII.J.AP-6 | 3.3.1-121 | A |
| Tubing | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |

| Table 3.3.2-8: Fire Protection – Halon System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tubing | Pressure boundary | Copper alloy | Air – indoor (int) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Fire Protection | VII.G.AP-150 | 3.3.1-58 | A |
| Valve body | Pressure boundary | Carbon steel | Gas (int) | None | None | VII.J.AP-6 | 3.3.1-121 | A |

# Table 3.3.2-9
# Combustible Gas Control System
# Summary of Aging Management Evaluation

**Table 3.3.2-9: Combustible Gas Control System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Accumulator | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Accumulator | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Coil | Heat transfer | Stainless steel | Air – indoor (ext) | Reduction of heat transfer | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |

| Table 3.3.2-9: Combustible Gas Control System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Coil | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Fan housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F3.A-10 | 3.3.1-78 | C |
| Fan housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | External Surfaces Monitoring | V.B.E-25 | 3.2.1-44 | E |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-9: Combustible Gas Control System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | C |
| Piping | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-280 | 3.3.1-95 | C |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Condensation (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | H |
| Piping | Pressure boundary | Stainless steel | Condensation (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |

| Table 3.3.2-9: Combustible Gas Control System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Pump casing | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Separator | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Separator | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Sight glass | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Sight glass | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-9: Combustible Gas Control System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Sight glass | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Condensation (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | H |
| Tubing | Pressure boundary | Stainless steel | Condensation (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Tubing | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | External Surfaces Monitoring | V.D2.E-29 | 3.2.1-44 | E |

| Table 3.3.2-9: Combustible Gas Control System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | C |
| Valve body | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-280 | 3.3.1-95 | C |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Condensation (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | H |
| Valve body | Pressure boundary | Stainless steel | Condensation (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |

| Table 3.3.2-9: Combustible Gas Control System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |

## Table 3.3.2-10
## Standby Diesel Generator System
## Summary of Aging Management Evaluation

**Table 3.3.2-10: Standby Diesel Generator System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Expansion joint | Pressure boundary | Elastomer | Air – indoor (ext) | Change in material properties | External Surfaces Monitoring | VII.F2.AP-102 | 3.3.1-76 | C |
| Expansion joint | Pressure boundary | Elastomer | Air – indoor (ext) | Cracking | External Surfaces Monitoring | VII.F2.AP-102 | 3.3.1-76 | C |
| Expansion joint | Pressure boundary | Elastomer | Air – outdoor (int) | Change in material properties | External Surfaces Monitoring | -- | -- | G |
| Expansion joint | Pressure boundary | Elastomer | Air – outdoor (int) | Cracking | External Surfaces Monitoring | -- | -- | G |
| Expansion joint | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-10: Standby Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Expansion joint | Pressure boundary | Stainless steel | Exhaust gas (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-128 | 3.3.1-83 | A |
| Expansion joint | Pressure boundary | Stainless steel | Exhaust gas (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-104 | 3.3.1-88 | A |
| Filter housing | Pressure boundary | Aluminum | Air – indoor (ext) | None | None | VII.J.AP-135 | 3.3.1-113 | A |
| Filter housing | Pressure boundary | Aluminum | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F2.AP-142 | 3.3.1-92 | C |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Filter housing | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |

| Table 3.3.2-10: Standby Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Filter housing | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.A-23 | 3.3.1-89 | A |
| Filter housing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |
| Filter housing | Pressure boundary | Carbon steel with internal coating | Lube oil (int) | Loss of coating integrity | Coating Integrity | VII.H2.A-416 | 3.3.1-138 | A |
| Filter housing | Pressure boundary | Carbon steel with internal coating | Lube oil (int) | Loss of material | Coating Integrity | VII.H2.A-414 | 3.3.1-139 | A |
| Filter housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Filter housing | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.H2.AP-41 | 3.3.1-80 | A |

| Table 3.3.2-10: Standby Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | C |
| Heat exchanger (fins) | Heat transfer | Aluminum | Air – indoor (ext) | Reduction of heat transfer | Periodic Surveillance and Preventive Maintenance | -- | -- | G |
| Heat exchanger (housing) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.H2.AP-41 | 3.3.1-80 | A |
| Heat exchanger (housing) | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.H2.AP-41 | 3.3.1-80 | A |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-131 | 3.3.1-98 | A, 302 |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | C |

| Table 3.3.2-10: Standby Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (shell) | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | C |
| Heat exchanger (shell) | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-133 | 3.3.1-99 | C, 302 |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | C |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Air – indoor (ext) | Reduction of heat transfer | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-133 | 3.3.1-99 | C, 302 |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Lube oil (ext) | Reduction of heat transfer | Oil Analysis | V.D2.EP-78 | 3.2.1-51 | C, 302 |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Treated water (ext) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-205 | 3.3.1-50 | C |

| Table 3.3.2-10: Standby Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Treated water (int) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-205 | 3.3.1-50 | C |
| Heat exchanger (tubesheet) | Pressure boundary | Copper alloy | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-133 | 3.3.1-99 | C, 302 |
| Heat exchanger (tubesheet) | Pressure boundary | Copper alloy | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubesheet) | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubesheet) | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-133 | 3.3.1-99 | C, 302 |
| Heat exchanger (tubesheet) | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Treated water (ext) | Loss of material | Selective Leaching | VII.H2.AP-43 | 3.3.1-72 | C |

**Table 3.3.2-10: Standby Diesel Generator System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat exchanger (tubesheet) | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-199 | 3.3.1-46 | C |
| Heater housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.H2.AP-41 | 3.3.1-80 | A |
| Heater housing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-131 | 3.3.1-98 | A, 302 |
| Heater housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | C |
| Insulated piping components | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.H2.A-405 | 3.3.1-132 | A |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-138 | 3.3.1-100 | A, 302 |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |

| Table 3.3.2-10: Standby Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Piping | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.A-23 | 3.3.1-89 | A |
| Piping | Pressure boundary | Carbon steel | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |
| Piping | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |
| Piping | Pressure boundary | Carbon steel | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | A |

| Table 3.3.2-10: Standby Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VII.H2.AP-209 | 3.3.1-4 | A |
| Piping | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.H2.AP-221 | 3.3.1-6 | A |
| Piping | Pressure boundary | Stainless steel | Exhaust gas (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-128 | 3.3.1-83 | A |
| Piping | Pressure boundary | Stainless steel | Exhaust gas (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Piping | Pressure boundary | Stainless steel | Exhaust gas (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-104 | 3.3.1-88 | A |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |

| Table 3.3.2-10: Standby Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | A |
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Pump casing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Sight glass | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Sight glass | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-14 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Lube oil (int) | None | None | VII.J.AP-15 | 3.3.1-117 | A |
| Silencer | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Silencer | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |

| Table 3.3.2-10: Standby Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Silencer | Pressure boundary | Carbon steel | Exhaust gas (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-104 | 3.3.1-88 | A |
| Strainer | Filtration | Aluminum | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-162 | 3.3.1-99 | A, 302 |
| Strainer | Filtration | Copper alloy > 15% Zn or > 8% Al | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-133 | 3.3.1-99 | A, 302 |
| Strainer | Filtration | Stainless steel | Condensation (ext) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C, 306 |
| Strainer | Filtration | Stainless steel | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-138 | 3.3.1-100 | A, 302 |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Strainer housing | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.A-23 | 3.3.1-89 | A |
| Strainer housing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |

**Table 3.3.2-10: Standby Diesel Generator System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Tank | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Tank | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.A-23 | 3.3.1-89 | C |
| Tank | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | C, 302 |
| Tank | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | A |
| Thermowell | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Thermowell | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-138 | 3.3.1-100 | A, 302 |
| Thermowell | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Tubing | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |

| Table 3.3.2-10: Standby Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tubing | Pressure boundary | Copper alloy | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.G.AP-143 | 3.3.1-89 | C |
| Tubing | Pressure boundary | Copper alloy | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-133 | 3.3.1-99 | A, 302 |
| Tubing | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-199 | 3.3.1-46 | A |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Tubing | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-138 | 3.3.1-100 | A, 302 |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |

| Table 3.3.2-10: Standby Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Turbocharger | Pressure boundary | Aluminum | Air – indoor (ext) | None | None | VII.J.AP-135 | 3.3.1-113 | A |
| Turbocharger | Pressure boundary | Aluminum | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.I.AP-256 | 3.3.1-81 | E |
| Turbocharger | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Turbocharger | Pressure boundary | Carbon steel | Exhaust gas (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-104 | 3.3.1-88 | A |
| Valve body | Pressure boundary | Aluminum | Air – indoor (ext) | None | None | VII.J.AP-135 | 3.3.1-113 | A |
| Valve body | Pressure boundary | Aluminum | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F2.AP-142 | 3.3.1-92 | C |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-10: Standby Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.A-23 | 3.3.1-89 | A |
| Valve body | Pressure boundary | Carbon steel | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |
| Valve body | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | A |
| Valve body | Pressure boundary | Carbon steel with internal coating | Lube oil (int) | Loss of coating integrity | Coating Integrity | VII.H2.A-416 | 3.3.1-138 | A |
| Valve body | Pressure boundary | Carbon steel with internal coating | Lube oil (int) | Loss of material | Coating Integrity | VII.H2.A-414 | 3.3.1-139 | A |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |

**Table 3.3.2-10: Standby Diesel Generator System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.G.AP-143 | 3.3.1-89 | C |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-133 | 3.3.1-99 | A, 302 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-273 | 3.3.1-95 | C |
| Valve body | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-138 | 3.3.1-100 | A, 302 |
| Valve body | Pressure boundary | Stainless steel with internal coating | Treated water (int) | Loss of coating integrity | Coating Integrity | VII.H2.A-416 | 3.3.1-138 | A |
| Valve body | Pressure boundary | Stainless steel with internal coating | Treated water (int) | Loss of material | Coating Integrity | VII.H2.A-414 | 3.3.1-139 | A |

**Table 3.3.2-11**
**HPCS Diesel Generator System**
**Summary of Aging Management Evaluation**

| Table 3.3.2-11: HPCS Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Accumulator | Pressure boundary | Aluminum | Air – indoor (ext) | None | None | VII.J.AP-135 | 3.3.1-113 | A |
| Accumulator | Pressure boundary | Aluminum | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F2.AP-142 | 3.3.1-92 | C |
| Accumulator | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Accumulator | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.A-23 | 3.3.1-89 | A |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |

| Table 3.3.2-11: HPCS Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Expansion joint | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Expansion joint | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | A |
| Expansion joint | Pressure boundary | Elastomer | Air – indoor (ext) | Change in material properties | External Surfaces Monitoring | VII.F2.AP-102 | 3.3.1-76 | C |
| Expansion joint | Pressure boundary | Elastomer | Air – indoor (ext) | Cracking | External Surfaces Monitoring | VII.F2.AP-102 | 3.3.1-76 | C |
| Expansion joint | Pressure boundary | Elastomer | Air – outdoor (int) | Change in material properties | External Surfaces Monitoring | -- | -- | G |
| Expansion joint | Pressure boundary | Elastomer | Air – outdoor (int) | Cracking | External Surfaces Monitoring | -- | -- | G |
| Expansion joint | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Expansion joint | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F2.AP-99 | 3.3.1-94 | C |

| Table 3.3.2-11: HPCS Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Expansion joint | Pressure boundary | Stainless steel | Exhaust gas (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-128 | 3.3.1-83 | A |
| Expansion joint | Pressure boundary | Stainless steel | Exhaust gas (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-104 | 3.3.1-88 | A |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Filter housing | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Filter housing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.H2.AP-41 | 3.3.1-80 | A |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | C |

| Table 3.3.2-11: HPCS Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (fins) | Heat transfer | Aluminum | Air – indoor (ext) | Reduction of heat transfer | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Heat exchanger (fins) | Heat transfer | Aluminum | Lube oil (ext) | Reduction of heat transfer | Oil Analysis | VII.H2.AP-154 | 3.3.1-101 | A, 302 |
| Heat exchanger (housing) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.H2.AP-41 | 3.3.1-80 | A |
| Heat exchanger (housing) | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | C |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.H2.AP-41 | 3.3.1-80 | A |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-131 | 3.3.1-98 | A, 302 |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | C |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | C |

| Table 3.3.2-11: HPCS Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Air – indoor (ext) | Reduction of heat transfer | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-133 | 3.3.1-99 | C, 302 |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Lube oil (ext) | Reduction of heat transfer | Oil Analysis | V.D2.EP-78 | 3.2.1-51 | C, 302 |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Treated water (int) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-205 | 3.3.1-50 | C |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy > 15% zinc (inhibited) | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubes) | Heat transfer | Copper alloy > 15% zinc (inhibited) | Treated water (ext) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-205 | 3.3.1-50 | C |

| Table 3.3.2-11: HPCS Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy > 15% zinc (inhibited) | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubes) | Heat transfer | Copper alloy > 15% zinc (inhibited) | Treated water (int) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-205 | 3.3.1-50 | C |
| Heat exchanger (tubesheet) | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-131 | 3.3.1-98 | A, 302 |
| Heat exchanger (tubesheet) | Pressure boundary | Carbon steel | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | C |
| Heat exchanger (tubesheet) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | C |
| Heater housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.H2.AP-41 | 3.3.1-80 | A |
| Heater housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | C |

| Table 3.3.2-11: HPCS Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Insulated piping components | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.H2.A-405 | 3.3.1-132 | A |
| Orifice | Pressure boundary<br>Flow control | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Orifice | Pressure boundary<br>Flow control | Copper alloy > 15% Zn or > 8% Al | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-133 | 3.3.1-99 | A, 302 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | External Surfaces Monitoring | -- | -- | G, 307 |
| Piping | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.A-23 | 3.3.1-89 | A |
| Piping | Pressure boundary | Carbon steel | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |
| Piping | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |

| Table 3.3.2-11: HPCS Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | A |
| Piping | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VII.H2.AP-209 | 3.3.1-4 | A |
| Piping | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.H2.AP-221 | 3.3.1-6 | A |
| Piping | Pressure boundary | Stainless steel | Air – outdoor (int) | Cracking | External Surfaces Monitoring | -- | -- | G |
| Piping | Pressure boundary | Stainless steel | Air – outdoor (int) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Piping | Pressure boundary | Stainless steel | Exhaust gas (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-128 | 3.3.1-83 | A |
| Piping | Pressure boundary | Stainless steel | Exhaust gas (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Piping | Pressure boundary | Stainless steel | Exhaust gas (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-104 | 3.3.1-88 | A |

| Table 3.3.2-11: HPCS Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | A |
| Sight glass | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Sight glass | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |
| Sight glass | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Sight glass | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Treated water (int) | Loss of material | Selective Leaching | VII.H2.AP-43 | 3.3.1-72 | A |
| Sight glass | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-199 | 3.3.1-46 | A |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-14 | 3.3.1-117 | A |

**Table 3.3.2-11: HPCS Diesel Generator System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Sight glass | Pressure boundary | Glass | Lube oil (int) | None | None | VII.J.AP-15 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Treated water (int) | None | None | VII.J.AP-166 | 3.3.1-117 | A |
| Silencer | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Silencer | Pressure boundary | Carbon steel | Exhaust gas (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-104 | 3.3.1-88 | A |
| Strainer | Filtration | Aluminum | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-162 | 3.3.1-99 | A, 302 |
| Strainer | Filtration | Copper alloy > 15% Zn or > 8% Al | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-133 | 3.3.1-99 | A, 302 |
| Strainer | Filtration | Nickel alloy | Condensation (ext) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-274 | 3.3.1-95 | C, 306 |
| Strainer | Filtration | Stainless steel | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-138 | 3.3.1-100 | A, 302 |
| Strainer housing | Pressure boundary | Aluminum | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-162 | 3.3.1-99 | A, 302 |

| Table 3.3.2-11: HPCS Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
| Strainer housing | Pressure boundary | Aluminum | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-162 | 3.3.1-99 | A, 302 |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Strainer housing | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.A-23 | 3.3.1-89 | A |
| Strainer housing | Pressure boundary | Carbon steel | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |
| Strainer housing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |
| Tank | Pressure boundary | Aluminum | Air – indoor (ext) | None | None | VII.J.AP-135 | 3.3.1-113 | C |
| Tank | Pressure boundary | Aluminum | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-162 | 3.3.1-99 | C, 302 |
| Tank | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Tank | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.A-23 | 3.3.1-89 | C |

| Table 3.3.2-11: HPCS Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tank | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | C, 302 |
| Tank | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | A |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F2.AP-99 | 3.3.1-94 | C |
| Tubing | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-138 | 3.3.1-100 | A, 302 |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Turbocharger | Pressure boundary | Aluminum | Air – indoor (ext) | None | None | VII.J.AP-135 | 3.3.1-113 | A |

**Table 3.3.2-11: HPCS Diesel Generator System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Turbocharger | Pressure boundary | Aluminum | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.I.AP-256 | 3.3.1-81 | E |
| Turbocharger | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Turbocharger | Pressure boundary | Carbon steel | Exhaust gas (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.AP-104 | 3.3.1-88 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.A-23 | 3.3.1-89 | A |
| Valve body | Pressure boundary | Carbon steel | Lube oil (ext) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |
| Valve body | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-127 | 3.3.1-97 | A, 302 |

| Table 3.3.2-11: HPCS Diesel Generator System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | A |
| Valve body | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-133 | 3.3.1-99 | A, 302 |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.G.AP-143 | 3.3.1-89 | C |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F2.AP-99 | 3.3.1-94 | C |
| Valve body | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-138 | 3.3.1-100 | A, 302 |

**Table 3.3.2-12**
**Control Building HVAC System**
**Summary of Aging Management Evaluation**

| Table 3.3.2-12: Control Building HVAC System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Accumulator | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Accumulator | Pressure boundary | Stainless steel | Air – outdoor (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Accumulator | Pressure boundary | Stainless steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Damper housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F1.A-10 | 3.3.1-78 | A |

| Table 3.3.2-12: Control Building HVAC System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Damper housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Damper housing | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F1.A-08 | 3.3.1-90 | A, 305 |
| Demister | Filtration | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Demister | Filtration | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Demister housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F1.A-10 | 3.3.1-78 | A |
| Demister housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Ducting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F1.A-10 | 3.3.1-78 | A |

| Table 3.3.2-12: Control Building HVAC System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Ducting | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Ducting | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Expansion joint | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Expansion joint | Pressure boundary | Stainless steel | Air – indoor (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Fan housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F1.A-10 | 3.3.1-78 | A |
| Fan housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F1.A-10 | 3.3.1-78 | A |

| Table 3.3.2-12: Control Building HVAC System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Filter housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Filter housing | Pressure boundary | Stainless steel | Air – outdoor (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Filter housing | Pressure boundary | Stainless steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Flex connection | Pressure boundary | Elastomer | Air – indoor (ext) | Change in material properties | External Surfaces Monitoring | VII.F1.AP-102 | 3.3.1-76 | A |
| Flex connection | Pressure boundary | Elastomer | Air – indoor (ext) | Cracking | External Surfaces Monitoring | VII.F1.AP-102 | 3.3.1-76 | A |
| Flex connection | Pressure boundary | Elastomer | Air – indoor (ext) | Loss of material – wear | External Surfaces Monitoring | VII.F1.AP-113 | 3.3.1-82 | A |

| Table 3.3.2-12: Control Building HVAC System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flex connection | Pressure boundary | Elastomer | Air – indoor (int) | Loss of material – wear | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F1.AP-103 | 3.3.1-96 | A |
| Flex connection | Pressure boundary | Elastomer | Air – outdoor (int) | Change in material properties | External Surfaces Monitoring | -- | -- | G |
| Flex connection | Pressure boundary | Elastomer | Air – outdoor (int) | Cracking | External Surfaces Monitoring | -- | -- | G |
| Flex connection | Pressure boundary | Elastomer | Air – outdoor (int) | Loss of material – wear | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flex hose | Pressure boundary | Stainless steel | Air – outdoor (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |

| Table 3.3.2-12: Control Building HVAC System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flex hose | Pressure boundary | Stainless steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Heat exchanger (fins) | Heat transfer | Aluminum | Condensation (ext) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Heat exchanger (fins) | Heat transfer | Aluminum | Condensation (ext) | Reduction of heat transfer | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Heat exchanger (housing) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F1.AP-41 | 3.3.1-80 | A |
| Heat exchanger (housing) | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | C |

| Table 3.3.2-12: Control Building HVAC System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Condensation (ext) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.G.AP-143 | 3.3.1-89 | C, 306 |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Condensation (ext) | Reduction of heat transfer | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.F1.AP-203 | 3.3.1-46 | A |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Treated water (int) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.F1.AP-205 | 3.3.1-50 | C |
| Heater housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F1.AP-41 | 3.3.1-80 | A |
| Heater housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | C |

| Table 3.3.2-12: Control Building HVAC System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Insulated piping components | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.F1.A-405 | 3.3.1-132 | A |
| Manifold | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VII.F1.AP-209 | 3.3.1-4 | A |
| Manifold | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.F1.AP-221 | 3.3.1-6 | A |
| Manifold | Pressure boundary | Stainless steel | Air – outdoor (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Manifold | Pressure boundary | Stainless steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F1.A-10 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | C |
| Piping | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |

| Table 3.3.2-12: Control Building HVAC System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Piping | Pressure boundary | Carbon steel | Soil (ext) | Loss of material | Buried and Underground Piping and Tanks Inspection | VII.C1.AP-198 | 3.3.1-106 | C |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F1.A-10 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-48 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Air – outdoor (int) | None | None | VII.J.AP-167 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-12: Control Building HVAC System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Sight glass | Pressure boundary | Stainless steel | Air – outdoor (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Sight glass | Pressure boundary | Stainless steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Thermowell | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Thermowell | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Air – outdoor (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |

| Table 3.3.2-12: Control Building HVAC System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tubing | Pressure boundary | Stainless steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F1.A-10 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | C |
| Valve body | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-12: Control Building HVAC System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Air – outdoor (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Valve body | Pressure boundary | Stainless steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |

**Table 3.3.2-13**
**Miscellaneous HVAC System**
**Summary of Aging Management Evaluation**

| Table 3.3.2-13: Miscellaneous HVAC Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Accumulator | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Accumulator | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Damper housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |
| Damper housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |

| Table 3.3.2-13: Miscellaneous HVAC Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Damper housing | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F2.A-08 | 3.3.1-90 | A, 305 |
| Ducting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |
| Ducting | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Ducting | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F2.A-08 | 3.3.1-90 | A, 305 |
| Fan housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |
| Fan housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Filter housing | Pressure boundary | Aluminum | Air – indoor (ext) | None | None | VII.J.AP-135 | 3.3.1-113 | C |

| Table 3.3.2-13: Miscellaneous HVAC Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Filter housing | Pressure boundary | Aluminum | Air – indoor (int) | None | None | VII.J.AP-135 | 3.3.1-113 | C |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Filter housing | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Filter housing | Pressure boundary | Carbon steel | Gas (int) | None | None | VII.J.AP-6 | 3.3.1-121 | C |
| Filter housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Filter housing | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Flex connection | Pressure boundary | Elastomer | Air – indoor (ext) | Change in material properties | External Surfaces Monitoring | VII.F2.AP-102 | 3.3.1-76 | A |
| Flex connection | Pressure boundary | Elastomer | Air – indoor (ext) | Cracking | External Surfaces Monitoring | VII.F2.AP-102 | 3.3.1-76 | A |
| Flex connection | Pressure boundary | Elastomer | Air – indoor (ext) | Loss of material – wear | External Surfaces Monitoring | VII.F2.AP-113 | 3.3.1-82 | A |

| Table 3.3.2-13: Miscellaneous HVAC Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flex connection | Pressure boundary | Elastomer | Air – indoor (int) | Change in material properties | External Surfaces Monitoring | VII.F2.AP-102 | 3.3.1-76 | A |
| Flex connection | Pressure boundary | Elastomer | Air – indoor (int) | Cracking | External Surfaces Monitoring | VII.F2.AP-102 | 3.3.1-76 | A |
| Flex connection | Pressure boundary | Elastomer | Air – indoor (int) | Loss of material – wear | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F2.AP-103 | 3.3.1-96 | A |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Heat exchanger (channel head) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Heat exchanger (channel head) | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Heat exchanger (fins) | Heat transfer | Aluminum | Air – outdoor (ext) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.I.AP-256 | 3.3.1-81 | E, 306 |

**Table 3.3.2-13: Miscellaneous HVAC Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat exchanger (fins) | Heat transfer | Aluminum | Air – outdoor (ext) | Reduction of heat transfer | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | H |
| Heat exchanger (fins) | Heat transfer | Aluminum | Condensation (ext) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F2.AP-142 | 3.3.1-92 | A, 306 |
| Heat exchanger (fins) | Heat transfer | Aluminum | Condensation (ext) | Reduction of heat transfer | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Heat exchanger (housing) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.AP-41 | 3.3.1-80 | A |
| Heat exchanger (housing) | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.G.AP-40 | 3.3.1-80 | C |
| Heat exchanger (housing) | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |

| Table 3.3.2-13: Miscellaneous HVAC Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (housing) | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F2.A-08 | 3.3.1-90 | A |
| Heat exchanger (shell) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Heat exchanger (shell) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | C |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Air – outdoor (ext) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Air – outdoor (ext) | Reduction of heat transfer | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Condensation (ext) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.G.AP-143 | 3.3.1-89 | C, 306 |

| Table 3.3.2-13: Miscellaneous HVAC Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Condensation (ext) | Reduction of heat transfer | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Gas (int) | None | None | VII.J.AP-9 | 3.3.1-114 | C |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Service Water Integrity | VII.F3.AP-203 | 3.3.1-46 | E |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.F3.AP-203 | 3.3.1-46 | A |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Treated water (int) | Reduction of heat transfer | Service Water Integrity | VII.F2.AP-205 | 3.3.1-50 | E |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Treated water (int) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.F2.AP-205 | 3.3.1-50 | C |
| Heat exchanger (tubes) | Heat transfer | Stainless steel | Air – indoor (int) | Reduction of heat transfer | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | G |

| Table 3.3.2-13: Miscellaneous HVAC Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | C |
| Heat exchanger (tubes) | Heat transfer | Stainless steel | Treated water (ext) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-188 | 3.3.1-50 | C |
| Heat exchanger (tubesheet) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Heat exchanger (tubesheet) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | C |
| Heater housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.AP-41 | 3.3.1-80 | A |
| Heater housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | C |
| Insulated piping components | Pressure boundary | Copper alloy | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-405 | 3.3.1-132 | A |
| Manifold | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-13: Miscellaneous HVAC Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Manifold | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | C |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Pump casing | Pressure boundary | Aluminum | Air – indoor (ext) | None | None | VII.J.AP-135 | 3.3.1-113 | A |
| Pump casing | Pressure boundary | Aluminum | Air – indoor (int) | None | None | VII.J.AP-135 | 3.3.1-113 | A |
| Screen | Filtration | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Sight glass | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Sight glass | Pressure boundary | Copper alloy | Gas (int) | None | None | VII.J.AP-9 | 3.3.1-114 | A |

| Table 3.3.2-13: Miscellaneous HVAC Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-14 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Air – indoor (int) | None | None | VII.J.AP-48 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Gas (int) | None | None | VII.J.AP-98 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Sight glass | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Tubing | Pressure boundary | Copper alloy | Gas (int) | None | None | VII.J.AP-9 | 3.3.1-114 | A |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |

| Table 3.3.2-13: Miscellaneous HVAC Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.D2.E-29 | 3.2.1-44 | C |
| Valve body | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy | Air – indoor (int) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.AP-159 | 3.3.1-81 | A |
| Valve body | Pressure boundary | Copper alloy | Gas (int) | None | None | VII.J.AP-9 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Gas (int) | None | None | VII.J.AP-22 | 3.3.1-120 | A |

# Table 3.3.2-14
# Chilled Water System
# Summary of Aging Management Evaluation

| Table 3.3.2-14: Chilled Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Accumulator | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Accumulator | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-280 | 3.3.1-95 | C |
| Accumulator | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Air dryer | Pressure boundary<br>Filtration | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Air dryer | Pressure boundary<br>Filtration | Carbon steel | Gas (int) | None | None | VII.J.AP-6 | 3.3.1-121 | A |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |

| Table 3.3.2-14: Chilled Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | Bolting Integrity | VII.D.AP-121 | 3.3.1-12 | D |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Compressor housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Compressor housing | Pressure boundary | Carbon steel | Gas (int) | None | None | VII.J.AP-6 | 3.3.1-121 | A |
| Compressor housing | Pressure boundary | Carbon steel with internal coating | Lube oil (int) | Loss of coating integrity | Coating Integrity | VII.C2.A-416 | 3.3.1-138 | A |
| Compressor housing | Pressure boundary | Carbon steel with internal coating | Lube oil (int) | Loss of material | Coating Integrity | VII.C2.A-414 | 3.3.1-139 | A |
| Expansion joint | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Expansion joint | Pressure boundary | Stainless steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Expansion joint | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-14: Chilled Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Filter housing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-127 | 3.3.1-97 | A, 302 |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flex hose | Pressure boundary | Stainless steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Flex hose | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Flow element | Pressure boundary<br>Flow control | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Flow element | Pressure boundary<br>Flow control | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-189 | 3.3.1-46 | A |

| Table 3.3.2-14: Chilled Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel with internal coating | Treated water (int) | Loss of coating integrity | Coating Integrity | VII.C2.A-416 | 3.3.1-138 | A |
| Heat exchanger (channel head) | Pressure boundary | Carbon steel with internal coating | Treated water (int) | Loss of material | Coating Integrity | VII.C2.A-414 | 3.3.1-139 | A |
| Heat exchanger (channel head) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Heat exchanger (channel head) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | C |
| Heat exchanger (fins) | Heat transfer | Copper alloy | Gas (ext) | None | None | VII.J.AP-9 | 3.3.1-114 | C |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Gas (int) | None | None | VII.J.AP-6 | 3.3.1-121 | C |
| Heat exchanger (shell) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Heat exchanger (shell) | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-138 | 3.3.1-100 | A, 302 |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Gas (ext) | None | None | VII.J.AP-9 | 3.3.1-114 | C |

| Table 3.3.2-14: Chilled Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (tubes) | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | C |
| Heat exchanger (tubes) | Heat transfer | Copper alloy | Treated water (int) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-205 | 3.3.1-50 | A |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Lube oil (ext) | Loss of material | Oil Analysis | VII.C2.AP-138 | 3.3.1-100 | C, 302 |
| Heat exchanger (tubes) | Heat transfer | Stainless steel | Lube oil (ext) | Reduction of heat transfer | Oil Analysis | V.D2.EP-79 | 3.2.1-51 | C, 301 |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | C |
| Heat exchanger (tubes) | Heat transfer | Stainless steel | Treated water (int) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-188 | 3.3.1-50 | A |
| Heat exchanger (tubesheet) | Pressure boundary | Carbon steel | Gas (int) | None | None | VII.J.AP-6 | 3.3.1-121 | C |

| Table 3.3.2-14: Chilled Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (tubesheet) | Pressure boundary | Carbon steel | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-189 | 3.3.1-46 | A |
| Heat exchanger (tubesheet) | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-138 | 3.3.1-100 | C, 302 |
| Heat exchanger (tubesheet) | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | C |
| Insulated piping components | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.C2.A-405 | 3.3.1-132 | A |
| Orifice | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Orifice | Pressure boundary | Copper alloy | Gas (int) | None | None | VII.J.AP-9 | 3.3.1-114 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-280 | 3.3.1-95 | C |

| Table 3.3.2-14: Chilled Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Gas (int) | None | None | VII.J.AP-6 | 3.3.1-121 | A |
| Piping | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-127 | 3.3.1-97 | A, 302 |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Piping | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-138 | 3.3.1-100 | A, 302 |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-127 | 3.3.1-97 | A, 302 |
| Pump casing | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |

| Table 3.3.2-14: Chilled Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Pump casing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Separator | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Separator | Pressure boundary | Carbon steel | Gas (int) | None | None | VII.J.AP-6 | 3.3.1-121 | A |
| Sight glass | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Sight glass | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Sight glass | Pressure boundary | Carbon steel | Gas (int) | None | None | VII.J.AP-6 | 3.3.1-121 | A |
| Sight glass | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-127 | 3.3.1-97 | A, 302 |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-14 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Condensation (ext) | None | None | VII.J.AP-97 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Gas (int) | None | None | VII.J.AP-98 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Lube oil (int) | None | None | VII.J.AP-15 | 3.3.1-117 | A |

| Table 3.3.2-14: Chilled Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Strainer | Filtration | Stainless steel | Gas (ext) | None | None | VII.J.AP-22 | 3.3.1-120 | A |
| Strainer | Filtration | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Strainer housing | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Strainer housing | Pressure boundary | Carbon steel | Gas (int) | None | None | VII.J.AP-6 | 3.3.1-121 | A |
| Strainer housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Strainer housing | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Strainer housing | Pressure boundary | Copper alloy | Gas (int) | None | None | VII.J.AP-9 | 3.3.1-114 | A |
| Thermowell | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |

| Table 3.3.2-14: Chilled Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Thermowell | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Tubing | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Tubing | Pressure boundary | Copper alloy | Gas (int) | None | None | VII.J.AP-9 | 3.3.1-114 | A |
| Tubing | Pressure boundary | Copper alloy | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-133 | 3.3.1-99 | A, 302 |
| Tubing | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | A |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Tubing | Pressure boundary | Stainless steel | Gas (int) | None | None | VII.J.AP-22 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-138 | 3.3.1-100 | A, 302 |

| Table 3.3.2-14: Chilled Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-280 | 3.3.1-95 | C |
| Valve body | Pressure boundary | Carbon steel | Gas (int) | None | None | VII.J.AP-6 | 3.3.1-121 | A |
| Valve body | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-127 | 3.3.1-97 | A, 302 |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Valve body | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy | Gas (int) | None | None | VII.J.AP-9 | 3.3.1-114 | A |

| Table 3.3.2-14: Chilled Water System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
| Valve body | Pressure boundary | Copper alloy | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-133 | 3.3.1-99 | A, 302 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Valve body | Pressure boundary | Stainless steel | Gas (int) | None | None | VII.J.AP-22 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-138 | 3.3.1-100 | A, 302 |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |

# Table 3.3.2-15
## Fuel Pool Cooling and Cleanup System
## Summary of Aging Management Evaluation

**Table 3.3.2-15: Fuel Pool Cooling and Cleanup System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flex hose | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Flex hose | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Flex hose | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Flow element | Pressure boundary<br>Flow control | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flow element | Pressure boundary<br>Flow control | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |

| Table 3.3.2-15: Fuel Pool Cooling and Cleanup System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flow element | Pressure boundary<br>Flow control | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Heat exchanger (channel head) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Heat exchanger (channel head) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VII.E3.AP-112 | 3.3.1-20 | C, 301 |
| Heat exchanger (channel head) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-111 | 3.3.1-25 | A, 301 |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.A4.AP-189 | 3.3.1-46 | A |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | C |
| Heat exchanger (tubes) | Heat transfer | Stainless steel | Treated water (ext) | Reduction of heat transfer | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-188 | 3.3.1-50 | C |

| Table 3.3.2-15: Fuel Pool Cooling and Cleanup System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VII.E3.AP-112 | 3.3.1-20 | C, 301 |
| Heat exchanger (tubes) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-111 | 3.3.1-25 | A, 301 |
| Heat exchanger (tubes) | Heat transfer | Stainless steel | Treated water > 140°F (int) | Reduction of heat transfer | Water Chemistry Control – BWR | VII.A4.AP-139 | 3.3.1-17 | A, 301 |
| Heat exchanger (tubesheet) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | C |
| Heat exchanger (tubesheet) | Pressure boundary | Stainless steel | Treated water > 140°F (ext) | Cracking | Water Chemistry Control – BWR | VII.E3.AP-112 | 3.3.1-20 | C, 301 |
| Heat exchanger (tubesheet) | Pressure boundary | Stainless steel | Treated water > 140°F (ext) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-111 | 3.3.1-25 | A, 301 |
| Neutron absorber | Neutron absorption | Boron carbide / elastomer | Treated water (ext) | Change in material properties | Boraflex Monitoring | VII.A2.A-87 | 3.3.1-51 | A |
| Neutron absorber | Neutron absorption | Boron carbide / elastomer | Treated water (ext) | Reduction in neutron absorption capacity | Boraflex Monitoring | VII.A2.A-87 | 3.3.1-51 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-15: Fuel Pool Cooling and Cleanup System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Pump casing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Pump casing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Rack | Support for criterion (a)(1) equipment | Aluminum | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-130 | 3.3.1-25 | C, 301 |
| Rack | Support for criterion (a)(1) equipment | Stainless steel | Treated water (ext) | Loss of material | Water Chemistry Control – BWR | VII.A2.A-98 | 3.3.1-125 | A, 301 |

| Table 3.3.2-15: Fuel Pool Cooling and Cleanup System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Strainer housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Strainer housing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Strainer housing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Thermowell | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Thermowell | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Thermowell | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Tubing | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | C |

| Table 3.3.2-15: Fuel Pool Cooling and Cleanup System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Valve body | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | C |

**Table 3.3.2-16**
**Plant Drains**
**Summary of Aging Management Evaluation**

| Table 3.3.2-16: Plant Drains | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Carbon steel (coated) | Waste water (ext) | Loss of material | Bolting Integrity | -- | -- | G |
| Bolting | Pressure boundary | Carbon steel (coated) | Waste water (ext) | Loss of preload | Bolting Integrity | -- | -- | G |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Orifice | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Orifice | Pressure boundary<br>Flow control | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | A |

| Table 3.3.2-16: Plant Drains | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Concrete (ext) | None | None | VII.J.AP-282 | 3.3.1-112 | A |
| Piping | Pressure boundary | Carbon steel | Waste water (ext) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-281 | 3.3.1-91 | E |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | A |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-281 | 3.3.1-91 | E |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material – erosion | Flow-Accelerated Corrosion | VII.C1.A-409 | 3.3.1-126 | C, 304 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Concrete (ext) | None | None | VII.J.AP-19 | 3.3.1-120 | A |

| Table 3.3.2-16: Plant Drains | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Stainless steel | Waste water (ext) | Cracking | Periodic Surveillance and Preventive Maintenance | -- | -- | H |
| Piping | Pressure boundary | Stainless steel | Waste water (ext) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-278 | 3.3.1-95 | E |
| Piping | Pressure boundary | Stainless steel | Waste water (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | H |
| Piping | Pressure boundary | Stainless steel | Waste water (int) | Cracking | Periodic Surveillance and Preventive Maintenance | -- | -- | H |
| Piping | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | A |
| Piping | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-278 | 3.3.1-95 | E |

| Table 3.3.2-16: Plant Drains | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Pump casing | Pressure boundary | Stainless steel | Waste water (ext) | Cracking | Periodic Surveillance and Preventive Maintenance | -- | -- | H |
| Pump casing | Pressure boundary | Stainless steel | Waste water (ext) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.A-411 | 3.3.1-135 | E |
| Pump casing | Pressure boundary | Stainless steel | Waste water (int) | Cracking | Periodic Surveillance and Preventive Maintenance | -- | -- | H |
| Pump casing | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.A-411 | 3.3.1-135 | E |
| Strainer | Filtration | Stainless steel | Waste water (ext) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-278 | 3.3.1-95 | E |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-16: Plant Drains | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Waste water (int) | Cracking | Internal Surfaces in Miscellaneous Piping and Ducting Components | -- | -- | H |
| Valve body | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | A |

# Table 3.3.2-17
# Fuel Oil System
# Summary of Aging Management Evaluation

| Table 3.3.2-17: Fuel Oil System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Filter housing | Pressure boundary | Carbon steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-105 | 3.3.1-70 | A, 303 |
| Flame arrestor | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Flame arrestor | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | External Surfaces Monitoring | -- | -- | G, 307 |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flex hose | Pressure boundary | Stainless steel | Fuel oil (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Flex hose | Pressure boundary | Stainless steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-136 | 3.3.1-71 | A, 303 |

| Table 3.3.2-17: Fuel Oil System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flow element | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flow element | Pressure boundary | Stainless steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-136 | 3.3.1-71 | A, 303 |
| Orifice | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Orifice | Pressure boundary | Carbon steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-105 | 3.3.1-70 | A, 303 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-78 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Air – outdoor (int) | Loss of material | External Surfaces Monitoring | -- | -- | G, 307 |
| Piping | Pressure boundary | Carbon steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-105 | 3.3.1-70 | A, 303 |
| Piping | Pressure boundary | Carbon steel | Soil (ext) | Loss of material | Buried and Underground Piping and Tanks Inspection | VII.H1.AP-198 | 3.3.1-106 | A |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Carbon steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-105 | 3.3.1-70 | A, 303 |

| Table 3.3.2-17: Fuel Oil System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Strainer | Filtration | Stainless steel | Fuel oil (ext) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-136 | 3.3.1-71 | A, 303 |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Strainer housing | Pressure boundary | Carbon steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-105 | 3.3.1-70 | A, 303 |
| Strainer housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Strainer housing | Pressure boundary | Stainless steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-136 | 3.3.1-71 | A, 303 |
| Tank | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Tank | Pressure boundary | Carbon steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-105 | 3.3.1-70 | A, 303 |
| Tank | Pressure boundary | Carbon steel | Soil (ext) | Loss of material | Buried and Underground Piping and Tanks Inspection | VII.H1.AP-198 | 3.3.1-106 | C |
| Tubing | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Tubing | Pressure boundary | Copper alloy | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-132 | 3.3.1-69 | A, 303 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-17: Fuel Oil System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tubing | Pressure boundary | Stainless steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-136 | 3.3.1-71 | A, 303 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-105 | 3.3.1-70 | A, 303 |
| Valve body | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-132 | 3.3.1-69 | A, 303 |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-132 | 3.3.1-69 | A, 303 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-136 | 3.3.1-71 | A, 303 |

**Table 3.3.2-18-1**
**Control Rod Drive Hydraulic System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

**Table 3.3.2-18-1: Control Rod Drive Hydraulic System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Accumulator | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Accumulator | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-127 | 3.3.1-97 | C, 302 |
| Accumulator | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Accumulator | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Accumulator | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Filter housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |

| Table 3.3.2-18-1: Control Rod Drive Hydraulic System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Filter housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Filter housing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Filter housing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Flow element | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flow element | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Flow element | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Heat exchanger (end cover) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Heat exchanger (end cover) | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-131 | 3.3.1-98 | C, 302 |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.H2.AP-131 | 3.3.1-98 | C, 302 |
| Orifice | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-18-1: Control Rod Drive Hydraulic System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Orifice | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Orifice | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-127 | 3.3.1-97 | C, 302 |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-18-1: Control Rod Drive Hydraulic System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Pump casing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Pump casing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Sight glass | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Sight glass | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-133 | 3.3.1-99 | C, 302 |
| Strainer housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Strainer housing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Strainer housing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-18-1: Control Rod Drive Hydraulic System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-127 | 3.3.1-97 | C, 302 |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-133 | 3.3.1-99 | C, 302 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |

**Table 3.3.2-18-2**
**Fuel Transfer Equipment System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

**Table 3.3.2-18-2: Fuel Transfer Equipment System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Demister housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Demister housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C1.AP-138 | 3.3.1-100 | C, 302 |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |

**Table 3.3.2-18-2: Fuel Transfer Equipment System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Pump casing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Strainer housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Strainer housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Tank | Pressure boundary | Fiberglass | Air – indoor (ext) | Change in material properties | External Surfaces Monitoring | -- | -- | G |
| Tank | Pressure boundary | Fiberglass | Treated water (int) | Change in material properties | Water Chemistry Control – BWR | -- | -- | G |
| Tank | Pressure boundary | Fiberglass | Treated water (int) | Cracking | Water Chemistry Control – BWR | -- | -- | G |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-138 | 3.3.1-100 | C, 302 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VII.C2.AP-138 | 3.3.1-100 | C, 302 |

| Table 3.3.2-18-2: Fuel Transfer Equipment System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |

**Table 3.3.2-18-3**
**Closed Cooling Water – Reactor Plant System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

**Table 3.3.2-18-3: Closed Cooling Water – Reactor Plant, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Cooler housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Cooler housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Demineralizer | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Demineralizer | Pressure boundary | Carbon steel with internal coating | Treated water (int) | Loss of coating integrity | Coating Integrity | VII.C2.A-416 | 3.3.1-138 | A |
| Demineralizer | Pressure boundary | Carbon steel with internal coating | Treated water (int) | Loss of material | Coating Integrity | VII.C2.A-414 | 3.3.1-139 | A |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-18-3: Closed Cooling Water – Reactor Plant, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Filter housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flex hose | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Flow element | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flow element | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Orifice | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Orifice | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-18-3: Closed Cooling Water – Reactor Plant, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Sight glass | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Sight glass | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Sight glass | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |

| Table 3.3.2-18-3: Closed Cooling Water – Reactor Plant, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Sight glass | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-199 | 3.3.1-46 | A |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-48 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Treated water (int) | None | None | VII.J.AP-166 | 3.3.1-117 | A |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Strainer housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Tank | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Tank | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Thermowell | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-18-3: Closed Cooling Water – Reactor Plant, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Thermowell | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |

## Table 3.3.2-18-4
## Service Water – Normal System
## Nonsafety-Related Components Affecting Safety-Related Systems
## Summary of Aging Management Evaluation

**Table 3.3.2-18-4: Service Water – Normal System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Accumulator | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Accumulator | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Bolting | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | Bolting Integrity | VII.D.AP-121 | 3.3.1-12 | D |
| Filter housing | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Filter housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Flow element | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |

| Table 3.3.2-18-4: Service Water – Normal System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flow element | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Heat exchanger (Shell) | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Heat exchanger (Shell) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-189 | 3.3.1-46 | A |
| Orifice | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Orifice | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Piping | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Pump casing | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |

| Table 3.3.2-18-4: Service Water – Normal System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |
| Tubing | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | A |
| Valve body | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | A |

**Table 3.3.2-18-5**
**Compressed Air System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

**Table 3.3.2-18-5: Compressed Air System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.D.A-80 | 3.3.1-78 | A |
| Filter housing | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | B |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.D.A-80 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | B |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | C |

| Table 3.3.2-18-5: Compressed Air System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Separator | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.D.A-80 | 3.3.1-78 | A |
| Separator | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | B |
| Trap | Pressure boundary | Aluminum | Air – indoor (ext) | None | None | VII.J.AP-135 | 3.3.1-113 | A |
| Trap | Pressure boundary | Aluminum | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.F2.AP-142 | 3.3.1-92 | E |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.D.A-80 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | B |

**Table 3.3.2-18-6
Standby Liquid Control System
Nonsafety-Related Components Affecting Safety-Related Systems
Summary of Aging Management Evaluation**

| Table 3.3.2-18-6: Standby Liquid Control System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-48 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Treated water (int) | None | None | VII.J.AP-51 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-18-6: Standby Liquid Control System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Sight glass | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Tank | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Tank | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |

# Table 3.3.2-18-7
# Leak Detection System
# Nonsafety-Related Components Affecting Safety-Related Systems
# Summary of Aging Management Evaluation

| Table 3.3.2-18-7: Leak Detection System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-281 | 3.3.1-91 | E |
| Sight glass | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-18-7: Leak Detection System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Sight glass | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Sight glass | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-281 | 3.3.1-91 | E |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-48 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Waste water (int) | None | None | VII.J.AP-277 | 3.3.1-119 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Valve body | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-281 | 3.3.1-91 | E |

| Table 3.3.2-18-7: Leak Detection System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | C |

**Table 3.3.2-18-8**
**Main Steam Positive Leakage Control System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

| Table 3.3.2-18-8: Main Steam Positive Leakage Control System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.D.A-80 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-280 | 3.3.1-95 | C |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-48 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Treated water (int) | None | None | VII.J.AP-51 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-18-8: Main Steam Positive Leakage Control System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Sight glass | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |

# Table 3.3.2-18-9
# Fire Protection – Water System
# Nonsafety-Related Components Affecting Safety-Related Systems
# Summary of Aging Management Evaluation

| Table 3.3.2-18-9: Fire Protection – Water System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Raw water (int) | Loss of material | Fire Water System | VII.G.A-33 | 3.3.1-64 | B |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Raw water (int) | Loss of material | Fire Water System | VII.G.A-33 | 3.3.1-64 | B |

**Table 3.3.2-18-10**
**Hydrogen Mixing, Purge and Recombiner System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

**Table 3.3.2-18-10: Hydrogen Mixing, Purge and Recombiner System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Blower housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | C |
| Blower housing | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F2.A-08 | 3.3.1-90 | C |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Flow element | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Flow element | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-280 | 3.3.1-95 | C |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-18-10: Hydrogen Mixing, Purge and Recombiner System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-280 | 3.3.1-95 | C |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-280 | 3.3.1-95 | C |

**Table 3.3.2-18-11**
**Service Water – Standby System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

**Table 3.3.2-18-11: Service Water – Standby System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-281 | 3.3.1-91 | E |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-281 | 3.3.1-91 | E |

# Table 3.3.2-18-12
## Standby Diesel Generator System
## Nonsafety-Related Components Affecting Safety-Related Systems
## Summary of Aging Management Evaluation

| Table 3.3.2-18-12: Standby Diesel Generator System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.A-23 | 3.3.1-89 | A |
| Piping | Pressure boundary | Carbon steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-105 | 3.3.1-70 | C, 303 |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-48 | 3.3.1-117 | A |

| Table 3.3.2-18-12: Standby Diesel Generator System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Sight glass | Pressure boundary | Glass | Fuel oil (int) | None | None | VII.J.AP-49 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Sight glass | Pressure boundary | Stainless steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-136 | 3.3.1-71 | C, 303 |
| Tank | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Tank | Pressure boundary | Carbon steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-105 | 3.3.1-70 | C, 303 |
| Trap | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Trap | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | C |

| Table 3.3.2-18-12: Standby Diesel Generator System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.A-23 | 3.3.1-89 | A |
| Valve body | Pressure boundary | Carbon steel | Fuel oil (int) | Loss of material | Diesel Fuel Monitoring | VII.H1.AP-105 | 3.3.1-70 | C, 303 |
| Valve body | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |

## Table 3.3.2-18-13
## HPCS Diesel Generator System
## Nonsafety-Related Components Affecting Safety-Related Systems
## Summary of Aging Management Evaluation

| Table 3.3.2-18-13: HPCS Diesel Generator System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Cooler housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Cooler housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | C |
| Dryer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Dryer housing | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | D |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Filter housing | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | D |

| Table 3.3.2-18-13: HPCS Diesel Generator System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | D |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.H2.AP-202 | 3.3.1-45 | A |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Silencer | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Silencer | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | D |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Strainer housing | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |

| Table 3.3.2-18-13: HPCS Diesel Generator System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Trap | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Trap | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.H2.A-23 | 3.3.1-89 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.A-26 | 3.3.1-55 | D |
| Valve body | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | D |

**Table 3.3.2-18-14**
**HVAC – Containment Cooling System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

| Table 3.3.2-18-14: HVAC – Containment Cooling System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Damper housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |
| Damper housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Ducting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |
| Ducting | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Fan housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |

| Table 3.3.2-18-14: HVAC – Containment Cooling System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Fan housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Filter housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Filter housing | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Heat exchanger (housing) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.AP-41 | 3.3.1-80 | A |
| Heat exchanger (housing) | Pressure boundary | Carbon steel | Condensation (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.F2.A-08 | 3.3.1-90 | C |

# Table 3.3.2-18-15
# HVAC – Aux Building System
# Nonsafety-Related Components Affecting Safety-Related Systems
# Summary of Aging Management Evaluation

**Table 3.3.2-18-15: HVAC – Aux Building System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Damper housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |
| Damper housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Ducting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |
| Ducting | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Fan housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |

| Table 3.3.2-18-15: HVAC – Aux Building System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Fan housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-10 | 3.3.1-78 | A |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | V.B.E-25 | 3.2.1-44 | C |

**Table 3.3.2-18-16**
**HVAC – Chilled Water System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

| Table 3.3.2-18-16: HVAC – Chilled Water System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Accumulator | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Accumulator | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.F2.AP-202 | 3.3.1-45 | A |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Condenser housing | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Condenser housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.F2.AP-189 | 3.3.1-46 | A |
| Insulated piping components | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.F2.A-405 | 3.3.1-132 | A |
| Piping | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |

| Table 3.3.2-18-16: HVAC – Chilled Water System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.F2.AP-202 | 3.3.1-45 | A |
| Pump casing | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.F2.AP-202 | 3.3.1-45 | A |
| Separator | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Separator | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.F2.AP-202 | 3.3.1-45 | A |
| Sight glass | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Sight glass | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.F2.AP-202 | 3.3.1-45 | A |
| Sight glass | Pressure boundary | Glass | Condensation (ext) | None | None | VII.J.AP-97 | 3.3.1-117 | A |

| Table 3.3.2-18-16: HVAC – Chilled Water System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Sight glass | Pressure boundary | Glass | Treated water (int) | None | None | VII.J.AP-166 | 3.3.1-117 | A |
| Tubing | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Valve body | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.F2.AP-202 | 3.3.1-45 | A |
| Valve body | Pressure boundary | Stainless steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | -- | -- | G |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |

**Table 3.3.2-18-17**
**Radiation Monitoring System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

**Table 3.3.2-18-17: Radiation Monitoring System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Heat exchanger (shell) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Heat exchanger (shell) | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-278 | 3.3.1-95 | E |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-278 | 3.3.1-95 | E |
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |

| Table 3.3.2-18-17: Radiation Monitoring System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Pump casing | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-278 | 3.3.1-95 | E |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-14 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Waste water (int) | None | None | VII.J.AP-277 | 3.3.1-119 | A |
| Sight glass | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Sight glass | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-278 | 3.3.1-95 | E |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-278 | 3.3.1-95 | E |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |

| Table 3.3.2-18-17: Radiation Monitoring System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-272 | 3.3.1-95 | E |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Waste water (int) | Loss of material | Selective Leaching | VII.E5.A-407 | 3.3.1-72 | C |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-278 | 3.3.1-95 | E |

## Table 3.3.2-18-18
## Containment Atmosphere & Leakage Monitoring System
## Nonsafety-Related Components Affecting Safety-Related Systems
## Summary of Aging Management Evaluation

**Table 3.3.2-18-18: Containment Atmosphere & Leakage Monitoring System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (int) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

**Table 3.3.2-18-19**
**Reactor Water Cleanup System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

**Table 3.3.2-18-19: Reactor Water Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Cooler housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Cooler housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | A |
| Demineralizer | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-81 | 3.3.1-78 | A |
| Demineralizer | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | A, 301 |
| Expansion joint | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Expansion joint | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |

| Table 3.3.2-18-19: Reactor Water Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
| Expansion joint | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | A |
| Expansion joint | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | A, 301 |
| Flow element | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flow element | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Flow element | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | A, 301 |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Heat exchanger (shell) | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – erosion | Flow-Accelerated Corrosion | VII.E3.A-408 | 3.3.1-126 | A |
| Orifice | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Orifice | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Orifice | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | A |

| Table 3.3.2-18-19: Reactor Water Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
| Orifice | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | A, 301 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | V.D2.E-10 | 3.2.1-1 | C |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | A, 301 |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – erosion | Flow-Accelerated Corrosion | VII.E3.A-408 | 3.3.1-126 | A |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-281 | 3.3.1-91 | E |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | A, 301 |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | A, 301 |

| Table 3.3.2-18-19: Reactor Water Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – erosion | Flow-Accelerated Corrosion | VII.E3.A-408 | 3.3.1-126 | A |
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Pump casing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Pump casing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | A, 301 |
| Sight glass | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Sight glass | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | A, 301 |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-48 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Treated water (int) | None | None | VII.J.AP-51 | 3.3.1-117 | A |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Strainer housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | A, 301 |
| Strainer housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – erosion | Flow-Accelerated Corrosion | VII.E3.A-408 | 3.3.1-126 | A |

| Table 3.3.2-18-19: Reactor Water Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
| Tank | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Tank | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Tank | Pressure boundary | Carbon steel with internal coating | Treated water (int) | Loss of coating integrity | Coating Integrity | VII.E3.A-416 | 3.3.1-138 | A |
| Tank | Pressure boundary | Carbon steel with internal coating | Treated water (int) | Loss of material | Coating Integrity | VII.E3.A-414 | 3.3.1-139 | A |
| Thermowell | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Thermowell | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | V.D2.E-10 | 3.2.1-1 | C |
| Thermowell | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | A, 301 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Tubing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | A, 301 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-18-19: Reactor Water Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | V.D2.E-10 | 3.2.1-1 | C |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | A, 301 |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – erosion | Flow-Accelerated Corrosion | VII.E3.A-408 | 3.3.1-126 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | A, 301 |

# Table 3.3.2-18-20
## Fuel Pool Cooling and Cleanup System
## Nonsafety-Related Components Affecting Safety-Related Systems
## Summary of Aging Management Evaluation

**Table 3.3.2-18-20: Fuel Pool Cooling and Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Demineralizer | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Demineralizer | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Demister housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Demister housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Filter housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Filter housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Flow element | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-18-20: Fuel Pool Cooling and Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flow element | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Heat exchanger (end cover) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Heat exchanger (end cover) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-111 | 3.3.1-25 | A, 301 |
| Heat exchanger (shell) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Heat exchanger (shell) | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-111 | 3.3.1-25 | A, 301 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |

| Table 3.3.2-18-20: Fuel Pool Cooling and Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-278 | 3.3.1-95 | E |
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Pump casing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Strainer housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Strainer housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Tank | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Tank | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | A, 301 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |

| Table 3.3.2-18-20: Fuel Pool Cooling and Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-278 | 3.3.1-95 | E |
| Valve body | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | C |

# Table 3.3.2-18-21
# Radwaste – Liquid System
# Nonsafety-Related Components Affecting Safety-Related Systems
# Summary of Aging Management Evaluation

| Table 3.3.2-18-21: Radwaste – Liquid System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Orifice | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Orifice | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-18-21: Radwaste – Liquid System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | A |

**Table 3.3.2-18-22**
**Sampling System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

| Table 3.3.2-18-22: Sampling System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Accumulator | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Accumulator | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Cooler housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.F1.AP-41 | 3.3.1-80 | C |
| Cooler housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-189 | 3.3.1-46 | C |
| Cooler housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | C |
| Cooler housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-111 | 3.3.1-25 | C, 301 |

| Table 3.3.2-18-22: Sampling System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Cooler housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-191 | 3.3.1-47 | C |
| Filter housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Filter housing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Insulated piping components | Pressure boundary | Carbon steel | Condensation (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-405 | 3.3.1-132 | A |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | A, 301 |

| Table 3.3.2-18-22: Sampling System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-14 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Treated water (int) | None | None | VII.J.AP-51 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Sight glass | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Tank | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Tank | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Trap | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Trap | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |

| Table 3.3.2-18-22: Sampling System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-106 | 3.3.1-21 | C, 301 |
| Valve body | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-140 | 3.3.1-22 | C, 301 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-110 | 3.3.1-25 | C, 301 |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – BWR | VIII.C.SP-88 | 3.4.1-11 | C, 301 |

| Table 3.3.2-18-22: Sampling System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – BWR | VII.E3.AP-110 | 3.3.1-25 | A, 301 |

# Table 3.3.2-18-23
# Drains – Floor and Equipment System
# Nonsafety-Related Components Affecting Safety-Related Systems
# Summary of Aging Management Evaluation

| Table 3.3.2-18-23: Drains – Floor and Equipment System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Cooler housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Cooler housing | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | A |
| Expansion joint | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Expansion joint | Pressure boundary | Stainless steel | Waste water (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Expansion joint | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | A |

| Table 3.3.2-18-23: Drains – Floor and Equipment System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Flex hose | Pressure boundary | Nickel alloy | Air – indoor (ext) | None | None | VII.J.AP-16 | 3.3.1-118 | A |
| Flex hose | Pressure boundary | Nickel alloy | Waste water (int) | Cracking – fatigue | TLAA – metal fatigue | IV.C1.R-220 | 3.1.1-6 | C, 308 |
| Flex hose | Pressure boundary | Nickel alloy | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-279 | 3.3.1-95 | A |
| Flex hose | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Flex hose | Pressure boundary | Stainless steel | Waste water (int) | Cracking – fatigue | TLAA – metal fatigue | VII.E3.A-62 | 3.3.1-2 | C, 308 |
| Flex hose | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | A |
| Orifice | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Orifice | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | A |

| Table 3.3.2-18-23: Drains – Floor and Equipment System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | A |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-281 | 3.3.1-91 | E |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material – FAC | Flow-Accelerated Corrosion | VIII.D2.S-16 | 3.4.1-5 | C, 304 |
| Piping | Pressure boundary | Carbon steel with internal coating | Waste water (int) | Loss of coating integrity | Coating Integrity | VII.E5.A-416 | 3.3.1-138 | A |
| Piping | Pressure boundary | Carbon steel with internal coating | Waste water (int) | Loss of material | Coating Integrity | VII.E5.A-414 | 3.3.1-139 | A, 305 |
| Piping | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |

| Table 3.3.2-18-23: Drains – Floor and Equipment System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Copper alloy | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-272 | 3.3.1-95 | A |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | A |
| Pump casing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Pump casing | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | A |
| Sight glass | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Sight glass | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | A |

| Table 3.3.2-18-23: Drains – Floor and Equipment System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Sight glass | Pressure boundary | Glass | Air – indoor (ext) | None | None | VII.J.AP-48 | 3.3.1-117 | A |
| Sight glass | Pressure boundary | Glass | Waste water (int) | None | None | VII.J.AP-277 | 3.3.1-119 | A |
| Strainer housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Strainer housing | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | A |
| Trap | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Trap | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Valve body | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | A |

| Table 3.3.2-18-23: Drains – Floor and Equipment System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
| Valve body | Pressure boundary | Carbon steel with internal coating | Waste water (int) | Loss of coating integrity | Coating Integrity | VII.E5.A-416 | 3.3.1-138 | A |
| Valve body | Pressure boundary | Carbon steel with internal coating | Waste water (int) | Loss of material | Coating Integrity | VII.E5.A-414 | 3.3.1-139 | A, 305 |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Air – indoor (ext) | None | None | VII.J.AP-144 | 3.3.1-114 | A |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-272 | 3.3.1-95 | E |
| Valve body | Pressure boundary | Copper alloy > 15% Zn or > 8% Al | Waste water (int) | Loss of material | Selective Leaching | VII.E5.A-407 | 3.3.1-72 | A |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-278 | 3.3.1-95 | A |

# Table 3.3.2-18-24
# Domestic Water System
# Nonsafety-Related Components Affecting Safety-Related Systems
# Summary of Aging Management Evaluation

**Table 3.3.2-18-24: Domestic Water System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-270 | 3.3.1-88 | C |
| Strainer housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |
| Strainer housing | Pressure boundary | Stainless steel | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-270 | 3.3.1-88 | C |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-17 | 3.3.1-120 | A |

| Table 3.3.2-18-24: Domestic Water System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Raw water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-270 | 3.3.1-88 | C |

**Table 3.3.2-18-25**
**Suppression Pool Cleanup System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

**Table 3.3.2-18-25: Suppression Pool Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Expansion joint | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Expansion joint | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-186 | 3.3.1-43 | C |
| Expansion joint | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Heat exchanger (end cover) | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | C |
| Heat exchanger (end cover) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – Closed Treated Water Systems | VII.E3.AP-192 | 3.3.1-44 | C |

| Table 3.3.2-18-25: Suppression Pool Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Heat exchanger (end cover) | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-186 | 3.3.1-43 | C |
| Piping | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Pump casing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Pump casing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-186 | 3.3.1-43 | C |
| Pump casing | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |

| Table 3.3.2-18-25: Suppression Pool Cleanup System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Cracking | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-186 | 3.3.1-43 | C |
| Valve body | Pressure boundary | Stainless steel | Treated water > 140°F (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |

**Table 3.3.2-18-26**
**Makeup Water System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

**Table 3.3.2-18-26: Makeup Water System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VII.I.AP-125 | 3.3.1-12 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VII.I.AP-124 | 3.3.1-15 | B |
| Filter housing | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Filter housing | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | C |
| Flow element | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |
| Flow element | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | C |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VII.I.A-77 | 3.3.1-78 | A |

| Table 3.3.2-18-26: Makeup Water System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.AP-202 | 3.3.1-45 | C |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-281 | 3.3.1-91 | E |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |
| Piping | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-278 | 3.3.1-95 | E |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VII.J.AP-123 | 3.3.1-120 | A |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – Closed Treated Water Systems | VII.C2.A-52 | 3.3.1-49 | C |

| Table 3.3.2-18-26: Makeup Water System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Waste water (int) | Loss of material | Periodic Surveillance and Preventive Maintenance | VII.E5.AP-278 | 3.3.1-95 | E |

# 3.4 STEAM AND POWER CONVERSION SYSTEMS

## 3.4.1 Introduction

This section provides the results of the aging management reviews for components in the steam and power conversion systems that are subject to aging management review. The following systems are addressed in this section (the system descriptions are available in the referenced section).

- Condensate Makeup, Storage and Transfer (Section 2.3.4.1)
- Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2) (Section 2.3.4.2)

Table 3.4.1, Summary of Aging Management Programs for Steam and Power Conversion System Evaluated in Chapter VIII of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for the steam and power conversion system component group. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

## 3.4.2 Results

The following system tables summarize the results of aging management reviews and the NUREG-1801 comparison for the condensate storage system.

- Table 3.4.2-1 Condensate Makeup, Storage and Transfer System—Summary of Aging Management Evaluation

*Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)*

- Table 3.4.2-2-1 Condensate Makeup, Storage and Transfer System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-2-2 Feedwater System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-2-3 Main Steam System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

- Table 3.4.2-2-4 Auxiliary Condensate System, Nonsafety-Related Components Affecting Safety-Related Systems—Summary of Aging Management Evaluation

## 3.4.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for the steam and power conversion systems. Programs are described in Appendix B. Further details are provided in the system tables.

### 3.4.2.1.1 Condensate Makeup, Storage and Transfer System

**Materials**

Condensate makeup, storage and transfer system components are constructed of the following materials.

- Aluminum
- Carbon steel
- Gray cast iron
- Stainless steel

**Environments**

Condensate makeup, storage and transfer system components are exposed to the following environments.

- Air – indoor
- Air – outdoor
- Concrete
- Soil
- Treated water

**Aging Effects Requiring Management**

The following aging effects associated with the condensate makeup, storage and transfer system require management.

- Cracking
- Loss of material
- Loss of preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the condensate makeup, storage and transfer system components.

- Aboveground Metallic Tanks

- Bolting Integrity
- Buried and Underground Piping and Tanks Inspection
- External Surfaces Monitoring
- One-Time Inspection
- Selective Leaching
- Water Chemistry Control – BWR

3.4.2.1.2 Steam and Power Conversion Systems in Scope for 10 CFR 54.4(a)(2)

The following lists encompass materials, environments, aging effects requiring management, and aging management programs for the series 3.4.2-2-x tables.

**Materials**

Nonsafety-related components affecting safety-related systems are constructed of the following materials.

- Carbon steel
- Copper alloy
- Fiberglass
- Stainless steel

**Environments**

Nonsafety-related components affecting safety-related systems are exposed to the following environments.

- Air – indoor
- Concrete
- Condensation
- Lube oil
- Treated water
- Waste water

**Aging Effects Requiring Management**

The following aging effects associated with nonsafety-related components affecting safety-related systems require management.

- Change in material properties
- Cracking
- Cracking – fatigue
- Loss of material
- Loss of material – erosion

- Loss of preload

**Aging Management Programs**

The following aging management programs manage the effects of aging on nonsafety-related components affecting safety-related systems.

- Bolting Integrity
- Compressed Air Monitoring
- External Surfaces Monitoring
- Flow-Accelerated Corrosion
- Internal Surfaces in Miscellaneous Piping and Ducting Components
- Oil Analysis
- One-Time Inspection
- Water Chemistry Control – BWR

### 3.4.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.4.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the approach to those areas requiring further evaluation. Programs are described in Appendix B.

#### 3.4.2.2.1 Cumulative Fatigue Damage

Where fatigue is identified as an aging effect requiring management, the analysis of fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). Evaluation of this TLAA is addressed in Section 4.3.

#### 3.4.2.2.2 Cracking due to Stress Corrosion Cracking (SCC)

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Water in the RBS cooling towers is treated with chlorine compounds. Chloride contamination of components exposed to outdoor air may occur. Consistent with NUREG-1801 for outdoor air with a potential source of chloride contamination, cracking of stainless steel components directly exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. There are no stainless steel steam and power conversion system components in the scope of license renewal that are located indoors near unducted air intakes.

3.4.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Water in the RBS cooling towers is treated with chlorine compounds. Chloride contamination of components exposed to outdoor air may occur. Consistent with NUREG-1801, loss of material for stainless steel components exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. There are no stainless steel steam and power conversion system components in the scope of license renewal that are located indoors near unducted air intakes.

3.4.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of RBS quality assurance procedures and administrative controls for aging management programs.

3.4.2.2.5 Ongoing Review of Operating Experience

See Appendix B Section B.0.4 for discussion of the RBS operating experience review programs.

3.4.2.2.6 Loss of Material due to Recurring Internal Corrosion

A review of 10 years of plant operating experience identified no conditions of recurring internal corrosion (RIC) as defined in LR-ISG 2012-02, Section A, in the piping components of the steam and power conversion systems in the scope of license renewal.

### 3.4.2.3 Time-Limited Aging Analysis

The only time-limited aging analysis identified for the steam and power conversion systems components is metal fatigue. This is evaluated in Section 4.3.

## 3.4.3 Conclusion

The steam and power conversion system components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21. The aging management programs selected to manage the effects of aging on steam and power conversion system components are identified in Section 3.4.2.1 and in the following tables. A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the steam and power conversion system components will be managed such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

**Table 3.4.1**
**Summary of Aging Management Programs for the Steam and Power Conversion Systems Evaluated in Chapter VIII of NUREG-1801**

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-1 | Steel piping, piping components, and piping elements exposed to steam or treated water | Cumulative fatigue damage due to fatigue | Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the SRP, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1). | Yes, TLAA | Fatigue is a TLAA.<br>See Section 3.4.2.2.1. |
| 3.4.1-2 | Stainless steel piping, piping components, and piping elements; tanks exposed to air – outdoor | Cracking due to stress corrosion cracking | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | Yes, environmental conditions need to be evaluated | Consistent with NUREG-1801. Cracking of stainless steel components exposed to outdoor air is managed by the External Surfaces Monitoring Program.<br><br>See Section 3.4.2.2.2. |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-3 | Stainless steel piping, piping components, and piping elements; tanks exposed to air – outdoor | Loss of material due to pitting and crevice corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | Yes, environmental conditions need to be evaluated | Consistent with NUREG-1801. Loss of material for stainless steel components exposed to outdoor air is managed by the External Surfaces Monitoring Program.<br><br>See Section 3.4.2.2.3. |
| 3.4.1-4 | PWR only | | | | |
| 3.4.1-5 | Steel piping, piping components, and piping elements exposed to steam, treated water | Wall thinning due to flow-accelerated corrosion | Chapter XI.M17, "Flow-Accelerated Corrosion" | No | Consistent with NUREG-1801. Loss of material due to flow-accelerated corrosion in steel components is managed by the Flow-Accelerated Corrosion Program. |
| 3.4.1-6 | Steel, stainless steel bolting exposed to soil | Loss of preload | Chapter XI.M18, "Bolting Integrity" | No | This item was not used. There is no steel or stainless steel bolting exposed to soil in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-7 | High-strength steel closure bolting exposed to air with steam or water leakage | Cracking due to cyclic loading, stress corrosion cracking | Chapter XI.M18, "Bolting Integrity" | No | This item was not used. There is no high-strength steel bolting in the steam and power conversion systems in the scope of license renewal. |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-8 | Steel; stainless steel bolting, closure bolting exposed to air – outdoor (external), air – indoor, uncontrolled (external) | Loss of material due to general (steel only), pitting, and crevice corrosion | Chapter XI.M18, "Bolting Integrity" | No | Consistent with NUREG-1801. Loss of material for steel and stainless steel closure bolting exposed to indoor and outdoor air is managed by the Bolting Integrity Program. |
| 3.4.1-9 | Steel closure bolting exposed to air with steam or water leakage | Loss of material due to general corrosion | Chapter XI.M18, "Bolting Integrity" | No | This item was not used. As stated in Item 3.4.1-8, loss of material of steel bolting exposed to air in the steam and power conversion systems is managed by the Bolting Integrity Program. However, steam or water leakage is not considered as a separate aspect of the indoor air environment. |
| 3.4.1-10 | Copper alloy, nickel alloy, steel; stainless steel, steel; stainless steel bolting, closure bolting exposed to any environment, air – outdoor (external), air – indoor, uncontrolled (external) | Loss of preload due to thermal effects, gasket creep, and self-loosening | Chapter XI.M18, "Bolting Integrity" | No | Consistent with NUREG-1801. Loss of preload for steel and stainless steel bolting is managed by the Bolting Integrity Program. There is no copper alloy or nickel alloy bolting in steam and power conversion systems in the scope of license renewal. |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-11 | Stainless steel piping, piping components, and piping elements, tanks, heat exchanger components exposed to steam, treated water >60°C (> 140°F) | Cracking due to stress corrosion cracking | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Cracking of stainless steel components exposed to steam or treated water > 60°C (> 140°F) is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage cracking. This item applies to components in Tables 3.1.2-3, 3.2.2-x series, and 3.3.2-x series. |
| 3.4.1-12 | Steel; stainless steel tanks exposed to treated water | Loss of material due to general (steel only), pitting, and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | This item was not used. There are no steel or stainless steel tanks exposed to treated water in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-13 | PWR only | | | | |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-14 | Steel piping, piping components, and piping elements, PWR heat exchanger components exposed to steam, treated water | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for steel components exposed to steam or treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material. |
| 3.4.1-15 | Steel heat exchanger components exposed to treated water | Loss of material due to general, pitting, crevice, and galvanic corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | This item was not used. There are no steel heat exchanger components exposed to treated water in the steam and power conversion systems in the scope of license renewal. |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-16 | Copper alloy, stainless steel, nickel alloy, aluminum piping, piping components, and piping elements, heat exchanger components and tubes, PWR heat exchanger components exposed to treated water, steam | Loss of material due to pitting and crevice corrosion | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for aluminum, copper alloy and stainless steel components exposed to steam or treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage loss of material. There are no nickel alloy components exposed to treated water or steam in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-17 | PWR only | | | | |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-18 | Copper alloy, stainless steel heat exchanger tubes exposed to treated water | Reduction of heat transfer due to fouling | Chapter XI.M2, "Water Chemistry," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Reduction of heat transfer of copper alloy heat exchanger tubes exposed to treated water is managed by the Water Chemistry Control – BWR Program. The One-Time Inspection Program will verify the effectiveness of the water chemistry control program to manage reduction of heat transfer. This item applies to components in Table 3.2.2-3. There are no copper alloy or stainless steel heat exchanger tubes exposed to treated water in the steam and power conversion systems with a license renewal intended function of heat transfer. |
| 3.4.1-19 | Stainless steel, steel heat exchanger components exposed to raw water | Loss of material due to general, pitting, crevice, galvanic, and microbiologically influenced corrosion; fouling that leads to corrosion | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. There are no heat exchanger components exposed to raw water in the steam and power conversion systems in the scope of license renewal. |

**Table 3.4.1: Steam and Power Conversion Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.4.1-20 | Copper alloy, stainless steel piping, piping components, and piping elements exposed to raw water | Loss of material due to pitting, crevice, and microbiologically influenced corrosion | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. There are no piping components exposed to raw water (open cycle cooling water) in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-21 | PWR only | | | | |
| 3.4.1-22 | Stainless steel, copper alloy, steel heat exchanger tubes, heat exchanger components exposed to raw water | Reduction of heat transfer due to fouling | Chapter XI.M20, "Open-Cycle Cooling Water System" | No | This item was not used. There are no heat exchanger tubes exposed to raw water with an intended function of heat transfer in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-23 | Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water >60°C (> 140°F) | Cracking due to stress corrosion cracking | Chapter XI.M21A, "Closed Treated Water Systems" | No | This item was not used. There are no stainless steel components exposed to closed-cycle cooling water > 60°C (> 140°F) in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-24 | Steel heat exchanger components exposed to closed-cycle cooling water | Loss of material due to general, pitting, crevice, and galvanic corrosion | Chapter XI.M21A, "Closed Treated Water Systems" | No | This item was not used. There are no steel heat exchanger components exposed to closed-cycle cooling water in the steam and power conversion systems in the scope of license renewal. |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-25 | Steel heat exchanger components exposed to closed-cycle cooling water | Loss of material due to general, pitting, crevice, and galvanic corrosion | Chapter XI.M21A, "Closed Treated Water Systems" | No | This item was not used. There are no steel heat exchanger components exposed to closed-cycle cooling water in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-26 | Stainless steel heat exchanger components, piping, piping components, and piping elements exposed to closed-cycle cooling water | Loss of material due to pitting and crevice corrosion | Chapter XI.M21A, "Closed Treated Water Systems" | No | This item was not used. There are no stainless steel components exposed to closed-cycle cooling water in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-27 | Copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water | Loss of material due to pitting, crevice, and galvanic corrosion | Chapter XI.M21A, "Closed Treated Water Systems" | No | This item was not used. There are no copper alloy components exposed to closed-cycle cooling water in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-28 | Steel, stainless steel, copper alloy heat exchanger components and tubes, heat exchanger tubes exposed to closed-cycle cooling water | Reduction of heat transfer due to fouling | Chapter XI.M21A, "Closed Treated Water Systems" | No | This item was not used. There are no heat exchanger tubes exposed to closed-cycle cooling water with an intended function of heat transfer in the steam and power conversion systems in the scope of license renewal. |

**Table 3.4.1: Steam and Power Conversion Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.4.1-29 | Steel tanks exposed to air – outdoor (external) | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M29, "Aboveground Metallic Tanks" | No | This item was not used. There are no steel tanks exposed to outdoor air in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-30 | Steel, stainless steel, aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation | Loss of material due to general (steel only), pitting, and crevice corrosion; cracking due to stress corrosion cracking (stainless steel and aluminum only) | Chapter XI.M29, "Aboveground Metallic Tanks" | No | This item was not used. There are no steel or stainless steel tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the steam and power conversion systems. Aluminum tanks are addressed in Item 3.4.1-31. |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-31 | Stainless steel, aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to soil or concrete, or the following external environments air-outdoor, air-indoor uncontrolled, moist air, condensation | Loss of material due to pitting, and crevice corrosion; cracking due to stress corrosion cracking | Chapter XI.M29, "Aboveground Metallic Tanks" | No | Consistent with NUREG-1801. Loss of material for the aluminum condensate storage tank exposed to outdoor air, concrete or soil is managed by the Aboveground Metallic Tanks Program. The aluminum alloy of the condensate storage tank has < 12% Zn and < 6% magnesium so cracking is not a significant aging effect for the tank. There are no stainless steel tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the steam and power conversion systems. |
| 3.4.1-32 | Gray cast iron piping, piping components, and piping elements exposed to soil | Loss of material due to selective leaching | Chapter XI.M33, "Selective Leaching" | No | This item was not used. There are no gray cast iron components exposed to soil in the steam and power conversion systems in the scope of license renewal. |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-33 | Gray cast iron, copper alloy (>15% Zn or >8% Al) piping, piping components, and piping elements exposed to treated water, raw water, closed-cycle cooling water | Loss of material due to selective leaching | Chapter XI.M33, "Selective Leaching" | No | Consistent with NUREG-1801. Loss of material for gray cast iron components exposed to treated water is managed by the Selective Leaching Program. There are no copper alloy (> 15% Zn or > 8% Al) components exposed to water environments in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-34 | Steel external surfaces exposed to air – indoor, uncontrolled (external), air – outdoor (external), condensation (external) | Loss of material due to general corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | Consistent with NUREG-1801. Loss of material for steel components exposed to indoor or outdoor air is managed by the External Surfaces Monitoring Program. There are no steel components exposed to condensation in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-35 | Aluminum piping, piping components, and piping elements exposed to air - outdoor | Loss of material due to pitting and crevice corrosion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | Consistent with NUREG-1801. Loss of material for aluminum piping components exposed to outdoor air is managed by the External Surfaces Monitoring Program. |
| 3.4.1-36 | PWR only | | | | |
| 3.4.1-37 | PWR only | | | | |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-38 | PWR only | | | | |
| 3.4.1-39 | Stainless steel piping, piping components, and piping elements exposed to condensation (internal) | Loss of material due to pitting and crevice corrosion | Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | This item was not used. Stainless steel tubing exposed to condensation is addressed in Table 3.3.1, Item 3.3.1-56. |
| 3.4.1-40 | Steel piping, piping components, and piping elements exposed to lubricating oil | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection" | No | This item was not used. There are no steel components exposed to lube oil in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-41 | PWR only | | | | |
| 3.4.1-42 | PWR only | | | | |
| 3.4.1-43 | Copper alloy piping, piping components, and piping elements exposed to lubricating oil | Loss of material due to pitting and crevice corrosion | Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection" | No | This item was not used. There are no copper alloy components exposed to lube oil in the steam and power conversion systems in the scope of license renewal. |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-44 | Stainless steel piping, piping components, and piping elements, heat exchanger components exposed to lubricating oil | Loss of material due to pitting, crevice, and microbiologically influenced corrosion | Chapter XI.M39, "Lubricating Oil Analysis," and Chapter XI.M32, "One-Time Inspection" | No | Consistent with NUREG-1801. Loss of material for stainless steel components exposed to lube oil is managed by the Oil Analysis Program. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program to manage loss of material. |
| 3.4.1-45 | PWR only | | | | |
| 3.4.1-46 | PWR only | | | | |
| 3.4.1-47 | Steel (with coating or wrapping), stainless steel, nickel-alloy piping, piping components, and piping elements; tanks exposed to soil or concrete | Loss of material due to general (steel only), pitting, crevice, and microbiologically influenced corrosion | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | Consistent with NUREG-1801. Loss of material for stainless steel components exposed to soil is managed by the Buried and Underground Piping and Tanks Inspection Program. There are no steel or nickel alloy components exposed to soil or concrete in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-48 | Stainless steel, nickel-alloy bolting exposed to soil | Loss of material due to pitting and crevice corrosion | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. There is no stainless steel or nickel alloy bolting exposed to soil in the steam and power conversion systems in the scope of license renewal. |

**Table 3.4.1: Steam and Power Conversion Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.4.1-49 | Stainless steel, nickel-alloy piping, piping components, and piping elements exposed to soil or concrete | Loss of material due to pitting and crevice corrosion | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. Loss of material for stainless steel components exposed to soil is addressed in Item 3.4.1-47. There are no nickel alloy components exposed to soil or concrete in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-50 | Steel bolting exposed to soil | Loss of material due to general, pitting and crevice corrosion | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. There is no steel bolting exposed to soil in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-50.5 | Underground stainless steel, nickel-alloy and steel piping, piping components, and piping elements | Loss of material due to general (steel only), pitting and crevice corrosion | Chapter XI.M41, "Buried and Underground Piping and Tanks" | No | This item was not used. There is no underground piping in areas of restricted access in the steam and power conversion systems in the scope of license renewal. |

**Table 3.4.1: Steam and Power Conversion Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.4.1-51 | Steel piping, piping components, and piping elements exposed to concrete | None | None, provided 1) attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant OE indicates no degradation of the concrete | No, if conditions are met. | Consistent with NUREG-1801. Embedded steel components are in concrete that is designed and constructed in accordance with ACI and ASTM standards, which provide a good-quality, relatively high-strength, dense, low-permeability concrete. This design is sufficient to preclude embedded steel corrosion for concrete not exposed to an aggressive environment. Operating experience indicates no significant aging related degradation of this concrete. |
| 3.4.1-52 | Aluminum piping, piping components, and piping elements exposed to gas, air – indoor, uncontrolled (internal/ external) | None | None | NA – No AEM or AMP | This item was not used. There are no aluminum components exposed to indoor air or gas in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-53 | PWR only | | | | |

**Table 3.4.1: Steam and Power Conversion Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.4.1-54 | Copper alloy piping, piping components, and piping elements exposed to gas, air – indoor, uncontrolled (external) | None | None | NA – No AEM or AMP | Consistent with NUREG-1801 for copper alloy components exposed to air. There are no copper alloy components exposed to gas in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-55 | Glass piping elements exposed to lubricating oil, air – outdoor, condensation (internal/ external), raw water, treated water, air with borated water leakage, gas, closed-cycle cooling water, air – indoor, uncontrolled (external) | None | None | NA – No AEM or AMP | This item was not used. There are no glass steam and power conversion system components in the scope of license renewal. |
| 3.4.1-56 | Nickel alloy piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external) | None | None | NA – No AEM or AMP | This item was not used. There are no nickel alloy components in the steam and power conversion systems in the scope of license renewal. |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-57 | Nickel alloy, PVC piping, piping components, and piping elements exposed to air with borated water leakage, air – indoor, uncontrolled, condensation (internal) | None | None | NA – No AEM or AMP | This item was not used. There are no nickel alloy or PVC components in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-58 | Stainless steel piping, piping components, and piping elements exposed to air – indoor, uncontrolled (external), concrete, gas, air – indoor, uncontrolled (internal) | None | None | NA – No AEM or AMP | Consistent with NUREG-1801 for stainless steel components exposed to air. There are no stainless steel steam and power conversion system components exposed to other environments represented by this item in the scope of license renewal. |
| 3.4.1-59 | Steel piping, piping components, and piping elements exposed to air – indoor controlled (external), gas | None | None | NA – No AEM or AMP | This item was not used. There are no steel steam and power conversion system components exposed to the environments represented by this item in the scope of license renewal. |
| 3.4.1-60 | Any material, piping, piping components, and piping elements exposed to treated water | Wall thinning due to erosion | Chapter XI.M17, "Flow-Accelerated Corrosion" | No | Consistent with NUREG-1801. Loss of material due to erosion is managed by the Flow-Accelerated Corrosion Program for components exposed to treated water. |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-61 | Metallic piping, piping components, and tanks exposed to raw water or waste water | Loss of material due to recurring internal corrosion | A plant-specific aging management program is to be evaluated to address recurring internal corrosion. | Yes, plant-specific | This line was not used. No conditions of recurring internal corrosion (RIC) as defined in LR-ISG 2012-02, Section A, were identified in piping components of the steam and power conversion systems.<br>(See Section 3.4.2.2.6.) |
| 3.4.1-62 | Steel, stainless steel or aluminum tanks (within the scope of Chapter XI.M29, "Aboveground Metallic Tanks") exposed to treated water | Loss of material due to general (steel only), pitting, and crevice corrosion | Chapter XI.M29, "Aboveground Metallic Tanks" | No | Consistent with NUREG-1801. Loss of material for aluminum tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") exposed to treated water is managed by the Aboveground Metallic Tanks Program. There are no steel or stainless steel tanks (consistent with the scope of NUREG-1801, Chapter XI.M29, "Aboveground Metallic Tanks") in the steam and power conversion systems. |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.4.1-63 | Insulated steel, stainless steel, copper alloy, aluminum, or copper alloy (> 15% Zn) piping, piping components, and tanks exposed to condensation, air-outdoor | Loss of material due to general (steel, and copper alloy), pitting, or crevice corrosion, and cracking due to stress corrosion cracking (aluminum, stainless steel and copper alloy (>15% Zn) only) | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" or Chapter XI.M29, "Aboveground Metallic Tanks" (for tanks only) | No | Consistent with NUREG-1801. Cracking of stainless steel and loss of material for steel and stainless steel insulated piping components exposed to condensation or outdoor air is managed by the External Surfaces Monitoring Program. There is no insulated aluminum or copper alloy (> 15% zinc) piping in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-64 | Jacketed calcium silicate or fiberglass insulation in an air-indoor uncontrolled or air-outdoor environment | Reduced thermal insulation resistance due to moisture intrusion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | Consistent with NUREG-1801. Reduced thermal insulation resistance for calcium silicate or fiberglass insulation is managed by the External Surfaces Monitoring Program. This item applies to components in Table 3.5.2-4. |
| 3.4.1-65 | Jacketed foamglas ® (glass dust) insulation in an air-indoor uncontrolled or air-outdoor environment | Reduced thermal insulation resistance due to moisture intrusion | Chapter XI.M36, "External Surfaces Monitoring of Mechanical Components" | No | This item was not used. There are no foamglas insulation components with an intended function of thermal insulation in the steam and power conversion systems. |

| Table 3.4.1: Steam and Power Conversion Systems | | | | | |
|---|---|---|---|---|---|
| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
| 3.4.1-66 | Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil | Loss of coating or lining integrity due to blistering, cracking, flaking, peeling, delamination, rusting, or physical damage, and spalling for cementitious coatings/linings | Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks" | No | There are no metallic components with internal coating or linings in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-67 | Metallic piping, piping components, heat exchangers, tanks with internal coatings/linings exposed to closed-cycle cooling water, raw water, treated water, treated borated water, or lubricating oil | Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion | Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks" | No | There are no metallic components with internal coating or linings in the steam and power conversion systems in the scope of license renewal. |
| 3.4.1-68 | Gray cast iron piping components with internal coatings/linings exposed to closed-cycle cooling water, raw water, or treated water | Loss of material due to selective leaching | Chapter XI.M42, "Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks" | No | There are no gray cast iron components with internal coatings or linings in the steam and power conversion systems in the scope of license renewal. |

## Notes for Tables 3.4.2-1 through 3.4.2-2-4

### Generic Notes

A. Consistent with component, material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different AMP is credited or NUREG-1801 identifies a plant-specific AMP.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

### Plant-Specific Notes

401. The One-Time Inspection Program will verify the effectiveness of the Water Chemistry Control – BWR Program.

402. The One-Time Inspection Program will verify the effectiveness of the Oil Analysis Program.

**Table 3.4.2-1**
**Condensate Makeup, Storage and Transfer System**
**Summary of Aging Management Evaluation**

**Table 3.4.2-1: Condensate Makeup, Storage and Transfer System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VIII.H.SP-84 | 3.4.1-8 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VIII.H.SP-83 | 3.4.1-10 | B |
| Bolting | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | Bolting Integrity | VIII.H.SP-82 | 3.4.1-8 | B |
| Bolting | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of preload | Bolting Integrity | VIII.H.SP-151 | 3.4.1-10 | B |
| Bolting | Pressure boundary | Stainless steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VIII.H.SP-83 | 3.4.1-10 | B |
| Bolting | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | Bolting Integrity | VIII.H.SP-82 | 3.4.1-8 | B |
| Bolting | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of preload | Bolting Integrity | VIII.H.SP-151 | 3.4.1-10 | B |
| Insulated piping components | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VIII.E.S-402 | 3.4.1-63 | A |
| Insulated piping components | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VIII.E.S-402 | 3.4.1-63 | A |

| Table 3.4.2-1: Condensate Makeup, Storage and Transfer System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Insulated piping components | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VIII.E.S-402 | 3.4.1-63 | A |
| Piping | Pressure boundary | Aluminum | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.SP-147 | 3.4.1-35 | A |
| Piping | Pressure boundary | Aluminum | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.E.SP-90 | 3.4.1-16 | A, 401 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.S-29 | 3.4.1-34 | A |
| Piping | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.S-41 | 3.4.1-34 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.E.SP-73 | 3.4.1-14 | A, 401 |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VIII.I.SP-12 | 3.4.1-58 | A |
| Piping | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VIII.E.SP-118 | 3.4.1-2 | A |
| Piping | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VIII.E.SP-127 | 3.4.1-3 | A |
| Piping | Pressure boundary | Stainless steel | Soil (ext) | Cracking | Buried and Underground Piping and Tanks Inspection | -- | -- | H |

| Table 3.4.2-1: Condensate Makeup, Storage and Transfer System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Piping | Pressure boundary | Stainless steel | Soil (ext) | Loss of material | Buried and Underground Piping and Tanks Inspection | VIII.E.SP-145 | 3.4.1-47 | A |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.E.SP-87 | 3.4.1-16 | A, 401 |
| Screen | Filtration | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VIII.E.SP-118 | 3.4.1-2 | A |
| Tank | Pressure boundary | Aluminum | Air – outdoor (ext) | Loss of material | Aboveground Metallic Tanks | VIII.E.SP-139 | 3.4.1-31 | A |
| Tank | Pressure boundary | Aluminum | Concrete (ext) | Loss of material | Aboveground Metallic Tanks | VIII.E.SP-139 | 3.4.1-31 | A |
| Tank | Pressure boundary | Aluminum | Soil (ext) | Loss of material | Aboveground Metallic Tanks | VIII.E.SP-139 | 3.4.1-31 | A |
| Tank | Pressure boundary | Aluminum | Treated water (int) | Loss of material | Aboveground Metallic Tanks | VIII.E.S-405 | 3.4.1-62 | A |
| Thermowell | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.S-41 | 3.4.1-34 | A |
| Thermowell | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.E.SP-73 | 3.4.1-14 | A, 401 |
| Tubing | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VIII.E.SP-118 | 3.4.1-2 | A |

| Table 3.4.2-1: Condensate Makeup, Storage and Transfer System | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Tubing | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VIII.E.SP-127 | 3.4.1-3 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.E.SP-87 | 3.4.1-16 | A, 401 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.S-29 | 3.4.1-34 | A |
| Valve body | Pressure boundary | Carbon steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.S-41 | 3.4.1-34 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.E.SP-73 | 3.4.1-14 | A, 401 |
| Valve body | Pressure boundary | Gray cast iron | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.S-41 | 3.4.1-34 | A |
| Valve body | Pressure boundary | Gray cast iron | Treated water (int) | Loss of material | Selective Leaching | VIII.E.SP-27 | 3.4.1-33 | A |
| Valve body | Pressure boundary | Gray cast iron | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.E.SP-73 | 3.4.1-14 | A, 401 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VIII.I.SP-12 | 3.4.1-58 | A |
| Valve body | Pressure boundary | Stainless steel | Air – outdoor (ext) | Cracking | External Surfaces Monitoring | VIII.E.SP-118 | 3.4.1-2 | A |
| Valve body | Pressure boundary | Stainless steel | Air – outdoor (ext) | Loss of material | External Surfaces Monitoring | VIII.E.SP-127 | 3.4.1-3 | A |

**Table 3.4.2-1: Condensate Makeup, Storage and Transfer System**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.E.SP-87 | 3.4.1-16 | A, 401 |

**Table 3.4.2-2-1**
**Condensate Makeup, Storage and Transfer System**
**Nonsafety-Related Components Affecting Safety-Related Systems**
**Summary of Aging Management Evaluation**

| Table 3.4.2-2-1: Condensate Makeup, Storage and Transfer System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VIII.H.SP-84 | 3.4.1-8 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VIII.H.SP-83 | 3.4.1-10 | B |
| Filter housing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VIII.I.SP-12 | 3.4.1-58 | A |
| Filter housing | Pressure boundary | Stainless steel | Lube oil (int) | Loss of material | Oil Analysis | VIII.E.SP-95 | 3.4.1-44 | A, 402 |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.S-29 | 3.4.1-34 | A |
| Piping | Pressure boundary | Carbon steel | Concrete (ext) | None | None | VIII.I.SP-154 | 3.4.1-51 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.E.SP-73 | 3.4.1-14 | A, 401 |
| Piping | Pressure boundary | Fiberglass | Air – indoor (ext) | Change in material properties | External Surfaces Monitoring | -- | -- | G |

**Table 3.4.2-2-1: Condensate Makeup, Storage and Transfer System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure boundary | Fiberglass | Treated water (int) | Change in material properties | Water Chemistry Control – BWR | -- | -- | G |
| Piping | Pressure boundary | Fiberglass | Treated water (int) | Cracking | Water Chemistry Control – BWR | -- | -- | G |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VIII.I.SP-12 | 3.4.1-58 | A |
| Piping | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.E.SP-87 | 3.4.1-16 | A, 401 |
| Tubing | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VIII.I.SP-12 | 3.4.1-58 | A |
| Tubing | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.E.SP-87 | 3.4.1-16 | A, 401 |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.S-29 | 3.4.1-34 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.E.SP-73 | 3.4.1-14 | A, 401 |
| Valve body | Pressure boundary | Copper alloy | Air – indoor (ext) | None | None | VIII.I.SP-6 | 3.4.1-54 | A |
| Valve body | Pressure boundary | Copper alloy | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.A.SP-101 | 3.4.1-16 | C, 401 |
| Valve body | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VIII.I.SP-12 | 3.4.1-58 | A |

| Table 3.4.2-2-1: Condensate Makeup, Storage and Transfer System, Nonsafety-Related Components Affecting Safety-Related Systems | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Program** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Valve body | Pressure boundary | Stainless steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.E.SP-87 | 3.4.1-16 | A, 401 |

# Table 3.4.2-2-2
# Feedwater System
# Nonsafety-Related Components Affecting Safety-Related Systems
# Summary of Aging Management Evaluation

**Table 3.4.2-2-2: Feedwater System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VIII.H.SP-84 | 3.4.1-8 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VIII.H.SP-83 | 3.4.1-10 | B |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.S-29 | 3.4.1-34 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | VIII.D2.S-11 | 3.4.1-1 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.D2.SP-73 | 3.4.1-14 | A, 401 |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – erosion | Flow-Accelerated Corrosion | VIII.D2.S-408 | 3.4.1-60 | A |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.S-29 | 3.4.1-34 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | VIII.D2.S-11 | 3.4.1-1 | A |
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.D2.SP-73 | 3.4.1-14 | A, 401 |

**Table 3.4.2-2-2: Feedwater System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve body | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – erosion | Flow-Accelerated Corrosion | VIII.D2.S-408 | 3.4.1-60 | A |

## Table 3.4.2-2-3
## Main Steam System
## Nonsafety-Related Components Affecting Safety-Related Systems
## Summary of Aging Management Evaluation

**Table 3.4.2-2-3: Main Steam System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.S-29 | 3.4.1-34 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Cracking – fatigue | TLAA – metal fatigue | VIII.B2.S-08 | 3.4.1-1 | A |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material | Water Chemistry Control – BWR | VIII.B2.SP-73 | 3.4.1-14 | A, 401 |
| Piping | Pressure boundary | Carbon steel | Treated water (int) | Loss of material – erosion | Flow-Accelerated Corrosion | VIII.D2.S-408 | 3.4.1-60 | C |
| Piping | Pressure boundary | Stainless steel | Air – indoor (ext) | None | None | VIII.I.SP-12 | 3.4.1-58 | A |
| Piping | Pressure boundary | Stainless steel | Condensation (int) | Loss of material | Compressed Air Monitoring | VII.D.AP-81 | 3.3.1-56 | D |

## Table 3.4.2-2-4
## Auxiliary Condensate System
## Nonsafety-Related Components Affecting Safety-Related Systems
## Summary of Aging Management Evaluation

**Table 3.4.2-2-4: Auxiliary Condensate System, Nonsafety-Related Components Affecting Safety-Related Systems**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Program | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | Bolting Integrity | VIII.H.SP-84 | 3.4.1-8 | B |
| Bolting | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of preload | Bolting Integrity | VIII.H.SP-83 | 3.4.1-10 | B |
| Piping | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.S-29 | 3.4.1-34 | A |
| Piping | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |
| Valve body | Pressure boundary | Carbon steel | Air – indoor (ext) | Loss of material | External Surfaces Monitoring | VIII.H.S-29 | 3.4.1-34 | A |
| Valve body | Pressure boundary | Carbon steel | Waste water (int) | Loss of material | Internal Surfaces in Miscellaneous Piping and Ducting Components | VII.E5.AP-281 | 3.3.1-91 | C |

## 3.5 CONTAINMENTS, STRUCTURES AND COMPONENT SUPPORTS

### 3.5.1 Introduction

This section provides the results of the aging management review for structural components and commodities that are subject to aging management review. The following structures and commodity groups are addressed in this section (descriptions are available in the referenced sections).

- Reactor Building (Section 2.4.1)
- Water-Control Structures (Section 2.4.2)
- Turbine Building, Auxiliary Building, and Yard Structures (Section 2.4.3)
- Bulk Commodities (Section 2.4.4)

Table 3.5.1, Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of NUREG-1801, provides the summary of the programs evaluated in NUREG-1801 for structures and component supports. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

### 3.5.2 Results

The following tables summarize the results of aging management reviews and the NUREG-1801 comparison for structures and component supports.

- Table 3.5.2-1 Reactor Building—Summary of Aging Management Evaluation
- Table 3.5.2-2 Water-Control Structures—Summary of Aging Management Evaluation
- Table 3.5.2-3 Turbine Building, Auxiliary Building, and Yard Structures—Summary of Aging Management Evaluation
- Table 3.5.2-4 Bulk Commodities—Summary of Aging Management Evaluation

#### 3.5.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for structures and component supports subject to aging management review. Programs are described in Appendix B. Further details are provided in the structure and commodities tables.

3.5.2.1.1 Reactor Building

**Materials**

Reactor building components are constructed of the following materials.

- Aluminum
- Carbon steel
- Coatings
- Concrete
- Concrete block
- Elastomer
- Galvanized steel
- Stainless steel

**Environments**

Reactor building components are exposed to the following environments.

- Air – indoor uncontrolled
- Air – outdoor
- Exposed to fluid environment
- Soil

**Aging Effects Requiring Management**

The following aging effects associated with the reactor building require management.

- Cracking
- Cracking and distortion
- Increase in porosity and permeability
- Loss of bond
- Loss of coating integrity
- Loss of leak tightness
- Loss of material
- Loss of preload
- Loss of sealing

**Aging Management Programs**

The following programs are credited for managing the effects of aging on reactor building components.

- Containment Inservice Inspection – IWE

- Containment Leak Rate
- Fire Protection
- Inservice Inspection – IWF
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Masonry Wall
- Periodic Surveillance and Preventive Maintenance
- Protective Coating Monitoring and Maintenance
- Structures Monitoring
- Water Chemistry Control – BWR

3.5.2.1.2 Water-Control Structures

**Materials**

Water-control structure components are constructed of the following materials.

- Carbon steel
- Ceramic/clay
- Concrete
- Concrete block
- Galvanized steel
- Polyvinylchloride
- Stainless steel

**Environments**

Water-control structure components are exposed to the following environments.

- Air – indoor uncontrolled
- Air – outdoor
- Exposed to fluid environment
- Soil

**Aging Effects Requiring Management**

The following aging effects associated with water-control structure components require management.

- Cracking
- Cracking and distortion
- Increase in porosity and permeability
- Loss of bond
- Loss of material

- Loss of strength

**Aging Management Programs**

The following aging management programs manage the effects of aging on water-control structure components.

- Masonry Wall
- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants
- Structures Monitoring

3.5.2.1.3 Turbine Building, Auxiliary Building, and Yard Structures

**Materials**

Turbine building, auxiliary building, and yard structure components are constructed of the following materials.

- Aluminum
- Carbon steel
- Concrete
- Concrete block
- Elastomers
- Galvanized steel
- Stainless steel

**Environments**

Turbine building, auxiliary building, and yard structure components are exposed to the following environments.

- Air – indoor uncontrolled
- Air – outdoor
- Exposed to fluid environment
- Soil

**Aging Effects Requiring Management**

The following aging effects associated with the turbine building, auxiliary building, and yard structures require management.

- Cracking
- Cracking and distortion

- Increase in porosity and permeability
- Loss of bond
- Loss of material
- Loss of sealing
- Loss of strength

**Aging Management Programs**

The following aging management programs manage the effects of aging on the turbine building, auxiliary building, and yard structure components.

- Fire Protection
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems
- Masonry Wall
- Periodic Surveillance and Preventive Maintenance
- Structures Monitoring
- Water Chemistry Control – BWR

3.5.2.1.4 Bulk Commodities

**Materials**

Bulk commodity components are constructed of the following materials.

- Aluminum
- Calcium silicate
- Carbon steel
- Cerablanket
- Ceraboard
- Cerafiber
- Concrete
- Elastomers
- Fiberglass
- Galvanized steel
- Kaowool blanket
- Kaowool bulk fiber
- Stainless steel
- Thermo-lag

**Environments**

Bulk commodity components are exposed to the following environments.

- Air – indoor uncontrolled
- Air – outdoor
- Exposed to fluid environment

**Aging Effects Requiring Management**

The following aging effects associated with bulk commodities require management.

- Change in material properties
- Cracking
- Cracking/delamination, separation
- Increase in porosity and permeability
- Increased hardness, shrinkage, loss of strength
- Loss of bond
- Loss of material
- Loss of mechanical function
- Loss of preload
- Loss of sealing
- Reduction in concrete anchor capacity
- Reduction or loss of isolation function
- Reduced thermal insulation resistance

**Aging Management Programs**

The following aging management programs manage the effects of aging on the bulk commodity components.

- External Surfaces Monitoring
- Fire Protection
- Fire Water System
- Inservice Inspection – IWF
- RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants
- Structures Monitoring
- Water Chemistry Control – BWR

### 3.5.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues discussed in Section 3.5.2.2 of NUREG-1800. The following sections are numbered in accordance with the discussions in NUREG-1800 and explain the RBS approach to those areas requiring further evaluation. Programs are described in Appendix B.

3.5.2.2.1 PWR and BWR Containments

3.5.2.2.1.1 Cracking and Distortion due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, and Cracking due to Differential Settlement and Erosion of Porous Concrete Subfoundations

The RBS containment is a low-leakage, free-standing steel containment vessel (SCV) structure consisting of a cylindrical wall, the torispherical dome, and the floor liner plate with embedments and anchored at its base to the reactor building concrete mat. The containment is completely enclosed by the reinforced concrete shield building. The base foundation for the SCV is the reactor building foundation mat, which is founded on granular fill placed directly on the dense sands and gravels of the Citronelle Formation. The portion of RBS's containment that is classified as Class CC equivalent is the common concrete foundation with the reactor building (also known as shield building). Since the Class CC equivalent concrete foundation slab is inaccessible, it is exempted from examination in accordance with IWL-1220(b). However, the listed aging effects will be addressed under the concrete foundation for the safety-related reactor building, as discussed in Section 3.5.2.2.2.1, Item 3.

RBS does not rely on a dewatering system for control of settlement. The RBS SCV structure's base foundation is integral with the base foundation of the reactor building's foundation mat and does not use a porous concrete subfoundation. Additionally, Information Notice 97-11 did not identify RBS as a plant susceptible to erosion of porous concrete subfoundations. Therefore, reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundations does not apply to the RBS SCV structure's base foundation concrete.

3.5.2.2.1.2 Reduction of Strength and Modulus due to Elevated Temperature

The RBS containment is a low-leakage, free-standing SCV structure consisting of a cylindrical wall, the torispherical dome, and the floor liner plate with embedments, which is anchored at its base to the reactor building concrete mat. The containment is completely enclosed by the reinforced concrete shield building. The base foundation for the SCV is the reactor building foundation mat, which is founded on granular fill placed directly on the dense sands and gravels of the Citronelle Formation. The portion of containment that is classified as Class CC equivalent is the common concrete foundation with the reactor building. Since the Class CC equivalent concrete foundation slab is inaccessible, it is exempted from examination in accordance with IWL-1220(b). However, the listed aging effects will be addressed under the concrete foundation for the safety-related reactor building and further discussed in Section 3.5.2.2.2.2.

During normal operation, per technical specifications, areas within containment are maintained below the threshold temperature of greater than 150°F general area. Process piping carrying hot fluid (pipe temperature > 200°F) are routed through penetrations in the SCV that are not encased in concrete. Therefore, the local area temperatures greater than 200°F criterion is not applicable for the RBS containment. Therefore, change in material properties due to elevated temperature is not an aging effect requiring management for containment concrete.

As a result, reduction of strength and modulus of concrete due to elevated temperatures is not an aging effect requiring management for the RBS free-standing SCV structure. The aging effect "change in material properties" is equivalent to the NUREG-1801 aging effect "reduction of strength and modulus of elasticity."

3.5.2.2.1.3 Loss of Material due to General, Pitting and Crevice Corrosion

1. Loss of material due to general, pitting, and crevice corrosion could occur in steel elements of inaccessible areas for all types of PWR and BWR containments.

   The RBS SCV is inspected in accordance with the requirements of Subsection IWE of the ASME Code Section XI. These inspections include a visual examination of the accessible interior and the exterior surfaces of the class MC components, parts and appurtenances of the SCV. Loss of material due to general, pitting and crevice corrosion of the steel elements of accessible areas is managed by the Containment Inservice Inspection – IWE Program and the Containment Leak Rate Program (10 CFR Part 50, Appendix J Program).

   A review of plant operating experience was conducted from the Containment Inservice Inspection – IWE Program walkdowns. There were no deficiencies identified from the IWE inspections that required additional analysis for acceptance or corrective action.

   The continued monitoring of the RBS SCV for loss of material due to general, pitting, and crevice corrosion through the Containment Inservice Inspection – IWE Program and the Containment Leak Rate Program provides reasonable assurance that loss of material in inaccessible areas of containment is insignificant and will be detected prior to a loss of an intended function.

2. Loss of material due to general, pitting, and crevice corrosion could occur in steel torus shell of Mark I containments.

   RBS is a BWR with a free-standing SCV comprised of a cylindrical wall, the torispherical dome, and the floor liner plate with embedments, which is anchored at its base to the reactor building concrete mat. The RBS BWR containment does not have a steel torus shell. Therefore, this item does not apply to RBS.

3. Loss of material due to general, pitting, and crevice corrosion could occur in steel torus ring girders and downcomers of Mark I containments, downcomers of Mark II containments, and interior surface of suppression chamber shell of Mark III containments.

   RBS is a BWR Mark III with a free-standing SCV with a suppression chamber whose floor and outer wall is integral to the SCV. The portion of the SCV outer wall exposed to the suppression pool is clad with stainless steel. Therefore, the carbon steel SCV is not exposed to the suppression pool water environment. The RBS BWR containment does not have a torus ring girder or downcomers. The interior surfaces of the suppression chamber that is integral to the SCV, including the stainless steel cladding, are inspected in accordance with the requirements of Subsection IWE of the ASME Code Section XI.

   Therefore, loss of material due to general, pitting, and crevice corrosion to the carbon steel surface of the suppression chamber is not an aging effect requiring management for the interior surfaces of the suppression pool that is integral to the SCV, because it is lined with stainless steel. However, the Containment Inservice Inspection – IWE Program manages loss of material due to general, pitting, and crevice corrosion for the stainless steel clad portion of the interior surfaces of suppression chamber that is integral to the SCV.

#### 3.5.2.2.1.4 Loss of Prestress due to Relaxation, Shrinkage, Creep, and Elevated Temperature

The RBS reactor building is a reinforced concrete structure with no prestressed tendons associated with its design. Therefore, loss of prestress due to relaxation, shrinkage, creep, and elevated temperature do not apply.

#### 3.5.2.2.1.5 Cumulative Fatigue Damage

TLAAs are evaluated in accordance with 10 CFR 54.21(c) as documented in Section 4. Fatigue TLAAs for RBS containment, bellows and other related commodities are evaluated as documented in Section 4.6.

The RBS Mark III containment design does not contain the following NUREG-1801 BWR components related to Mark I and II containments: torus, vent line bellows, and unbraced downcomers.

3.5.2.2.1.6 Cracking due to Stress Corrosion Cracking

NUREG-1801 recommends further evaluation of inspection methods to detect cracking due to stress corrosion cracking (SCC) since visual VT-3 examinations may be unable to detect this aging effect. Potentially susceptible components at RBS are penetration sleeves and bellows.

Three factors are necessary to initiate and propagate cracking due to SCC, including transgranular stress corrosion cracking (TGSCC). These factors are susceptible or sensitized material (resulting from manufacturing or installation process), a high tensile stress (residual or applied), and corrosive environment (high temperatures, moist or wetted environment, or an environment contaminated with chlorides, fluorides, or sulfates). Elimination or reduction of any of these factors will decrease the likelihood of SCC. TGSCC of RBS stainless steel bellows is not considered credible because the corrosive environment (concentration of chloride or sulfate contaminants and temperatures greater than 140°F) does not exist for the bellows. Therefore, SCC of RBS stainless steel bellows due to TGSCC is not expected. A review of plant operating experience did not identify cracking of this component, and containment pressure boundary functions have not been identified as a concern.

SCC is not an aging effect requiring management for the SCV carbon steel penetration sleeves, stainless steel penetration bellows, and dissimilar metal welds. The RBS SCV and associated penetration sleeves are carbon steel. High temperature piping systems penetrating the containment are carbon steel. Stress corrosion cracking is only applicable to stainless steel and is predicted only under certain conditions as discussed above.

There are dissimilar metal welds associated with stainless steel bellows welded to carbon steel penetration sleeves. SCC of dissimilar metal welds of stainless steel at the penetration sleeves is not considered credible because stainless steel SCC requires a concentration of chloride or sulfate contaminants, which are not present in significant quantities, as well as high stress, and temperatures greater than 140°F. Leakage of water in the containment, which might contact the penetration sleeves, is not the normal operating environment and is event-driven. The containment pressure boundary welds between stainless steel piping and penetration sleeves, with normal operating temperatures above 140°F, are not highly stressed. In addition, the Technical Specification limits the average air temperature inside the primary containment during normal plant operation below the limits required for SCC to occur. A review of plant operating experience did not identify cracking of these components, and containment pressure boundary functions have not been identified as a concern. Therefore, cracking of these components due to stress corrosion cracking is not expected. However, cracking due to SCC of stainless steel bellows and dissimilar metal welds for carbon steel and stainless steel will be managed by the Containment Inservice Inspection – IWE Program and the Containment Leak Rate Program.

3.5.2.2.1.7 Loss of Material (Scaling, Spalling) and Cracking due to Freeze-Thaw

The RBS containment is a low-leakage, free-standing SCV completely enclosed by the reinforced concrete shield building. The base foundation for the SCV is the reactor building foundation mat, which is founded on granular fill placed directly on the dense sands and gravels of the Citronelle Formation. The base foundation of the SCV is below grade and protected from the outer environment by other building's base foundation and is not subject to freeze-thaw action. Additionally, the outdoor environment to which concrete structures are exposed does not experience temperatures below freezing for durations sufficient to cause the freeze-thaw aging mechanism. RBS is located in a "Negligible" weathering region per Figure 1 of ASTM C33-90. As a result, loss of material and cracking due to freeze-thaw are not aging effects requiring management for RBS SCV structure's base foundation concrete. Therefore, loss of material and cracking due to freeze-thaw are not aging effects requiring management for the RBS SCV concrete base foundation.

3.5.2.2.1.8 Cracking due to Expansion from Reaction with Aggregate

The RBS SCV is completely enclosed by the reinforced concrete shield building. The base foundation for the SCV is the reactor building foundation mat, which is founded on granular fill placed directly on the dense sands and gravels of the Citronelle Formation. The portion of SCV that is classified as Class CC equivalent is the common concrete foundation with the reactor building. Since the Class CC equivalent concrete foundation slab is inaccessible, it is exempted from examination in accordance with IWL-1220(b). Based on ongoing industry operating experience, the Structures Monitoring Program manages cracking due to expansion from reaction with aggregate in accessible concrete areas for the RBS concrete base foundation.

However, potential aging effects will be addressed under the concrete foundation for the safety-related reactor building and further discussed in Section 3.5.2.2.2.1 Item 2.

3.5.2.2.1.9 Increase in Porosity and Permeability due to Leaching of Calcium Hydroxide and Carbonation

The RBS containment is a low-leakage, free-standing SCV structure consisting of a cylindrical wall, the torispherical dome, and the floor liner plate with embedments, which is anchored at its base to the reactor building concrete mat. The RBS containment is completely enclosed by the reinforced concrete shield building. The base foundation for the RBS SCV is the reactor building foundation mat, which is founded on soil. The portion of RBS's containment that is classified as Class CC equivalent is the common concrete foundation with the reactor building. Since the Class CC equivalent concrete foundation slab is inaccessible, it is exempted from examination in accordance with IWL-1220(b). However, the listed aging effects will be addressed under the concrete foundation for the safety-related reactor building and further discussed in Section 3.5.2.2.2.1 Item 4.

3.5.2.2.2 Safety-Related and Other Structures and Component Supports

Structure groups and component support groups as used in the following discussions are defined in NUREG-1800, Section 3.5.1.

3.5.2.2.2.1 Aging Management of Inaccessible Areas

1. Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw in Below-Grade Inaccessible Concrete Areas of Groups 1–3, 5, and 7–9 Structures

   The Groups 1–3, 5 and 7–9 Structures at RBS subject to the air – outdoor environment are not exposed to temperatures below freezing for sufficient durations that would cause freeze-thaw aging effects to occur. RBS is located in a "Negligible" weathering region per Figure 1 of ASTM C33-90. Also, air entraining admixture was used in concrete, and total air content including that due to use of chemical admixtures generally ranged between 3.5 and 6.5 percent by volume for concrete with 1 inch nominal maximum size of coarse aggregate and between 4 and 8 percent by volume for concrete with 3/4 inch nominal maximum size of coarse aggregate. A review of the RBS corrective action program was conducted to determine whether inspection activities identified evidence of cracking or spalling due to freeze-thaw degradation. This review found no documented conditions of freeze-thaw degradation in exterior concrete structures exposed to an air – outdoor environment.

   As a result, loss of material and cracking due to freeze-thaw in below-grade inaccessible areas of Groups 1–3, 5 and 7–9 concrete structures are not aging effects requiring management for RBS. Therefore, loss of material and cracking due to freeze-thaw are not aging effects requiring management for the below-grade inaccessible areas of RBS Groups 1–3, 5 and 7–9 concrete structures.

2. Cracking Due to Expansion and Reaction with Aggregates in Below-Grade Inaccessible Concrete Areas for Groups 1–5 and 7–9 Structures

   The Groups 1–5 and 7–9 Structures at RBS are designed in accordance with ACI 318-63 and/or ACI 318-71 and constructed in accordance with the recommendations in ACI 318-63 and ACI 318-71 using ingredients/materials conforming to ACI and ASTM standards. The concrete mix uses Portland cement conforming to ASTM C150, Type II. Concrete aggregates conform to the requirements of ASTM C33. Materials for concrete used in RBS concrete structures and components were specifically investigated, tested, and examined in accordance with pertinent ASTM standards. Nevertheless, based on ongoing industry operating experience, cracking due to expansion and reaction with aggregates in below-grade inaccessible areas for RBS Groups 1–5 and 7–9 concrete structures will be managed. RBS has not identified operating experience with occurrences of this aging effect; however, RBS has conservatively elected to manage this aging effect by the Structures Monitoring Program.

3. Cracking and Distortion Due to Increased Stress Levels from Settlement for Below Grade Inaccessible Concrete Areas of Structures for all Groups and Reduction in Foundation Strength, and Cracking, due to Differential Settlement and Erosion of Porous Concrete Subfoundation in Below-Grade Inaccessible Concrete Areas for Groups 1–3, 5–9 Structures

   The Groups 1–3 and 5–9 Structures at RBS are founded on a compacted backfill or soil. For the inaccessible areas of Groups 1–3 and 5–9 Structures at RBS the safety-related structures' foundations are founded on a reinforced concrete foundation basemat that is founded on compacted structural backfill or soil. The aging effect cracking and distortion due to increased stress levels from settlement is applicable and will be managed by the Structures Monitoring Program. For other nonsafety-related concrete structures which are founded on compacted structural backfill or soil, the aging effect cracking and distortion due to increased stress levels from settlement is applicable and will be managed by the Structures Monitoring Program. Therefore, cracking and distortion due to increased stress levels from settlement is an applicable aging effect in below-grade inaccessible areas for RBS Groups 1–3 and 5–9 concrete structures and other nonsafety-related concrete structures and will be managed by the Structures Monitoring Program.

   The Groups 1–3 and 5–9 Structures at RBS do not rely on a dewatering system for control of settlement. The RBS Groups 1–3 and 5–9 concrete structures do not use porous concrete subfoundations. Therefore, reduction of foundation strength, and cracking due to differential settlement and erosion of porous concrete subfoundations are not aging effects requiring management in below grade inaccessible areas for RBS Groups 1–3 and 5–9 concrete structures.

4. Increase in Porosity and Permeability, and Loss of Strength Due to Leaching of Calcium Hydroxide and Carbonation of Below-Grade Inaccessible Concrete Areas of Groups 1–5 and 7–9 Structures

   The below-grade inaccessible areas of RBS Groups 1–5 and 7–9 concrete structures are exposed to groundwater, which is considered equivalent to a flowing water environment. The Groups 1–5 and 7–9 Structures at RBS are designed in accordance with ACI 318-63 and/or ACI 318-71 and constructed in accordance with the recommendations in ACI 318-63 and ACI 318-71 using ingredients/materials conforming to ACI and ASTM standards. The concrete mix uses Portland cement conforming to ASTM C150, Type II. Concrete aggregates conform to the requirements of ASTM C33. Materials for concrete used in RBS concrete structures and components were specifically investigated, tested, and examined in accordance with pertinent ASTM standards. The type and size of aggregate, slump, cement and additives have been established to produce durable concrete in accordance with ACI. Cracking is controlled through proper arrangement and distribution of reinforcing steel. Concrete structures and concrete components are constructed of a dense, well-cured concrete with an amount of cement suitable for strength development and achievement of a water-to-cement ratio that is characteristic of concrete having low permeability. This is consistent with the recommendations and guidance provided by ACI 201.2R-77.

Therefore, increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation is not an aging effect requiring management for the inaccessible areas of RBS Groups 1–5 and 7–9 concrete structures. Nevertheless, the Structures Monitoring Program manages increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation in below-grade inaccessible areas of RBS Groups 1–5 and 7–9 concrete structures.

3.5.2.2.2.2 Reduction of Strength and Modulus of Concrete Structures due to Elevated Temperature

ACI 349 specifies concrete temperature limits for normal operations or any other long-term period. During normal operation, areas within the Group 1–5 structures at RBS are maintained below a bulk average temperature of 150°F by plant cooling systems. Process piping carrying hot fluid (pipe temperature > 200°F) routed through penetrations in the concrete walls by design do not result in temperatures exceeding 200°F locally or result in a "hot spot" on the concrete surface. The penetration configuration includes guard pipes and insulation of the process piping to minimize heat transfer from the process pipe to the exterior environment surrounding the process piping. Therefore, change in material properties due to elevated temperature is not an aging effect requiring management for RBS Group 1–5 concrete structures.

The aging effect "change in material properties" is equivalent to the NUREG-1801 aging effect "reduction of strength and modulus."

3.5.2.2.2.3 Aging Management of Inaccessible Areas for Group 6 Structures

1. Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw in Below-Grade Inaccessible Concrete Areas of Group 6 Structures

   The Group 6 Structures at RBS subject to the air – outdoor environment are not exposed to temperatures below freezing for sufficient durations that would cause freeze-thaw aging effects to occur. RBS is located in a "Negligible" weathering region per Figure 1 of ASTM C33-90. Also, air entraining admixture was used in concrete and total air content including that due to use of chemical admixtures generally ranged between 3.5 and 6.5 percent by volume for concrete with 1 inch nominal maximum size of coarse aggregate and between 4 and 8 percent by volume for concrete with ¾ inch nominal maximum size of coarse aggregate. A review of the RBS corrective action program was conducted to determine whether inspection activities identified evidence of cracking or spalling due to freeze-thaw degradation. This review found no documented conditions of freeze-thaw degradation in exterior concrete structures exposed to an air – outdoor environment.

Therefore, loss of material and cracking due to freeze-thaw are not aging effects requiring management for the below-grade inaccessible areas of RBS Group 6 concrete structures.

2. Cracking Due to Expansion and Reaction with Aggregates in Below-Grade Inaccessible Concrete Areas of Group 6 Structures

   The Group 6 Structures at RBS are designed in accordance with ACI 318-63 and/ or ACI 318-71 and constructed in accordance with the recommendations in ACI 318-63 and ACI 318-71 using ingredients/materials conforming to ACI and ASTM standards. The concrete mix uses Portland cement conforming to ASTM C150, Type II. Concrete aggregates conform to the requirements of ASTM C33. Materials for concrete used in RBS concrete structures and components were specifically investigated, tested, and examined in accordance with pertinent ASTM standards. Nevertheless, based on ongoing industry operating experience, cracking due to expansion and reaction with aggregates in below-grade inaccessible areas for RBS Group 6 concrete structures will be managed. RBS has not identified operating experience for this aging effect; however, RBS has conservatively elected to manage this aging effect with the Structures Monitoring Program.

3. Increase in Porosity and Permeability and Loss of Strength due to Leaching of Calcium Hydroxide and Carbonation in Inaccessible Areas of Concrete Elements of Group 6 Structures

   The Group 6 Structures at RBS are designed in accordance with ACI 318-63 and/ or ACI 318-71 and constructed in accordance with the recommendations in ACI 318-63 and ACI 318-71 using ingredients/materials conforming to ACI and ASTM standards. The concrete mix uses Portland cement conforming to ASTM C150, Type II. Concrete aggregates conform to the requirements of ASTM C33. Materials for concrete used in RBS concrete structures and components were specifically investigated, tested, and examined in accordance with pertinent ASTM standards. The type and size of aggregate, slump, cement and additives have been established to produce durable concrete in accordance with ACI. Cracking is controlled through proper arrangement and distribution of reinforcing steel. Concrete structures and concrete components are constructed of a dense, well-cured concrete with an amount of cement suitable for strength development and achievement of a water-to-cement ratio that is characteristic of concrete having low permeability. This is consistent with the recommendations and guidance provided by ACI 201.2R-77. The below-grade inaccessible areas of

RBS Group 6 concrete structures are exposed to groundwater, which is considered equivalent to a flowing water environment.

Therefore, increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation is not an aging effect requiring management in below-grade inaccessible areas of RBS Group 6 concrete structures. Nevertheless, the Structures Monitoring Program manages increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide and carbonation in below-grade inaccessible areas of RBS Group 6 concrete structures.

3.5.2.2.2.4 Cracking due to Stress Corrosion Cracking and Loss of Material due to Pitting and Crevice Corrosion

NUREG-1800, Section 3.5.2.2.2.4, applies to stainless steel liners for concrete or steel tanks. No tanks with stainless steel liners are included in the structural scope of license renewal. However, the corresponding NUREG-1801 items can be compared to the stainless steel liners of other components, such as the reactor cavity and containment sump. These liners can be exposed to a fluid environment and may be subject to loss of material. The stainless steel liners, exposed to a fluid environment, are not in an environment conducive to stress corrosion cracking (SCC). Consistent with GALL Report Chapter IX, Sections D and F, the factors necessary to initiate and propagate SCC are combined actions of stress (both applied and residual tensile stresses) and harsh environment (significant presence of halogens, specifically chlorides), at a temperature above 140°F (60°C). Although SCC has been observed in stagnant, oxygenated borated water systems at lower temperatures than this 140°F threshold, all of these instances have identified a significant presence of contaminants (halogens, specifically chlorides) in the failed components. SCC of stainless steel liners is not credible because they are not exposed to a harsh environment (significant presence of contaminants [halogens, specifically chlorides]) and the normal operating temperature of the fluid environment to which these stainless steel liners are exposed is less than the SCC threshold temperature of 140°F. Therefore, cracking due to SCC is not an aging effect requiring management for the stainless steel liners exposed to a fluid environment. The Structures Monitoring Program manages loss of material by periodic inspections.

3.5.2.2.2.5 Cumulative Fatigue Damage due to Fatigue

TLAA are evaluated in accordance with 10 CFR 54.21(c) as documented in Section 4 of this application. During the process of identifying TLAAs in the RBS current licensing basis, no fatigue analyses were identified for component support members, welds, and support anchorage to building structure for Groups B1.1, B1.2, and B1.3.

3.5.2.2.3 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of RBS quality assurance procedures and administrative controls for aging management programs.

3.5.2.2.4 Ongoing Review of Operating Experience

See Appendix B Section B.0.4 for discussion of RBS operating experience review programs.

### 3.5.2.3 Time-Limited Aging Analyses

Potential TLAA identified for structural components and commodities include fatigue analyses for reactor building crane rails and structural girders, expansion bellows and refueling bellows assembly, and steel containment vessel penetrations. TLAAs are discussed in Section 4.

## 3.5.3 Conclusion

The structural components and commodities subject to aging management review have been identified in accordance with the criteria of 10 CFR 54.21. The aging management programs selected to manage the effects of aging on structural components and commodities are identified in Section 3.5.2.1 and the following tables. A description of the aging management programs is provided in Appendix B of this application, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the structural components and commodities will be managed such that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

## Table 3.5.1
## Summary of Aging Management Programs for Containments, Structures and Component Supports Evaluated in Chapters II and III of NUREG-1801

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| *PWR Concrete (Reinforced and Prestressed) and Steel Containments, BWR Concrete and Steel (Mark I, II, and III) Containments* | | | | | |
| 3.5.1-1 | Concrete: dome; wall; basemat; ring girders; buttresses, Concrete elements, all | Cracking and distortion due to increased stress levels from settlement | ISI (IWL) or Structures Monitoring Program<br>If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation. | Yes, if a de-watering system is relied upon to control settlement | RBS does not rely on a dewatering system for control of settlement. RBS has a free standing steel containment vessel (SCV) with its base foundation founded on the reactor building's foundation mat. Therefore, cracking and distortion due to increased stress levels from settlement are not aging effects requiring management for the RBS SCV base foundation concrete.<br>For further evaluation, see Section 3.5.2.2.1.1. |

**Table 3.5.1: Structures and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-2 | Concrete; foundation; subfoundation | Reduction of foundation strength and cracking due to differential settlement and erosion of porous concrete subfoundation | Structures Monitoring Program.<br>If a de-watering system is relied upon for control of erosion, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation. | Yes, if a de-watering system is relied upon to control settlement | RBS does not rely on a dewatering system for control of settlement. RBS SCV structure's base foundation is the reactor building's foundation mat and does not use a porous concrete subfoundation. Therefore, reduction of foundation strength, and cracking due to differential settlement and erosion of porous concrete subfoundations are not aging effects requiring management for the RBS SCV structure's base foundation concrete.<br>For further evaluation, see Section 3.5.2.2.1.1. |
| 3.5.1-3 | Concrete: dome; wall; basemat; ring girders; buttresses, Concrete: containment; wall; basemat, Concrete: basemat, concrete fill-in annulus | Reduction of strength and modulus due to elevated temperature (>150°F general; >200°F local) | A plant-specific aging management program is to be evaluated. | Yes, if temperature limits are exceeded | RBS containment is a free-standing SCV. The concrete foundation of the containment is not exposed to general and local temperatures that exceed the thresholds.<br>For further evaluation, see Section 3.5.2.2.1.2. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-4 | Steel elements (inaccessible areas): drywell shell; drywell head; and drywell shell | Loss of material due to general, pitting and crevice corrosion | ISI (IWE) and 10 CFR Part 50, Appendix J | Yes, if corrosion is indicated from the IWE examinations | RBS is a BWR Mark III with a free-standing SCV. RBS containment does not have the steel elements "drywell shell; drywell head; and drywell shell" subject to ISI (IWE) and 10 CFR Part 50, Appendix J programs.<br>For further discussion see Section 3.5.2.2.1.3 Item 1. |
| 3.5.1-5 | Steel elements (inaccessible areas): liner; liner anchors; integral attachments, Steel elements (inaccessible areas): suppression chamber; drywell; drywell head; embedded shell; region shielded by diaphragm floor (as applicable) | Loss of material due to general, pitting and crevice corrosion | ISI (IWE) and 10 CFR Part 50, Appendix J | Yes, if corrosion is indicated from the IWE examinations. | Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and the Containment Leak Rate Programs manage the loss of material of steel elements in this listing.<br>For further evaluation, see Section 3.5.2.2.1.3 Item 1. |
| 3.5.1-6 | Steel elements: torus shell | Loss of material due to general, pitting and crevice corrosion | ISI (IWE) and 10 CFR Part 50, Appendix J | Yes, if corrosion is significant, recoating of the torus is recommended. | RBS is a BWR Mark III with a free-standing SCV. RBS containment does not have the listed steel element.<br>For further discussion, see Section 3.5.2.2.1.3 Item 2. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-7 | Steel elements: torus ring girders; downcomers; Steel elements: suppression chamber shell (interior surface) | Loss of material due to general, pitting and crevice corrosion | ISI (IWE) | Yes, if corrosion is significant | RBS is a BWR Mark III with a free-standing SCV. The RBS BWR containment does not have a torus ring girder or downcomers. RBS does have a suppression chamber for the suppression pool. The suppression chamber inner surface is integral to the SCV, clad with stainless steel. Therefore, loss of material due to general, pitting and crevice corrosion related to carbon steel for this listing is not an aging effect requiring management for the SCV suppression pool.<br>For further discussion, see Section 3.5.2.2.1.3 Item 3. |
| 3.5.1-8 | Prestressing system; tendons | Loss of prestress due to relaxation, shrinkage, creep; elevated temperature | Yes, TLAA | Yes, TLAA | NUREG-1801 items referencing this item are associated with concrete containments. This is applicable only to PWR and BWR prestressed concrete containments. RBS containment is a BWR Mark III steel containment and does not incorporate a prestressing system.<br>For further evaluation, see Section 3.5.2.2.1.4. |

**Table 3.5.1: Structures and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-9 | Penetration sleeves; penetration bellows, Steel elements: torus; vent line; vent header; vent line bellows; downcomers, Suppression pool shell; unbraced downcomers, Steel elements: vent header; downcomers | Cumulative fatigue damage due to fatigue (only if CLB fatigue analysis exists) | Yes, TLAA | Yes, TLAA | Consistent with NUREG-1801. Fatigue analysis is a TLAA.<br>For further evaluation, see Section 3.5.2.2.1.5. |
| 3.5.1-10 | Penetration sleeves, penetration bellows | Cracking due to stress corrosion cracking | ISI (IWE) and 10 CFR Part 50, Appendix J | Yes, detection of aging effects is to be evaluated | Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and Containment Leak Rate Programs manage the listed aging effect.<br>For further evaluation see Section 3.5.2.2.1.6. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-11 | Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): dome; wall; basemat | Loss of material (spalling, scaling) and cracking due to freeze-thaw | Further evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557). | Yes, for plants located in moderate to severe weathering conditions | RBS containment is a free-standing SCV, completely enclosed by a reinforced concrete shield building. The concrete foundation mat (basemat) of the RBS primary containment is protected from the external environments by the reactor building's base foundation. Furthermore, RBS is located in a "Negligible" weathering region per Figure 1 of ASTM C33-90. Therefore, the concrete elements of the SCV foundation (basemat) are not subject to the listed aging effects due to freeze-thaw.<br>For further evaluation, see Section 3.5.2.2.1.7. |

**Table 3.5.1: Structures and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-12 | Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): containment; wall; basemat, Concrete (inaccessible areas): basemat, concrete fill-in annulus | Cracking due to expansion from reaction with aggregates | Further evaluation is required to determine if a plant-specific aging management program is needed. | Yes, if concrete is not constructed as stated function | RBS containment is a free-standing SCV completely enclosed by a reinforced concrete shield building. The SCV does not contain the listed concrete components except for its foundation, which is integral to the reactor building basemat. However, the listed aging effect for concrete elements of the foundation is addressed by Item 3.5.1-43.<br>For further evaluation, see Section 3.5.2.2.1.8. |
| 3.5.1-13 | Concrete (inaccessible areas): basemat, Concrete (inaccessible areas): dome; wall; basemat | Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation | Further evaluation is required to determine if a plant-specific aging management program is needed. | Yes, if leaching is observed in accessible areas that impact intended function | RBS containment is a free-standing SCV and does not contain a concrete dome or walls in its design. Also, RBS containment concrete foundation is integral to the reactor building basemat and is inaccessible and exempt from inspection.<br>For further evaluation, see Section 3.5.2.2.1.9. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-14 | Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): containment; wall; basemat | Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation | Further evaluation is required to determine if a plant-specific aging management program is needed. | Yes, if leaching is observed in accessible areas that impact intended function | NUREG-1801 items referencing this item number are associated with BWR concrete containment structures, and RBS is an SCV.<br>For further evaluation, see Section 3.5.2.2.1.9. |
| 3.5.1-15 | Concrete (accessible areas): basemat. | Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation | ISI (IWL). | No | RBS containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat and does not contain a basemat with accessible areas. |
| 3.5.1-16 | Concrete (accessible areas): basemat, Concrete: containment; wall; basemat | Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack | ISI (IWL) or Structures Monitoring Program | No | RBS containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat and does not contain a basemat or concrete containment walls with accessible areas. |
| 3.5.1-17 | Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses | Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack | ISI (IWL) | No | RBS containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat. RBS SCV design does not contain the listed concrete components. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-18 | Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): basemat | Loss of material (spalling, scaling) and cracking due to freeze-thaw | ISI (IWL) | No | RBS containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat. RBS SCV design does not contain the listed concrete components. |
| 3.5.1-19 | Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): basemat, Concrete (accessible areas) containment; wall; basemat, concrete fill-in annulus | Cracking due to expansion from reaction with aggregates | ISI (IWL) | No | RBS containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat. RBS SCV design does not contain the listed concrete components. |
| 3.5.1-20 | Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (accessible areas): containment; wall; basemat | Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation | ISI (IWL) | No | RBS containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat. RBS SCV design does not contain the listed concrete components. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-21 | Concrete (accessible areas): dome; wall; basemat; ring girders; buttresses; reinforcing steel, Concrete (accessible areas): basemat; reinforcing steel, Concrete (accessible areas): dome; wall; basemat; reinforcing steel | Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel | ISI (IWL) | No | RBS containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat. RBS SCV design does not contain the listed concrete components. |
| 3.5.1-22 | Concrete (inaccessible areas): basemat; reinforcing steel | Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel | Structures Monitoring Program | No | RBS containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat. RBS SCV design does not contain the listed concrete components. |
| 3.5.1-23 | Concrete (inaccessible areas): basemat; reinforcing steel, Concrete (inaccessible areas): dome; wall; basemat; reinforcing steel | Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel | ISI (IWL) or Structures Monitoring Program | No | RBS containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat. RBS SCV design does not contain the listed concrete components. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-24 | Concrete (inaccessible areas): dome; wall; basemat; ring girders; buttresses, Concrete (inaccessible areas): basemat, Concrete (accessible areas): dome; wall; basemat | Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack | ISI (IWL) or Structures Monitoring Program | No | RBS containment is a free-standing SCV, and its concrete foundation is integral to the reactor building basemat. RBS SCV design does not contain the listed concrete components. |
| 3.5.1-25 | PWR only | | | | |
| 3.5.1-26 | Moisture barriers (caulking, flashing, and other sealants) | Loss of sealing due to wear, damage, erosion, tear, surface cracks, or other defects | ISI (IWE) | No | The ISI (IWE) program is not used to manage moisture barriers because RBS primary containment design does not utilize moisture barriers. However, loss of sealing is a consequence of the aging effects cracking and change in material properties, and the Periodic Surveillance and Preventive Maintenance Program manages the listed aging effect for similar elastomer commodities. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-27 | Penetration sleeves; penetration bellows, Steel elements: torus; vent line; vent header; vent line bellows; downcomers, Suppression pool shell | Cracking due to cyclic loading (CLB fatigue analysis does not exist) | ISI (IWE) and 10 CFR Part 50, Appendix J | No | RBS has a CLB fatigue analysis associated with penetration sleeves, bellows, and suppression pool liner at the containment wall, and therefore this aging effect is addressed under line Item 3.5.1-9. RBS is a BWR Mark III, which does not have a torus, vent lines or downcomers. |
| 3.5.1-28 | Personnel airlock, equipment hatch, CRD hatch | Loss of material due to general, pitting, and crevice corrosion | ISI (IWE) and 10 CFR Part 50, Appendix J | No | Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and Containment Leak Rate Programs manage the listed aging effect. |
| 3.5.1-29 | Personnel airlock, equipment hatch, CRD hatch: locks, hinges, and closure mechanisms | Loss of leak tightness due to mechanical wear of locks, hinges and closure mechanisms | ISI (IWE) and 10 CFR Part 50, Appendix J | No | Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and Containment Leak Rate Programs manage the listed aging effect. |
| 3.5.1-30 | Pressure-retaining bolting | Loss of preload due to self-loosening | ISI (IWE) and 10 CFR Part 50, Appendix J | No | Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and Containment Leak Rate Programs manage the listed aging effect. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
| 3.5.1-31 | Pressure-retaining bolting, Steel elements: downcomer pipes | Loss of material due to general, pitting, and crevice corrosion | ISI (IWE) | No | Consistent with NUREG-1801. The Containment Inservice Inspection – IWE Program manages the pressure-retaining bolting aging effect. RBS is a BWR III and the steel elements *downcomer pipes* are not part of its design. |
| 3.5.1-32 | Prestressing system: tendons; anchorage components | Loss of material due to corrosion | ISI (IWL) | No | NUREG-1801 items referencing this item are associated with concrete containments and are applicable to PWR and BWR prestressed concrete containments. RBS is a BWR with a free-standing SCV. There are no prestressed tendons associated with RBS containment design. |
| 3.5.1-33 | Seals and gaskets | Loss of sealing due to wear, damage, erosion, tear, surface cracks, or other defects | 10 CFR Part 50, Appendix J | No | Consistent with NUREG-1801. The Containment Leak Rate Program manages the listed aging effect. |
| 3.5.1-34 | Service Level I coatings | Loss of coating integrity due to blistering, cracking, flaking, peeling, or physical damage | Protective Coating Monitoring and Maintenance Program | No | Consistent with NUREG 1801. The Protective Coating Monitoring and Maintenance Program manage the listed aging effect. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-35 | Steel elements (accessible areas): liner; liner anchors; integral attachments, Penetration sleeves, Steel elements (accessible areas): drywell shell; drywell head; drywell shell in sand pocket regions; Steel elements (accessible areas): suppression chamber; drywell; drywell head; embedded shell; region shielded by diaphragm floor (as applicable), Steel elements (accessible areas): drywell shell; drywell head | Loss of material due to general, pitting, and crevice corrosion | ISI (IWE) and 10 CFR Part 50, Appendix J | No | Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and Containment Leak Rate Programs manage the listed aging effect. RBS is a BWR III with free-standing SCV, and its design does not incorporate components associated with drywell shell and drywell shell in sand pocket region. |

**Table 3.5.1: Structures and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-36 | Steel elements: drywell head; downcomers | Fretting or lockup due to mechanical wear | ISI (IWE) | No | Loss of material is the aging effect caused by mechanical wear. RBS plant operating experience has not identified fretting or lock-up due to mechanical wear for the drywell head. RBS inspects the drywell head per the requirements of ASME Section XI. In addition, the drywell head is a stationary or fixed component with finger pin connections. Therefore, it is unlikely that fretting and lock-up will occur. The RBS SCV does not have downcomers. |
| 3.5.1-37 | Steel elements: suppression chamber (torus) liner (interior surface) | Loss of material due to general (steel only), pitting, and crevice corrosion | ISI (IWE) and 10 CFR Part 50, Appendix J | No | Consistent with NUREG-1801. The Containment Inservice Inspection – IWE and Containment Leak Rate Programs manage the listed aging effect. RBS is a BWR III with free-standing SCV and a stainless steel suppression chamber liner but does not have a torus. |

**Table 3.5.1: Structures and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-38 | Steel elements: suppression chamber shell (interior surface) | Cracking due to stress corrosion cracking | ISI (IWE) and 10 CFR Part 50, Appendix J | No | Three factors are necessary to initiate and propagate cracking due to stress corrosion cracking (SCC). These factors are susceptible or sensitized material (resulting from manufacturing or installation process), a high tensile stress (residual or applied), and corrosive environment (high temperatures, moist or wetted environment or an environment contaminated with chlorides, fluorides, or sulfates). Elimination or reduction of any of these factors will decrease the likelihood of SCC. SCC of RBS stainless suppression chamber liner is not considered credible because the corrosive environment (concentration of chloride or sulfate contaminants and temperatures greater than 140°F) does not exist for the suppression chamber shell. Therefore, SCC of RBS stainless suppression chamber liner is not expected. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-39 | Steel elements: vent line bellows | Cracking due to stress corrosion cracking | ISI (IWE) and 10 CFR Part 50, Appendix J | No | RBS is a BWR III with free-standing SCV that does not contain components associated with vent line bellows. |
| 3.5.1-40 | Unbraced downcomers, Steel elements: vent header; downcomers | Cracking due to cyclic loading (CLB fatigue analysis does not exist) | ISI (IWE) and 10 CFR Part 50, Appendix J | No | RBS is a BWR III with free-standing SCV that does not contain components associated with unbraced downcomers and vent header; downcomers. |
| 3.5.1-41 | Steel elements: drywell support skirt, Steel elements (inaccessible areas): support skirt | None | None | NA – No AEM or AMP | RBS is a BWR III with free-standing SCV and it does not contain components associated with drywell support skirt. |
| *Safety-Related and Other Structures; and Component Supports* | | | | | |
| 3.5.1-42 | Groups 1-3, 5, 7-9: Concrete (inaccessible areas): foundation | Loss of material (spalling, scaling) and cracking due to freeze-thaw | Further evaluation is required for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557) | Yes, for plants located in moderate to severe weathering conditions | RBS is located in a region where weathering conditions are considered negligible as shown in ASTM C33-90, Figure 1. Therefore, the concrete elements are not subject to listed aging effects due to freeze-thaw.<br>For further discussion, see Section 3.5.2.2.2.1 Item 1. |

**Table 3.5.1: Structures and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-43 | All Groups except Group 6: Concrete (inaccessible areas): all | Cracking due to expansion from reaction with aggregates | Further evaluation is required to determine if a plant-specific aging management program is needed. | Yes, if concrete is not constructed as stated | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.<br>For further evaluation, see Section 3.5.2.2.2.1 Item 2. |
| 3.5.1-44 | All Groups: concrete: all | Cracking and distortion due to increased stress levels from settlement | Structures Monitoring Program<br>If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation. | Yes, if a de-watering system is relied upon to control settlement | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. RBS does not rely on a de-watering system to control settlement.<br>For further evaluation, see Section 3.5.2.2.2.1 Item 3. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-45 | Groups 1-3, 5-9: concrete: foundation; subfoundation | Reduction in foundation strength, cracking due to differential settlement, erosion of porous concrete subfoundation | Structures Monitoring Program<br>If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation. | Yes, if a de-watering system is relied upon to control settlement | RBS does not rely on a de-watering system to control settlement and structures do not have porous concrete subfoundation.<br>For further discussion, see Section 3.5.2.2.2.1 Item 3. |
| 3.5.1-46 | Groups 1-3, 5-9: concrete: foundation; subfoundation | Reduction in foundation strength, cracking due to differential settlement, erosion of porous concrete subfoundation | Structures Monitoring Program<br>If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation. | Yes, if a de-watering system is relied upon to control settlement | RBS does not rely on a de-watering system to control settlement and structures do not have porous concrete subfoundation.<br>For further evaluation, see Section 3.5.2.2.2.1 Item 3. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-47 | Groups 1-5, 7-9: concrete (inaccessible areas): exterior above and below-grade; foundation | Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation | Further evaluation is required to determine if a plant-specific aging management program is needed. | Yes, if leaching is observed in accessible areas that impact intended function | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.<br>For further evaluation, see Section 3.5.2.2.2.1 Item 4. |
| 3.5.1-48 | Group 1-5: concrete: all | Reduction of strength and modulus due to elevated temperature (>150°F general; >200°F local) | A plant-specific aging management program is to be evaluated. | Yes, if temperature limits are exceeded | RBS concrete in areas for this grouping are not exposed to general and local temperatures that exceed the listed thresholds.<br>For further evaluation, see Section 3.5.2.2.2.2. |
| 3.5.1-49 | Groups 6 – concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab | Loss of material (spalling, scaling) and cracking due to freeze-thaw | Further evaluation is required for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557) | Yes, for plants located in moderate to severe weathering conditions | RBS is located in a region where weathering conditions are considered negligible as shown in ASTM C33-90, Figure 1.<br>For further evaluation, see Section 3.5.2.2.2.3 Item 1. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-50 | Groups 6: concrete (inaccessible areas): all | Cracking due to expansion from reaction with aggregates | Further evaluation is required to determine if a plant-specific aging management program is needed. | Yes, if concrete is not constructed as stated | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.<br>For further evaluation, see Section 3.5.2.2.2.3 Item 2. |
| 3.5.1-51 | Groups 6: concrete (inaccessible areas): exterior above- and below-grade; foundation; interior slab | Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation | Further evaluation is required to determine if a plant-specific aging management program is needed. | Yes, if leaching is observed in accessible areas that impact intended function | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect.<br>For further evaluation, see Section 3.5.2.2.2.3 Item 3. |
| 3.5.1-52 | Groups 7, 8 – steel components: tank liner | Cracking due to stress corrosion cracking; Loss of material due to pitting and crevice corrosion | A plant-specific aging management program is to be evaluated. | Yes, plant-specific | Consistent with NUREG-1801. The Structures Monitoring Program manages loss of material for similar components of this grouping. RBS does not have stainless steel tank liners with intended functions exposed to an environment of water-standing > 140°F (> 60°C). Cracking due to stress corrosion is not an aging effect requiring management for an environment of water-standing < 140°F (< 60°C).<br>For further evaluation, see Section 3.5.2.2.2.4. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-53 | Support members; welds; bolted connections; support anchorage to building structure | Cumulative fatigue damage due to fatigue (Only if CLB fatigue analysis exists) | Yes, TLAA | Yes, TLAA | No CLB fatigue analysis exists for component supports members, welds, and support anchorage to building structure.<br>For further evaluation, see Section 3.5.2.2.2.5. |
| 3.5.1-54 | All groups except 6: concrete (accessible areas): all | Cracking due to expansion from reaction with aggregates | Structures Monitoring Program | No | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. |
| 3.5.1-55 | Building concrete at locations of expansion and grouted anchors; grout pads for support base plates | Reduction in concrete anchor capacity due to local concrete degradation/ service induced cracking or other concrete aging mechanisms | Structures Monitoring Program | No | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-56 | Concrete: exterior above- and below-grade; foundation; interior slab | Loss of material due to abrasion; cavitation | Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs. | No | Consistent with NUREG-1801. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effect. |
| 3.5.1-57 | Constant and variable load spring hangers; guides; stops | Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads | ISI (IWF) | No | Consistent with NUREG-1801. The Inservice Inspection – IWF Program manages the listed aging effect. |

**Table 3.5.1: Structures and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-58 | Earthen water-control structures: dams; embankments; reservoirs; channels; canals and ponds | Loss of material; loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, seepage | Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs. | No | RBS does not have the listed components associated with water-control structures. |
| 3.5.1-59 | Group 6: concrete (accessible areas): all | Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel | Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs. | No | Consistent with NUREG 1801. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effects. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-60 | Group 6: concrete (accessible areas): exterior above- and below-grade; foundation | Loss of material (spalling, scaling) and cracking due to freeze-thaw | Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs. | No | RBS is located in a region where weathering conditions are considered negligible as shown in ASTM C33-90, Figure 1. Therefore, the concrete elements are not subject to the listed aging effects due to freeze-thaw. |
| 3.5.1-61 | Group 6: concrete (accessible areas): exterior above- and below-grade; foundation; interior slab | Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation | Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs. | No | Consistent with NUREG-1801. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effects. |

**Table 3.5.1: Structures and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-62 | Group 6: Wooden Piles; sheeting | Loss of material; change in material properties due to weathering, chemical degradation, and insect infestation repeated wetting and drying, fungal decay | Regulatory Guide 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs. | No | RBS does not have the listed components associated with water-control structures. |
| 3.5.1-63 | Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above and below-grade; foundation | Increase in porosity and permeability; loss of strength due to leaching of calcium hydroxide and carbonation | Structures Monitoring Program | No | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. |
| 3.5.1-64 | Groups 1-3, 5, 7-9: concrete (accessible areas): exterior above and below-grade; foundation | Loss of material (spalling, scaling) and cracking due to freeze-thaw | Structures Monitoring Program | No | RBS is located in a region where weathering conditions are considered negligible as shown in ASTM C33-90, Figure 1. Therefore, the concrete elements are not subject to listed aging effects due to freeze-thaw. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-65 | Groups 1-3, 5, 7-9: concrete (inaccessible areas): below-grade exterior; foundation, Groups 1-3, 5, 7-9: concrete (accessible areas): below-grade exterior; foundation, Groups 6: concrete (inaccessible areas): all | Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel | Structures Monitoring Program | No | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. |
| 3.5.1-66 | Groups 1-5, 7, 9: concrete (accessible areas): interior and above-grade exterior | Cracking; loss of bond; and loss of material (spalling, scaling) due to corrosion of embedded steel | Structures Monitoring Program | No | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. |
| 3.5.1-67 | Groups 1-5, 7, 9: Concrete: interior; above-grade exterior, Groups 1-3, 5, 7-9 - concrete (inaccessible areas): below-grade exterior; foundation, Group 6: concrete (inaccessible areas): all | Increase in porosity and permeability; cracking; loss of material (spalling, scaling) due to aggressive chemical attack | Structures Monitoring Program | No | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-68 | High-strength structural bolting | Cracking due to stress corrosion cracking | ISI (IWF) | No | RBS does not have high-strength structural bolts with actual measured yield strength greater than or equal to 150 ksi in sizes greater than 1 inch diameter within the scope of the RBS Inservice Inspection – IWF Program. Therefore, the listed aging effect is not an aging effect requiring management for RBS ISI (IWF) high-strength bolting. |
| 3.5.1-69 | High-strength structural bolting | Cracking due to stress corrosion cracking | Structures Monitoring Program Note: ASTM A 325, F 1852, and ASTM A 490 bolts used in civil structures have not shown to be prone to SCC. SCC potential need not be evaluated for these bolts. | No | Listed aging effects do not require management at RBS. RBS does not have high strength bolts that are subject to sustained high tensile stress in a corrosive environment. As defined in this line item, ASTM A 325, F 1852, and ASTM A 490 bolts used in civil structures have not shown to be prone to SCC. Therefore, the listed aging effect is not applicable for RBS high strength bolting. |
| 3.5.1-70 | Masonry walls: all | Cracking due to restraint shrinkage, creep, and aggressive environment | Masonry Wall Program | No | Consistent with NUREG-1801. The Masonry Wall Program manages the listed aging effect. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-71 | Masonry walls: all | Loss of material (spalling, scaling) and cracking due to freeze-thaw | Masonry Wall Program | No | RBS is located in a region where weathering conditions are considered negligible as shown in ASTM C33-90, Figure 1. Therefore, the listed components are not subject to the aging effects due to freeze-thaw. |
| 3.5.1-72 | Seals; gasket; moisture barriers (caulking, flashing, and other sealants) | Loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants) | Structures Monitoring Program | No | Consistent with NUREG-1801. The aging effects cited in the NUREG-1801 item are loss of sealing due to deterioration of seals. Loss of sealing is a consequence of the aging effects cracking and change in material properties. Additionally, the items referencing this item are associated with water-control structures. RBS items referring to seals and gaskets are associated with structures other than water-control structures and are managed by the Structures Monitoring Program for cracking and change in material properties. |
| 3.5.1-73 | Service Level I coatings | Loss of coating integrity due to blistering, cracking, flaking, peeling, physical damage | Protective Coating Monitoring and Maintenance | No | Consistent with NUREG-1801. The Protective Coating Monitoring and Maintenance Program manage the listed aging effect. |

**Table 3.5.1: Structures and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-74 | Sliding support bearings; sliding support surfaces | Loss of mechanical function due to corrosion, distortion, dirt, debris, overload, wear | Structures Monitoring Program | No | The NUREG-1801 item referencing this item is associated with equipment supports, such as cable trays, HVAC duct, instrument tubing and mechanical equipment. RBS design does not use Lubrite, graphic tool steel, Fluorogold, or Lubrofluor for the component listed. |
| 3.5.1-75 | Sliding surfaces | Loss of mechanical function due to corrosion, distortion, dirt, debris, overload, wear | ISI (IWF) | No | The NUREG-1801 item referencing this item is associated with Lubrite plates. Lubrite plates are not subject to aging management because the listed aging mechanisms are event-driven and typically can be avoided though proper design. Loss of material, which could cause loss of mechanical function, is addressed under Items 3.5.1-57 and 3.5.1-91 related to component support members. |
| 3.5.1-76 | Sliding surfaces: radial beam seats in BWR drywell | Loss of mechanical function due to corrosion, distortion, dirt, overload, wear | Structures Monitoring Program | No | RBS is a BWR Mark III with a free-standing SCV. RBS containment does not have the steel elements: radial beam seats in BWR drywell subject to the listed aging effects. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-77 | Steel components: all structural steel | Loss of material due to corrosion | Structures Monitoring Program | No | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. |
| 3.5.1-78 | Steel components: fuel pool liner | Cracking due to stress corrosion cracking; Loss of material due to pitting and crevice corrosion | Water Chemistry and Monitoring of the spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels. | No, unless leakages have been detected through the SFP liner that cannot be accounted for from the leak chase channels | The Water Chemistry Control – BWR Program and monitoring of the spent fuel pool water level in accordance with technical specifications and leakage from the leak chase channels manages the listed aging effects for the fuel pool liner. The Structures Monitoring program manages other steel elements subject to the listed aging effects |
| 3.5.1-79 | Steel components: piles | Loss of material due to corrosion | Structures Monitoring Program | No | RBS does not have the listed components. |
| 3.5.1-80 | Structural bolting | Loss of material due to general, pitting and crevice corrosion | Structures Monitoring Program | No | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. |
| 3.5.1-81 | Structural bolting | Loss of material due to general, pitting and crevice corrosion | ISI (IWF) | No | Consistent with NUREG-1801. The Inservice Inspection – IWF Program manages the listed aging effect. |

**Table 3.5.1: Structures and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-82 | Structural bolting | Loss of material due to general, pitting and crevice corrosion | Structures Monitoring Program | No | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. |
| 3.5.1-83 | Structural bolting | Loss of material due to general, pitting and crevice corrosion | Chapter XI.S7, "Regulatory Guide 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants" or the FERC/US Army Corp of Engineers dam inspections and maintenance programs. | No | Consistent with NUREG-1801. The RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program manages the listed aging effect. |
| 3.5.1-84 | Structural bolting | Loss of material due to pitting and crevice corrosion | Water Chemistry and ISI (IWF) | No | The NUREG-1801 item referencing this item is associated with ASME Class MC stainless steel structural bolting in a fluid environment. RBS does not have this component/ material/environment combination. |

**Table 3.5.1: Structures and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-85 | Structural bolting | Loss of material due to pitting and crevice corrosion | Water Chemistry for BWR water, and ISI (IWF) | No | The NUREG-1801 item referencing this item is associated with ASME Class 1, 2 and 3 stainless steel structural bolting in a fluid environment. RBS does not have this component/ material/ environment combination. |
| 3.5.1-86 | Structural bolting | Loss of material due to pitting and crevice corrosion | ISI (IWF) | No | Consistent with NUREG-1801. The Inservice Inspection – IWF Program manages the listed aging effect. |
| 3.5.1-87 | Structural bolting | Loss of preload due to self-loosening | ISI (IWF) | No | Consistent with NUREG-1801. The Inservice Inspection – IWF Program manages loss of preload due to self-loosening. |
| 3.5.1-88 | Structural bolting | Loss of preload due to self-loosening | Structures Monitoring Program | No | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. |
| 3.5.1-89 | PWR only | | | | |
| 3.5.1-90 | Support members; welds; bolted connections; support anchorage to building structure | Loss of material due to general (steel only), pitting, and crevice corrosion | Water Chemistry for BWR water, and ISI (IWF) | No | Consistent with NUREG-1801. The Water Chemistry Control – BWR and Inservice Inspection – IWF Programs manage the listed aging effect. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-91 | 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 Inservice Inspection – IWF Program manage the listed aging effect. |
| 3.5.1-92 | Support members; welds; bolted connections; support anchorage to building structure | Loss of material due to general and pitting corrosion | Structures Monitoring Program | No | The Structures Monitoring and Fire Water System Programs manage the listed aging effect. |
| 3.5.1-93 | Support members; welds; bolted connections; support anchorage to building structure | Loss of material due to pitting and crevice corrosion | Structures Monitoring Program | No | Consistent with NUREG-1801. The Structures Monitoring Program manages the listed aging effect. |
| 3.5.1-94 | Vibration isolation elements | Reduction or loss of isolation function due to radiation hardening, temperature, humidity, sustained vibratory loading | ISI (IWF) | No | The Inservice Inspection – IWF Program is not used. The Structures Monitoring Program is used to manage the listed aging effects. |

| Table 3.5.1: Structures and Component Supports | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.5.1-95 | Aluminum, galvanized steel and stainless steel support members; welds; bolted connections; support anchorage to building structure exposed to Air – indoor, uncontrolled | None | None | NA – No AEM or AMP | Consistent with NUREG-1801. |

## Notes for Table 3.5.2-1 through 3.5.2-4

Generic Notes

A. Consistent with component, material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect, and AMP for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect, and AMP for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different AMP is credited, or NUREG-1801 identifies a plant-specific AMP.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

501. The One-Time Inspection Program will verify the effectiveness of the Water Chemistry Control – BWR Program.

**Table 3.5.2-1**
**Reactor Building**
**Summary of Aging Management Evaluation**

**Table 3.5.2-1: Reactor Building**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Cranes: rails and structural girders | SNS, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Inspection of OVHLL | VII B.A-07 | 3.5.1-52 | A |
| Cranes: structural girders | SNS, SSR | Carbon steel | Air – indoor uncontrolled | Cracking | TLAA – metal fatigue | VII.B.A-06 | 3.3.1-1 | A |
| Penetration: sleeves | EN, FLB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A1.TP-302 | 3.5.1-77 | A |
| Penetration: sleeves | EN, MB, PB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | CII – IWE<br>Containment Leak Rate | II.B4.CP-36 | 3.5.1-28 | B |
| Penetration: sleeves | EN, MB, SNS, SRE, SSR | Stainless steel | Exposed to fluid environment | Loss of material | Water Chemistry Control – BWR | III.A5.T-14 | 3.5.1-78 | C |
| Penetration: sleeves | EN, MB, PB, SNS, SRE, SSR | Stainless steel | Air – indoor uncontrolled | Loss of material | CII – IWE<br>Containment Leak Rate | II.B4.CP-36 | 3.5.1-28 | B |
| Penetration: sleeves | EN, PB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Cracking | TLAA – metal fatigue | II.B4.C-13 | 3.5.1-9 | A |

| Table 3.5.2-1: Reactor Building | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Penetration: sleeves and bellows | EN, PB, SSR | Stainless steel | Air – indoor uncontrolled | Cracking | TLAA – metal fatigue | II.B4.C-13 | 3.5.1-9 | A |
| Penetration: sleeves and bellows | EN,PB, SSR | Stainless steel | Air – indoor uncontrolled | Cracking | CII – IWE<br>Containment Leak Rate | II.B4.CP-38 | 3.5.1-10 | A |
| Plant exhaust stack | SNS | Carbon steel | Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-302 | 3.5.1-77 | C |
| Steel components: beams, columns, plates | EN, HS, MB, SNS, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A1.TP-302 | 3.5.1-77 | C |
| Steel components: impingement (missile) barriers | MB, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A8.TP-302 | 3.5.1-77 | A |
| Steel components: jib cranes | SNS | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A4.TP-302 | 3.5.1-77 | C |
| Steel components: monorails | SNS | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A1.TP-302<br>III.A4.TP-302 | 3.5.1-77 | C |
| Steel component: primary shield wall (steel portion) | EN, MB, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A4.TP-302<br>III.A8.TP-302 | 3.5.1-77 | C |

| Table 3.5.2-1: Reactor Building | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Steel components: reactor pressure vessel (RPV) support bearing plate | SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | ISI – IWF | III.B1.1.T-24 | 3.5.1-91 | A |
| Steel components: SCV personnel airlocks and equipment hatch | EN, FLB, MB, PB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | CII – IWE<br>Containment Leak Rate | II.B4.C-16 | 3.5.1-28 | A |
| Steel components: SCV personnel airlocks and equipment hatch | FB | Carbon steel | Air – indoor uncontrolled | Loss of material | Fire Protection | VII.G.A-21 | 3.3.1-59 | C |
| Steel components: SCV personnel airlocks: locks, hinges, and closure mechanisms | EN, FLB, MB, PB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | CII – IWE | II.B4.CP-148 | 3.5.1-31 | A |
| Steel components: SCV personnel airlocks: locks, hinges, and closure mechanisms | EN, FLB, FB, MB, PB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Loss of leak tightness | CII – IWE<br>Containment Leak Rate | II.B4.CP-39 | 3.5.1-29 | A |

| Table 3.5.2-1: Reactor Building | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Steel components: drywell personnel airlock, drywell combination equipment hatch and personnel door | EN, FLB, MB, PB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A1.TP-302 | 3.5.1-77 | A |
| Steel components: drywell personnel airlock, drywell combination equipment hatch and personnel door | EN, FLB, MB, PB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Cracking | TLAA – metal fatigue | II.B4.C-13 | 3.5.1-9 | C |
| Steel components: drywell personnel airlock, drywell combination equipment hatch and personnel door | FB | Carbon steel | Air – indoor uncontrolled | Loss of material | Fire Protection | VII.G.A-21 | 3.3.1-59 | C |
| Steel components: drywell personnel airlock, drywell combination equipment hatch and personnel door: locks, hinges, and closure mechanisms | EN, FLB, MB, PB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A1.TP-302 | 3.5.1-77 | A |

| Table 3.5.2-1: Reactor Building | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Steel components: shield building personnel doors, and equipment hatch | EN, FLB, MB, PB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-302 | 3.5.1-77 | A |
| Steel components: shield building personnel doors, and equipment hatch | FB | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Fire Protection | VII.G.A-21<br>VII.G.A-22 | 3.3.1-59 | C |
| Steel components: shield building personnel doors and equipment hatch: locks, hinges, and closure mechanisms | EN, FLB, MB, PB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-302 | 3.5.1-77 | A |
| Steel components: sump liner plates | EN, PB, SSR | Stainless steel | Exposed to fluid environment (temperature < 140°F) | Loss of material | Structures Monitoring | III.A7.T-23 | 3.5.1-52 | E |
| Steel components: sump liner plates | EN, PB, SSR | Stainless steel | Air – indoor uncontrolled | None | None | III.B2.TP-8 | 3.5.1-95 | C |
| Steel components: pressure retaining bolting | PB, SSR | Carbon steel<br>Stainless steel | Air – indoor uncontrolled | Loss of preload | CII – IWE<br>Containment Leak Rate | II.B4.CP-150 | 3.5.1-30 | A |

| Table 3.5.2-1: Reactor Building | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Steel components: pressure retaining bolting | PB, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | CII – IWE | II.B4.CP-148 | 3.5.1-31 | A |
| Steel components: pressure retaining bolting | PB, SSR | Stainless steel | Air – indoor uncontrolled | None | None | III.B1.3.TP-8 | 3.5.1-95 | C |
| Steel components: refueling platform equipment assembly and rails | SNS | Aluminum, Galvanized steel, Stainless steel | Air – indoor uncontrolled | None | None | III.B2.TP-8 | 3.5.1-95 | C |
| Steel components: refueling platform equipment assembly and rails | SNS | Carbon steel | Air – indoor uncontrolled | Loss of material | Inspection of OVHLL | VII.B.A-07 | 3.3.1-52 | A |
| Steel elements: drywell head and finger pins | EN, MB, PB, SSR | Stainless steel | Air – indoor uncontrolled | None | None | III.B1.3.TP-8 | 3.5.1-95 | C |
| Steel elements: drywell head and finger pins | EN, MB, PB, SSR | Stainless steel | Exposed to fluid environment (temperature < 140°F) | Loss of material | Structures Monitoring | III.A5.T-14 | 3.5.1-78 | E |
| Steel elements: drywell liner plate inner wall | EN, MB, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A1.TP-302 | 3.5.1-77 | A |

**Table 3.5.2-1: Reactor Building**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steel elements: drywell liner plate inner and outer walls, suppression pool inner wall, and weir wall liner plate | EN, MB, SSR | Stainless steel | Air – indoor uncontrolled | None | None | III.B1.3.TP-8 | 3.5.1-95 | C |
| Steel elements: drywell liner plate inner and outer walls, suppression pool inner wall, and weir wall liner plate | EN, MB, SSR | Stainless steel | Exposed to fluid environment (temperature < 140°F) | Loss of material | Structures Monitoring | III.A5.T-14 | 3.5.1-78 | E |
| Steel elements (accessible areas): liner; liner anchors; integral attachments (steel containment vessel, floor, and suppression pool outer wall liner) | EN, MB, PB, SRE, SSR | Carbon steel Stainless steel | Air – indoor uncontrolled | Loss of material | CII – IWE<br>Containment Leak Rate | II.B3.1.CP-43<br>II.B3.2.CP-35 | 3.5.1-35 | A |

**Table 3.5.2-1: Reactor Building**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steel elements (accessible areas): liner; liner anchors; integral attachments (steel containment vessel, floor, and suppression pool outer wall liner) | EN, MB, PB, SRE, SSR | Stainless steel | Exposed to fluid environment (temperature < 140°F) | Loss of material | CII – IWE<br>Containment Leak Rate | II.B2.2.C-49 | 3.5.1-37 | C |
| Steel elements (accessible areas): liner; liner anchors; integral attachments (steel containment vessel, floor and suppression pool outer wall liner) | EN, MB, PB, SRE, SSR | Carbon steel<br>Stainless steel | Air – indoor uncontrolled<br>Exposed to fluid environment | Cracking | TLAA – metal fatigue | II.B2.2.C-48 | 3.5.1-9 | C |
| Steel elements (inaccessible areas): liner; liner anchors; integral attachments (steel containment vessel, floor and suppression pool outer wall liner) | EN, MB, PB, SRE, SSR | Stainless steel | Exposed to fluid environment (temperature < 140°F) | Loss of material | CII – IWE<br>Containment Leak Rate | II.B2.2.C-49 | 3.5.1-37 | A |

| Table 3.5.2-1: Reactor Building | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Steel elements (inaccessible areas): liner; liner anchors; integral attachments (steel containment vessel floor and suppression pool outer wall liner) | EN, MB, PB, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | CII – IWE<br>Containment Leak Rate | II.B3.2.CP-98 | 3.5.1-5 | A |
| Steel elements: liner; liner anchors; integral attachments (Upper containment pool liner plate) | EN, SSR | Stainless steel | Exposed to fluid environment (temperature < 140°F) | Loss of material | Water Chemistry Control – BWR<br>Monitoring of the spent fuel pool water level in accordance with Technical Specifications and leakage from the leak chase channels | III.A5.T-14 | 3.5.1-78 | A, 501 |
| Steel elements: liner; liner anchors; integral attachments (upper containment pool liner plate) | EN, SSR | Stainless steel | Air – indoor uncontrolled | None | None | III.B1.3.TP-8 | 3.5.1-95 | C |

**Table 3.5.2-1: Reactor Building**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steel elements: upper containment pool gates | EN, SSR | Aluminum | Exposed to fluid environment (temperature < 140°F) | Loss of material | Water Chemistry Control – BWR | V.D2.EP-71 | 3.2.1-17 | C, 501 |
| Steel elements: upper containment pool gates | EN, SSR | Stainless steel | Exposed to fluid environment (temperature < 140°F) | Loss of material | Water Chemistry Control – BWR<br>Monitoring of spent fuel storage pool level per Technical Specifications and monitoring leakage from leak chase channel | III.A5.T-14 | 3.5.1-78 | A |
| Steel elements: SRV quencher support and restraint | SSR | Stainless steel | Exposed to fluid environment (temperature < 140°F) | Loss of material | Water Chemistry Control – BWR<br>ISI – IWF | III.B1.1.TP-10 | 3.5.1-90 | E |
| Steel elements: SRV quencher support and restraint | SSR | Stainless steel | Air – indoor uncontrolled or fluid environment | Cracking | TLAA – metal fatigue | II.B2.2.C-48 | 3.5.1-9 | C |

| Table 3.5.2-1: Reactor Building | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Steel elements: interior dome roof (steel framing) | SNS | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A1.TP-302 | 3.5.1-77 | A |
| Support members: welds; bolted connections; support anchorage to building structure (supports and restraints for the reactor pressure vessel) | SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | ISI – IWF | III.B1.1.T-24 | 3.5.1-91 | A |
| Concrete (accessible areas): shield building; all | EN, FLB, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking | Structures Monitoring | III.A1.TP-25 | 3.5.1-54 | A |
| Concrete (accessible areas): shield building; all | EN, FLB, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking and distortion | Structures Monitoring | III.A1.TP-30 | 3.5.1-44 | A |
| Concrete (accessible areas): containment internal structures; all | EN, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled | Cracking | Structures Monitoring | III.A4.TP-25 | 3.5.1-54 | A |
| Concrete (accessible areas): containment internal structures; all | EN, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled | Cracking and distortion | Structures Monitoring | III.A4.TP-304 | 3.5.1-44 | A |

| Table 3.5.2-1: Reactor Building | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Concrete (accessible areas): containment internal structures; all | EN, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A4.TP-26 | 3.5.1-56 | A |
| Concrete (accessible areas): refueling canal | EN, MB, SRE, SSR | Concrete | Air – indoor uncontrolled | Cracking | Structures Monitoring | III.A5.TP-25 | 3.5.1-54 | A |
| Concrete (accessible areas): refueling canal | EN, MB, SRE, SSR | Concrete | Air – indoor uncontrolled | Cracking and distortion | Structures Monitoring | III.A5.TP-30 | 3.5.1-44 | A |
| Concrete (accessible areas): refueling canal | EN, MB, SRE, SSR | Concrete | Air – indoor uncontrolled | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A5.TP-26 | 3.5.1-66 | A |
| Concrete (accessible areas): shield building; below grade exterior; foundation | EN, FLB, MB, PB, SRE, SSR | Concrete | Soil | Cracking | Structures Monitoring | III.A1.TP-25 | 3.5.1-54 | A |
| Concrete (accessible areas): shield building; below grade exterior; foundation | EN, FLB, MB, PB, SRE, SSR | Concrete | Soil | Cracking and distortion | Structures Monitoring | III.A1.TP-30 | 3.5.1-44 | A |

**Table 3.5.2-1: Reactor Building**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Concrete (accessible areas): shield building; below grade exterior; foundation | EN, FLB, MB, PB, SRE, SSR | Concrete | Soil | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-27 | 3.5.1-65 | A |
| Concrete (accessible areas): shield building; below grade exterior; foundation | EN, FLB, MB, PB, SRE, SSR | Concrete | Exposed to fluid environment | Increase in porosity and permeability, cracking, loss of material (spalling, scaling) | Structures Monitoring | III.A.1.TP-24 | 3.5.1-63 | A |
| Concrete (accessible areas): shield building wall and dome; interior and above grade exterior | EN, FLB, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking | Structures Monitoring | III.A1.TP-25 | 3.5.1-54 | A |
| Concrete (accessible areas): shield building wall and dome; interior and above grade exterior | EN, FLB, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking and distortion | Structures Monitoring | III.A1.TP-30 | 3.5.1-44 | A |

| Table 3.5.2-1: Reactor Building | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Concrete (accessible areas): shield building wall and dome; interior and above grade exterior | EN, FLB, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-26 | 3.5.1-66 | A |
| Concrete (inaccessible areas): shield building; all | EN, FLB, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking | Structures Monitoring | III.A1.TP-204 | 3.5.1-43 | A |
| Concrete (inaccessible areas): shield building; all | EN, FLB, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking and distortion | Structures Monitoring | III.A1.TP-30 | 3.5.1-44 | A |
| Concrete (inaccessible areas): containment internal structures; all | EN, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled | Cracking | Structures Monitoring | III.A4.TP-204 | 3.5.1-43 | A |
| Concrete (inaccessible areas): containment internal structures; all | EN, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled | Cracking and distortion | Structures Monitoring | III.A4.TP-304 | 3.5.1-44 | A |

| Table 3.5.2-1: Reactor Building | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Concrete (inaccessible areas): refueling canal | EN, MB, SRE, SSR | Concrete | Air – indoor uncontrolled | Cracking | Structures Monitoring | III.A5.TP-204 | 3.5.1-43 | A |
| Concrete (inaccessible areas): refueling canal | EN, MB, SRE, SSR | Concrete | Air – indoor uncontrolled | Cracking and distortion | Structures Monitoring | III.A5.TP-30 | 3.5.1-44 | A |
| Concrete (inaccessible areas): shield building; below grade exterior; foundation | EN, FLB MB, PB, SRE, SSR | Concrete | Soil | Cracking | Structures Monitoring | III.A1.TP-204 | 3.5.1-43 | A |
| Concrete (inaccessible areas): shield building; below grade exterior; foundation | EN, FLB, MB, PB, SRE, SSR | Concrete | Soil | Cracking and distortion | Structures Monitoring | III.A1.TP-30 | 3.5.1-44 | A |
| Concrete (inaccessible areas): shield building; below grade exterior; foundation | EN, FLB, MB, PB, SRE, SSR | Concrete | Soil | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-212 | 3.5.1-65 | A |

**Table 3.5.2-1: Reactor Building**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Concrete (inaccessible areas): shield building; below grade exterior; foundation | EN, FLB, MB, PB, SRE, SSR | Concrete | Exposed to fluid environment | Increase in porosity and permeability, cracking, loss of material (spalling, scaling) | Structures Monitoring | III.A.1.TP-67 | 3.5.1-47 | E |
| Concrete (inaccessible areas): shield building wall and dome; interior and above grade exterior | EN, FLB, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking | Structures Monitoring | III.A1.TP-204 | 3.5.1-43 | A |
| Concrete (inaccessible areas): shield building wall and dome; interior and above grade exterior | EN, FLB, MB, PB, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking and distortion | Structures Monitoring | III.A1.TP-30 | 3.5.1-44 | A |
| Masonry walls | EN, MB, SNS, SSR | Concrete block | Air – indoor uncontrolled | Cracking | Masonry Wall | III.A1.T-12 | 3.5.1-70 | A |

| Table 3.5.2-1: Reactor Building | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Compressible and inflatable seals and gaskets for shield building equipment door and personnel doors | PB, SSR | Elastomer | Air – indoor uncontrolled | Loss of sealing | Structures Monitoring | III.A6.TP-7 | 3.5.1-72 | C |
| Compressible and inflatable seals and gaskets for SCV equipment hatch cover, SCV personnel airlocks, drywell head, transfer tube, drywell combination hatch and personnel door | PB, SSR | Elastomer | Air – indoor uncontrolled | Loss of sealing | Containment Leak Rate | II B4.CP-41 | 3.5.1-33 | C |
| Containment building penetration seals and sealant | PB, SSR | Elastomer | Air – indoor uncontrolled | Loss of sealing | Containment Leak Rate | II B4.CP-41 | 3.5.1-33 | A |
| Containment building penetration seals and sealant | PB, SSR | Elastomer | Air – outdoor | Loss of sealing | Structures Monitoring | III.A6.TP-7 | 3.5.1-72 | C |
| Inflatable seal for upper containment pool gates | EN | Elastomer | Air – indoor uncontrolled | Loss of sealing | Periodic Surveillance and Preventive Maintenance | II B4.CP-40 | 3.5.1-26 | E |

| Table 3.5.2-1: Reactor Building | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Service Level I coatings | SNS | Coatings | Air – indoor uncontrolled | Loss of coating integrity | Protective Coating Monitoring and Maintenance | II.A3.CP-152 | 3.5.1-34 | A |
| Service Level I coatings | SNS | Coatings | Air – indoor uncontrolled | Loss of coating integrity | Protective Coating Monitoring and Maintenance | III.A4.TP-301 | 3.5.1-73 | A |

**Table 3.5.2-2**
**Water-Control Structures**
**Summary of Aging Management Evaluation**

**Table 3.5.2-2: Water-Control Structures**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steel components: beams, columns, plates | EN, MB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor<br>Exposed to fluid environment | Loss of material | RG 1.127 | III.A6.TP-221 | 3.5.1-83 | C |
| Steel components: monorail | SNS | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A6.TP-248 | 3.5.1-80 | C |
| Steel components: roof opening covers | EN, MB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | RG 1.127 | III.A6.TP-221 | 3.5.1-83 | C |
| Steel components: screen (SWC pump suction screens) | SRE | Stainless steel | Exposed to fluid environment (temperature < 140°F) | Loss of material | Structures Monitoring | III.A8.T-23 | 3.5.1-52 | E |
| Steel component: siding | EN, SRE | Galvanized steel | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-6 | 3.5.1-93 | C |

**Table 3.5.2-2: Water-Control Structures**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Concrete: all | EN, FLB, HS, MB, SNS, SRE, SSR | Concrete | Soil | Cracking and distortion | Structures Monitoring | III.A6.TP-30 | 3.5.1-44 | A |
| Concrete (accessible areas): all | EN, FLB, HS, MB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking, loss of bond, and loss of material (spalling, scaling) | RG 1.127 | III.A6.TP-38 | 3.5.1-59 | A |
| Concrete (accessible areas): all | EN, FLB, HS, MB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor<br>Exposed to fluid environment<br>Soil | Cracking | Structures Monitoring | III.A3.TP-25 | 3.5.1-54 | A |
| Concrete (accessible areas): below grade exterior; foundation | EN, HS, MB, SNS, SRE, SSR | Concrete | Soil | Cracking, loss of bond, and loss of material (spalling, scaling) | RG 1.127 | III.A6.TP-38 | 3.5.1-59 | A |
| Concrete (accessible areas): exterior above-below grade; foundation; interior slab | EN, HS, MB, SNS, SRE, SSR | Concrete | Exposed to fluid environment | Increase in porosity and permeability, loss of strength | RG 1.127 | III.A6.TP-37 | 3.5.1-61 | A |

**Table 3.5.2-2: Water-Control Structures**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Concrete (accessible areas): interior and above grade exterior | EN, HS, MB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air-outdoor<br>Exposed to fluid environment | Cracking, loss of bond, and loss of material (spalling, scaling) | RG 1.127 | III.A6.TP-38 | 3.5.1-59 | A |
| Concrete (inaccessible areas): all | EN, HS, MB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air-outdoor<br>Exposed to fluid environment<br>Soil | Cracking | Structures Monitoring | III.A6.TP-220 | 3.5.1-50 | E |
| Concrete (inaccessible areas): exterior above-below grade; foundation; interior slab | EN, HS, MB, SNS, SRE, SSR | Concrete | Exposed to fluid environment | Increase in porosity and permeability, loss of strength | Structures Monitoring | III.A6.TP-109 | 3.5.1-51 | E |
| Concrete: exterior above-below grade; foundation; interior slab | EN, HS, MB, SNS, SRE, SSR | Concrete | Exposed to fluid environment | Loss of material | RG 1.127 | III.A6.T-20 | 3.5.1-56 | A |

**Table 3.5.2-2: Water-Control Structures**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Concrete (inaccessible areas): all | EN, HS, MB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air-outdoor<br>Soil | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A6.TP-104 | 3.5.1-65 | A |
| Masonry walls | EN, SRE | Concrete block | Air – indoor uncontrolled<br>Air-outdoor | Cracking | Masonry Wall | III.A6.T-12 | 3.5.1-70 | A |
| Cooling tower drift eliminators (SSW and SWC cooling tower) | HS, SNS | Polyvinylchloride | Exposed to fluid environment | None | None | -- | -- | J |
| Cooling tower tile fill (SSW and SWC cooling tower) | HS, SNS | Ceramic and clay tile | Exposed to fluid environment | None | None | -- | -- | J |
| Cooling tower tile fill (SSW and SWC cooling tower) | HS, SNS | Polyvinylchloride | Exposed to fluid environment | None | None | -- | -- | J |

**Table 3.5.2-3**
**Turbine Building, Auxiliary Building, and Yard Structures**
**Summary of Aging Management Evaluation**

| Table 3.5.2-3: Turbine Building, Auxiliary Building, and Yard Structures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Control room ceiling support system | SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A1.TP-302 | 3.5.1-77 | A |
| Control room ceiling support system | SSR | Galvanized steel | Air – indoor uncontrolled | None | None | III.B5.TP-8 | 3.5.1-95 | A |
| Cranes: rails and girders | SNS | Carbon steel | Air – indoor uncontrolled | Loss of material | Inspection of OVHLL | VII.B.A-07 | 3.3.1-52 | A |
| Cranes: structural girders | SNS | Carbon steel | Air – indoor uncontrolled | Cumulative fatigue damage | TLAA – metal fatigue | VII.B.A-06 | 3.3.1-1 | A |
| Steel components: fuel building fuel handling platform | SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Inspection of OVHLL | VII.B.A-07 | 3.3.1-52 | A |
| Steel components: fuel building pool liner plate and gates | EN, SSR | Stainless steel | Air – indoor uncontrolled | None | None | III.B4.TP-8 | 3.5.1-95 | C |

| Table 3.5.2-3: Turbine Building, Auxiliary Building, and Yard Structures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Steel components: fuel building pool liner plate and gates | EN, SSR | Stainless steel | Exposed to fluid environment | Loss of material | Water Chemistry Control – BWR<br>Monitoring of spent fuel pool water level and monitoring leakage from leak chase | III.A5.T-14 | 3.5.1-78 | A, 501 |
| Steel components: fuel storage pool gates | EN, SSR | Aluminum | Air – indoor uncontrolled | None | None | III.B5.TP-8 | 3.5.1-95 | C |
| Steel components: fuel storage pool gates | EN, SSR | Aluminum | Exposed to fluid environment | Loss of material | Water Chemistry Control – BWR | VII.A4.AP-130 | 3.3.1-25 | C, 501 |
| Steel components: monorails | SNS | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A1.TP-302 | 3.5.1-77 | C |
| Steel components: pressure relief louvers (blow off panels) | SNS | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-302 | 3.5.1-77 | C |
| Steel components: all structural steel | EN, MB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-302<br>III.A3.TP-302<br>III.A5.TP-302 | 3.5.1-77 | A |

**Table 3.5.2-3: Turbine Building, Auxiliary Building, and Yard Structures**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steel components: all structural steel | EN, MB, SNS, SRE, SSR | Galvanized steel | Air – indoor uncontrolled | None | None | III.B5.TP-8 | 3.5.1-95 | A |
| Steel components: all structural steel | EN, MB, SNS, SRE, SSR | Galvanized steel | Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-302<br>III.A3.TP-302<br>III.A5.TP-302 | 3.5.1-77 | A |
| Steel components: metal siding | EN, SNS | Galvanized steel | Air – indoor uncontrolled | None | None | III.B5.TP-8 | 3.5.1-95 | A |
| Steel components: metal siding | EN, SNS | Galvanized steel | Air – outdoor | Loss of material | Structures Monitoring | III.A3.TP-302 | 3.5.1-77 | A |
| Steel components: missile barriers | MB, SNS | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A3.TP-302 | 3.5.1-77 | A |
| Steel components: roof decking or floor decking | EN | Galvanized steel | Air – indoor uncontrolled | None | None | III.B5.TP-8 | 3.5.1-95 | A |
| Steel components: roof decking or floor decking | EN | Galvanized steel | Air – outdoor | Loss of material | Structures Monitoring | III.A3.TP-302 | 3.5.1-77 | A |
| Transmission tower, pull-off tower | SRE | Galvanized steel | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-6 | 3.5.1-93 | C |
| Beams, columns, floor slabs | EN, MB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A3.TP-26 | 3.5.1-66 | A |

| Table 3.5.2-3: Turbine Building, Auxiliary Building, and Yard Structures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Beams, columns, floor slabs | EN, MB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled | Cracking | Structures Monitoring | III.A1.TP-25<br>III.A2.TP-25<br>III.A3.TP-25 | 3.5.1-54 | A |
| Concrete (accessible areas): all | EN, MB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking | Structures Monitoring | III.A1.TP-25<br>III.A2.TP-25<br>III.A3.TP-25 | 3.5.1-54 | A |
| Concrete (accessible areas): below-grade exterior; foundation | EN, MB, SNS, SRE, SSR | Concrete | Soil | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-27<br>III.A3.TP-27<br>III.A5.TP-27 | 3.5.1-65 | A |
| Concrete (accessible areas): interior and above-grade exterior | EN, MB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-26<br>III.A3.TP-26<br>III.A5.TP-26 | 3.5.1-66 | A |
| Concrete (accessible areas): interior and above-grade exterior | EN, MB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Increase in porosity and permeability; cracking; loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-28<br>III.A3.TP-28<br>III.A5.TP-28 | 3.5.1-67 | A |
| Concrete (accessible areas): exterior above- and below-grade; foundation | EN, MB, SNS, SRE, SSR | Concrete | Exposed to fluid environment | Increase in porosity and permeability; Loss of strength | Structures Monitoring | III.A1.TP-24<br>III.A3.TP-24<br>III.A5.TP-24 | 3.5.1-63 | A |

**Table 3.5.2-3: Turbine Building, Auxiliary Building, and Yard Structures**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Concrete (accessible areas): exterior above- and below-grade; foundation | EN, MB, SNS, SRE, SSR | Concrete | Soil | Cracking and distortion | Structures Monitoring | III.A1.TP-30<br>III.A3.TP-30<br>III.A5.TP-30 | 3.5.1-44 | A |
| Concrete (inaccessible areas): all | EN, MB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor<br>Soil<br>Exposed to fluid environment | Cracking | Structures Monitoring | III.A1.TP-204<br>III.A3.TP-204<br>III.A5.TP-204 | 3.5.1-43 | A |
| Concrete (inaccessible areas): exterior above- and below-grade; foundation | EN, SNS, SRE | Concrete | Soil | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-212<br>III.A3.TP-212<br>III.A5.TP-212 | 3.5.1-65 | A |
| Concrete (inaccessible areas): exterior above- and below-grade; foundation | EN, SNS, SRE | Concrete | Soil | Increase in porosity and permeability; cracking; loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-29<br>III.A3.TP-29<br>III.A5.TP-29 | 3.5.1-67 | A |
| Duct banks | EN, SNS, SRE | Concrete | Soil | Cracking and distortion | Structures Monitoring | III.A3.TP-30 | 3.5.1-44 | A |

| Table 3.5.2-3: Turbine Building, Auxiliary Building, and Yard Structures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Duct banks | EN, SNS, SRE | Concrete | Soil | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A3.TP-212 | 3.5.1-65 | A |
| Duct banks | EN, SNS, SRE | Concrete | Soil | Increase in porosity and permeability; cracking; loss of material (spalling, scaling) | Structures Monitoring | III.A3.TP-29 | 3.5.1-67 | A |
| Foundations (e.g., switchyard, transformers, tanks, circuit breakers) | SNS, SRE | Concrete | Soil | Cracking and distortion | Structures Monitoring | III.A3.TP-30 | 3.5.1-44 | A |
| Foundations (e.g., switchyard, transformers, tanks, circuit breakers) | SNS, SRE | Concrete | Soil | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A3.TP-212 | 3.5.1-65 | A |
| Foundations (e.g., switchyard, transformers, tanks, circuit breakers) | SNS, SRE | Concrete | Soil | Increase in porosity and permeability; cracking; loss of material (spalling, scaling) | Structures Monitoring | III.A3.TP-29 | 3.5.1-67 | A |

**Table 3.5.2-3: Turbine Building, Auxiliary Building, and Yard Structures**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Foundations (e.g., switchyard, transformers, tanks, circuit breakers) | SNS, SRE | Concrete | Air – outdoor | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A3.TP-26 | 3.5.1-66 | A |
| Foundations (e.g., switchyard, transformers, tanks, circuit breakers) | SNS, SRE | Concrete | Air – outdoor | Increase in porosity and permeability; cracking; loss of material (spalling, scaling) | Structures Monitoring | III.A3.TP-28 | 3.5.1-67 | A |
| Manholes and handholes | EN, FLB, SNS, SRE, SSR | Concrete | Air – outdoor | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A3.TP-26 | 3.5.1-66 | A |
| Manholes and handholes | EN, FLB, SNS, SRE, SSR | Concrete | Air – outdoor | Increase in porosity and permeability; cracking; loss of material (spalling, scaling) | Structures Monitoring | III.A3.TP-28 | 3.5.1-67 | A |
| Manholes and handholes | EN, FLB, SNS, SRE, SSR | Concrete | Soil | Cracking and distortion | Structures Monitoring | III.A3.TP-30 | 3.5.1-44 | A |

| Table 3.5.2-3: Turbine Building, Auxiliary Building, and Yard Structures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Manholes and handholes | EN, FLB, SNS, SRE, SSR | Concrete | Soil | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A3.TP-212 | 3.5.1-65 | A |
| Manholes and handholes | EN, FLB, SNS, SRE, SSR | Concrete | Soil | Increase in porosity and permeability; cracking; loss of material (spalling, scaling) | Structures Monitoring | III.A3.TP-29 | 3.5.1-67 | A |
| Manholes and handholes | FB | Concrete | Air – outdoor | Cracking, loss of material | Fire Protection<br>Structures Monitoring | VII.G.A-92 | 3.3.1-61 | A |
| Manholes and handholes | FB | Concrete | Air – outdoor | Loss of material | Fire Protection<br>Structures Monitoring | VII.G.A-93 | 3.3.1-62 | A |
| Masonry wall | EN, FLB, SNS | Concrete block | Air – indoor uncontrolled | Cracking | Masonry Wall | III.A3.T-12 | 3.5.1-70 | A |
| Masonry wall | FB | Concrete block | Air – indoor uncontrolled | Cracking | Fire Protection<br>Structures Monitoring | VII.G.A-90 | 3.3.1-60 | C |
| Masonry wall | FB | Concrete block | Air – indoor uncontrolled | Loss of material | Fire Protection<br>Structures Monitoring | VII.G.A-91 | 3.3.1-62 | C |

| Table 3.5.2-3: Turbine Building, Auxiliary Building, and Yard Structures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Inflatable seal for spent fuel storage pool gates | EN | Elastomer | Air – indoor uncontrolled | Loss of sealing | Periodic Surveillance and Preventive Maintenance | II B4.CP-40 | 3.5.1-26 | E |

**Table 3.5.2-4**
**Bulk Commodities**
**Summary of Aging Management Evaluation**

**Table 3.5.2-4: Bulk Commodities**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Anchorage/ embedments | SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-43<br>III.B3.TP-43<br>III.B4.TP-43<br>III.B5.TP-43 | 3.5.1-92 | C |
| Anchorage/ embedments | SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-302<br>III.A3.TP-302<br>III.A4.TP-302<br>III.A5.TP-302 | 3.5.1-77 | C |
| Anchorage/ embedments | SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | ISI – IWF | III.B1.1.T-24<br>III.B1.2.T-24<br>III.B1.3.T-24 | 3.5.1-91 | C |
| Anchorage/ embedments | SNS, SRE, SSR | Carbon steel | Exposed to fluid environment | Loss of material | RG 1.127 | III.A6.TP-221 | 3.5.1-83 | A |
| Anchorage/ embedments | SNS, SRE, SSR | Carbon steel | Exposed to fluid environment | Loss of material | Water Chemistry Control – BWR<br>ISI – IWF | III.B1.1.TP-10 | 3.5.1-90 | A |
| Anchorage/ embedments | SNS, SRE, SSR | Stainless steel | Exposed to fluid environment (temperature < 140°F) | Loss of material | Water Chemistry Control – BWR<br>ISI – IWF | III.B1.1.TP-10 | 3.5.1-90 | A |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Anchorage/ embedments | SNS, SRE, SSR | Stainless steel | Air – indoor uncontrolled | None | None | III.B2.TP-8<br>III.B3.TP-8<br>III.B4.TP-8<br>III.B5.TP-8 | 3.5.1-95 | A |
| Cable tray | SNS, SRE, SSR | Galvanized steel, Aluminum | Air – indoor uncontrolled | None | None | III.B2.TP-8 | 3.5.1-95 | C |
| Cable tray | SNS, SRE, SSR | Galvanized steel, Aluminum | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-6 | 3.5.1-93 | C |
| Conduit | SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-43 | 3.5.1-92 | C |
| Conduit | SNS, SRE, SSR | Galvanized steel, Aluminum | Air – indoor uncontrolled | None | None | III.B2.TP-8 | 3.5.1-95 | C |
| Conduit | SNS, SRE, SSR | Galvanized steel, Aluminum | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-6 | 3.5.1-93 | C |
| Doors | EN, FLB, MB, PB | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A1.TP-302<br>III.A3.TP-302<br>III.A4.TP-302<br>III.A5.TP-302 | 3.5.1-77 | C |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Doors | EN, FLB, MB, PB | Carbon steel | Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-302<br>III.A3.TP-302<br>III.A5.TP-302 | 3.5.1-77 | C |
| Doors | EN, FLB, MB, PB | Galvanized steel | Air – indoor uncontrolled | None | None | III.B2.TP-8 | 3.5.1-95 | C |
| Doors | EN, FLB, MB, PB | Galvanized steel | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-6 | 3.5.1-93 | C |
| Fire doors | FB | Carbon steel | Air – indoor uncontrolled | Loss of material | Fire Protection | VII.G.A-21 | 3.3.1-59 | A |
| Fire doors | FB | Aluminum | Air – indoor uncontrolled | None | None | III.B2.TP-8 | 3.5.1-95 | C |
| Fire doors | SRE | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-302<br>III.A3.TP-302<br>III.A4.TP-302<br>III.A5.TP-302 | 3.5.1-77 | C |
| Fire hose reels | SRE | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Fire Water System | III.B2.TP-43 | 3.5.1-92 | E |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Fire protection components - miscellaneous steel, including framing steel, curbs, vents and louvers, radiant energy shields, tray covers | FB | Carbon steel | Air – indoor uncontrolled | Loss of material | Fire Protection | VII.G.A-21 | 3.3.1-59 | A |
| Fire protection components - miscellaneous steel, including framing steel, curbs, vents and louvers, radiant energy shields, tray covers | SNS, SRE | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A1.TP-302<br>III.A3.TP-302<br>III.A4.TP-302<br>III.A5.TP-302 | 3.5.1-77 | C |
| Fire protection components - miscellaneous steel, including framing steel, curbs, vents and louvers, radiant energy shields, tray covers | FB, SNS, SRE | Galvanized steel, Aluminum | Air – indoor uncontrolled | None | None | III.B2.TP-8<br>III.B4.TP-8<br>III.B5.TP-8 | 3.5.1-95 | C |

**Table 3.5.2-4: Bulk Commodities**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Manways, hatches, manhole covers and hatch covers | EN, FLB, PB, MB, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-302<br>III.A3.TP-302<br>III.A4.TP-302<br>III.A5.TP-302 | 3.5.1-77 | C |
| Mirror insulation | SNS | Stainless steel | Air – indoor uncontrolled | None | None | VII.J.AP-17 | 3.3.1-120 | C |
| Missile shields | EN, MB | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.A7.TP-302 | 3.5.1-77 | C |
| Missile shields | EN, MB | Galvanized steel | Air – indoor uncontrolled | None | None | III.B5.TP-8 | 3.5.1-95 | C |
| Missile shields | EN, MB | Galvanized steel | Air – outdoor | Loss of material | Structures Monitoring | III.A7.TP-302 | 3.5.1-77 | C |
| Miscellaneous steel (decking, framing, grating, handrails, ladders, enclosure plates, platforms, stairs, vents and louvers, framing steel, etc) | EN, FLB, SNS, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-302<br>III.A3.TP-302<br>III.A4.TP-302<br>III.A5.TP-302 | 3.5.1-77 | C |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Miscellaneous steel (decking, framing, grating, handrails, ladders, enclosure plates, platforms, stairs, vents and louvers, framing steel, etc) | EN, FLB, SNS, SSR | Galvanized steel, Aluminum | Air – indoor uncontrolled | None | None | III.B2.TP-8<br>III.B4.TP-8<br>III.B5.TP-8 | 3.5.1-95 | C |
| Miscellaneous steel (decking, framing, grating, handrails, ladders, enclosure plates, platforms, stairs, vents and louvers, framing steel, etc) | EN, FLB, SNS, SSR | Galvanized steel, Aluminum | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-6 | 3.5.1-93 | C |
| Penetration seals (end caps) | EN, FLB, PB, SNS, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-302<br>III.A3.TP-302<br>III.A4.TP-302<br>III.A5.TP-302 | 3.5.1-77 | C |
| Penetration seals (end caps) | FB | Carbon steel | Air – indoor uncontrolled | Loss of material | Fire Protection | VII.G.A-21 | 3.3.1-59 | C |
| Penetration sleeves (mechanical/ electrical not penetrating SCV boundary) | EN, FLB, PB, SNS, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.B2.TP-43 | 3.5.1-92 | C |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Penetration sleeves (mechanical/ electrical not penetrating SCV boundary) | FB | Carbon steel | Air – indoor uncontrolled | Loss of material | Fire Protection | VII.G.A-21 | 3.3.1-59 | C |
| Racks, panels, cabinets and enclosures for electrical equipment and instrumentation | EN, SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.B3.TP-43 | 3.5.1-92 | C |
| Racks, panels, cabinets and enclosures for electrical equipment and instrumentation | EN, SNS, SRE, SSR | Galvanized steel | Air – indoor uncontrolled | None | None | III.B3.TP-8 | 3.5.1-95 | C |
| Racks, panels, cabinets and enclosures for electrical equipment and instrumentation | EN, SNS, SRE, SSR | Galvanized steel | Air – outdoor | Loss of material | Structures Monitoring | III.B3.TP-43 | 3.5.1-92 | C |
| Racks, panels, cabinets and enclosures for electrical equipment and instrumentation | EN, SNS, SRE, SSR | Stainless steel | Air – indoor uncontrolled | None | None | III.B3.TP-8 | 3.5.1-95 | C |

**Table 3.5.2-4: Bulk Commodities**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Racks, panels, cabinets and enclosures for electrical equipment and instrumentation | EN, SNS, SRE, SSR | Stainless steel | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-6<br>III.B4.TP-6 | 3.5.1-93 | C |
| Supports for ASME Class 1, 2 and 3 piping and components (constant and variable load spring hangers; guides; stops) | SRE, SSR | Carbon steel, Galvanized steel | Air – indoor uncontrolled | Loss of mechanical function | ISI – IWF | III.B1.1.T-28<br>III.B1.2.T-28 | 3.5.1-57 | A |
| Support members; welds; bolted connections; support anchorage to building structure | SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-43<br>III.B3.TP-43<br>III.B4.TP-43<br>III.B5.TP-43 | 3.5.1-92 | A |
| Support members; welds; bolted connections; support anchorage to building structure | SRE, SSR | Carbon steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of material | ISI – IWF | III.B1.1.T-24<br>III.B1.2.T-24 | 3.5.1-91 | A |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Support members; welds; bolted connections; support anchorage to building structure | SNS, SRE, SSR | Galvanized steel, Aluminum | Air – indoor uncontrolled | None | None | III.B1.1.TP-8<br>III.B1.2.TP-8<br>III.B2.TP-8<br>III.B3.TP-8<br>III.B4.TP-8<br>III.B5.TP-8 | 3.5.1-95 | A |
| Support members; welds; bolted connections; support anchorage to building structure | SNS, SRE, SSR | Galvanized steel, Aluminum | Air – outdoor | Loss of material | ISI – IWF | III.B1.1.T-24<br>III.B1.2.T-24 | 3.5.1-91 | A |
| Support members; welds; bolted connections; support anchorage to building structure | SNS, SRE, SSR | Galvanized steel, Aluminum | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-6<br>III.B4.TP-6 | 3.5.1-93 | A |
| Support members; welds; bolted connections; support anchorage to building structure | SNS, SRE, SSR | Galvanized steel | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-43<br>III.B3.TP-43<br>III.B4.TP-43<br>III.B5.TP-43 | 3.5.1-92 | A |
| Support members; welds; bolted connections; support anchorage to building structure | SNS, SRE, SSR | Galvanized steel | Exposed to fluid environment | Loss of material | RG 1.127 | III.A6.TP-221 | 3.5.1-83 | C |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Support members; welds; bolted connections; support anchorage to building structure | SNS, SRE, SSR | Stainless steel | Air – indoor uncontrolled | None | None | III.B2.TP-8<br>III.B3.TP-8 | 3.5.1-95 | A |
| Support members; welds; bolted connections; support anchorage to building structure | SNS, SRE, SSR | Stainless steel | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-6<br>III.B4.TP-6 | 3.5.1-93 | A |
| Support members; welds; bolted connections; support anchorage to building structure | SNS, SRE, SSR | Stainless steel | Exposed to fluid environment (temperature < 140°F) | Loss of material | Water Chemistry Control – BWR<br>ISI – IWF | III.B1.1.TP-10 | 3.5.1-90 | A |
| Tube track | SNS, SRE, SSR | Galvanized steel | Air – indoor uncontrolled | None | None | III.B2.TP-8 | 3.5.1-95 | C |
| Tube track | SNS, SRE, SSR | Galvanized steel | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-6 | 3.5.1-93 | A |
| Tube track | SNS, SRE, SSR | Stainless steel | Air – indoor uncontrolled | None | None | III.B2.TP-8 | 3.5.1-95 | A |
| Tube track | SNS, SRE, SSR | Stainless steel | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-6 | 3.5.1-93 | A |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Anchor bolts | SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A1.TP-248<br>III.A3.TP-248<br>III.A4.TP-248<br>III.A5.TP-248 | 3.5.1-80 | A |
| Anchor bolts | SNS, SRE, SSR | Carbon steel | Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-274<br>III.A3.TP-274<br>III.A4.TP-274<br>III.A5.TP-274 | 3.5.1-82 | A |
| Anchor bolts | SNS, SRE, SSR | Carbon steel | Exposed to fluid environment | Loss of material | RG 1.127 | III.A6.TP-221 | 3.5.1-83 | A |
| Anchor bolts | SNS, SRE, SSR | Galvanized steel | Air – indoor uncontrolled | None | None | III.B2.TP-8 | 3.5.1-95 | C |
| Anchor bolts | SNS, SRE, SSR | Galvanized steel | Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-274<br>III.A3.TP-274<br>III.A4.TP-274<br>III.A5.TP-274 | 3.5.1-82 | A |
| Anchor bolts | SNS, SRE, SSR | Galvanized steel | Exposed to fluid environment | Loss of material | RG 1.127 | III.A6.TP-221 | 3.5.1-83 | A |
| Anchor bolts | SNS, SRE, SSR | Stainless steel | Air – indoor uncontrolled | None | None | III.B2.TP-8 | 3.5.1-95 | C |
| Anchor bolts | SNS, SRE, SSR | Stainless steel | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-6<br>III.B4.TP-6 | 3.5.1-93 | C |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Anchor bolts | SNS, SRE, SSR | Stainless steel | Exposed to fluid environment (temperature < 140°F) | Loss of material | Water Chemistry Control – BWR<br>ISI – IWF | III.B1.1.TP-10 | 3.5.1-90 | A |
| High strength structural bolting (supports for ASME Class 1, 2, and 3 piping and components) | SRE, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | ISI – IWF | III.B1.1.TP-226<br>III.B1.2.TP-226 | 3.5.1-81 | A |
| High strength structural bolting (supports for ASME Class 1, 2, and 3 piping and components) | SRE, SSR | Stainless steel | Air – indoor uncontrolled | None | None | III.B2.TP-8<br>III.B3.TP-8 | 3.5.1-95 | A |
| High strength structural bolting (supports for ASME Class 1, 2, and 3 piping and components) | SRE, SSR | Carbon steel, Stainless steel | Air – indoor uncontrolled | Loss of preload | ISI – IWF | III.B1.1.TP-229<br>III.B1.2.TP-229 | 3.5.1-87 | A |

**Table 3.5.2-4: Bulk Commodities**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural bolting; structural steel and miscellaneous steel connections, including high strength bolting (decking, grating, handrails, ladders, platforms, stairs, vents and louvers, framing steel, etc.) | SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.A1.TP-248<br>III.A3.TP-248<br>III.A4.TP-248<br>III.A5.TP-248<br>III.A6.TP-248<br>III.A7.TP-248<br>III.A8.TP-248 | 3.5.1-80 | A |
| Structural bolting; structural steel and miscellaneous steel connections, including high strength bolting (decking, grating, handrails, ladders, platforms, stairs, vents and louvers, framing steel, etc.) | SNS, SRE, SSR | Carbon steel Galvanized steel | Air – outdoor | Loss of material | Structures Monitoring | III.A1.TP-274<br>III.A3.TP-274<br>III.A4.TP-274<br>III.A5.TP-274<br>III.A7.TP-274<br>III.A8.TP-274 | 3.5.1-82 | A |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Structural bolting; structural steel and miscellaneous steel connections, including high strength bolting (decking, grating, handrails, ladders, platforms, stairs, vents and louvers, framing steel, etc.) | SNS, SRE, SSR | Galvanized steel | Air – indoor uncontrolled | None | None | III.B5.TP-8 | 3.5.1-95 | C |
| Structural bolting | SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | Structures Monitoring | III.B2.TP-248<br>III.B3.TP-248<br>III.B4.TP-248<br>III.B5.TP-248 | 3.5.1-80 | A |
| Structural bolting | SNS, SRE, SSR | Carbon steel | Air – indoor uncontrolled | Loss of material | ISI – IWF | III.B1.1.TP-226<br>III.B1.2.TP-226 | 3.5.1-81 | A |
| Structural bolting | SNS, SRE, SSR | Carbon steel | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-274<br>III.B3.TP-274<br>III.B4.TP-274<br>III.B5.TP-274 | 3.5.1-82 | A |
| Structural bolting | SNS, SRE, SSR | Carbon steel | Air – outdoor | Loss of material | RG 1.127 | III.A6.TP-221 | 3.5.1-83 | A |
| Structural bolting | SNS, SRE, SSR | Carbon steel | Air – outdoor | Loss of material | ISI – IWF | III.B1.1.TP-235<br>III.B1.2.TP-235 | 3.5.1-86 | A |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Structural bolting | SNS, SRE, SSR | Galvanized steel | Air – indoor uncontrolled | None | None | III.B1.1.TP-8<br>III.B1.2.TP-8<br>III.B2.TP-8<br>III.B3.TP-8<br>III.B4.TP-8<br>III.B5.TP-8 | 3.5.1-95 | C |
| Structural bolting | SNS, SRE, SSR | Galvanized steel | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-274<br>III.B3.TP-274<br>III.B4.TP-274<br>III.B5.TP-274 | 3.5.1-82 | A |
| Structural bolting | SNS, SRE, SSR | Galvanized steel | Air – outdoor | Loss of material | ISI – IWF | III.B1.1.TP-235<br>III.B1.2.TP-235 | 3.5.1-86 | A |
| Structural bolting | SNS, SRE, SSR | Stainless steel | Air – indoor uncontrolled | None | None | III.B1.1.TP-8<br>III.B1.2.TP-8<br>III.B2.TP-8<br>III.B3.TP-8<br>III.B4.TP-8<br>III.B5.TP-8 | 3.5.1-95 | C |
| Structural bolting | SNS, SRE, SSR | Stainless steel | Air – outdoor | Loss of material | Structures Monitoring | III.B2.TP-6<br>III.B4.TP-6 | 3.5.1-93 | C |
| Structural bolting | SNS, SRE, SSR | Stainless steel | Air – outdoor | Loss of material | ISI – IWF | III.B2.TP-6 | 3.5.1-93 | E |

**Table 3.5.2-4: Bulk Commodities**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural bolting | SNS, SRE, SSR | Carbon steel, Galvanized steel, Stainless steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of preload | Structures Monitoring | III.A1.TP-261<br>III.A3.TP-261<br>III.A4.TP-261<br>III.A5.TP-261<br>III.A6.TP-261<br>III.A7.TP-261<br>III.A8.TP-261<br>III.B2.TP-261<br>III.B3.TP-261<br>III.B4.TP-261<br>III.B5.TP-261 | 3.5.1-88 | A |
| Structural bolting | SNS, SRE, SSR | Carbon steel, Galvanized steel, Stainless steel | Air – indoor uncontrolled<br>Air – outdoor | Loss of preload | ISI – IWF | III.B1.1.TP-229<br>III.B1.2.TP-229 | 3.5.1-87 | A |
| Building concrete at locations of expansion and grouted anchors; grout pads for support base plates | SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Reduction in concrete anchor capacity | Structures Monitoring | III.B1.1.TP-42<br>III.B1.2.TP-42<br>III.B2.TP-42<br>III.B3.TP-42<br>III.B4.TP-42<br>III.B5.TP-42 | 3.5.1-55 | A |
| Equipment pads/ foundations | SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking | Structures Monitoring | III.A1.TP-25<br>III.A3.TP-25<br>III.A4.TP-25<br>III.A5.TP-25 | 3.5.1-54 | A |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Equipment pads/ foundations | SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-26<br>III.A3.TP-26<br>III.A4.TP-26<br>III.A5.TP-26 | 3.5.1-66 | A |
| Equipment pads/ foundations | SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Increase in porosity and permeability, cracking, loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-28<br>III.A3.TP-28<br>III.A4.TP-28<br>III.A5.TP-28 | 3.5.1-67 | A |
| Equipment pads/ foundations | SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking, loss of bond, and loss of material (spalling, scaling) | RG 1.127 | III.A6.TP-38 | 3.5.1-59 | A |
| Curbs | FLB, SNS, SRE | Concrete | Air – indoor uncontrolled | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A3.TP-26 | 3.5.1-66 | A |
| Curbs | FLB, SNS, SRE | Concrete | Air – indoor uncontrolled | Increase in porosity and permeability, cracking, loss of material (spalling, scaling | Structures Monitoring | III.A3.TP-28 | 3.5.1-67 | A |
| Curbs | FLB, SNS, SRE | Concrete | Air – indoor uncontrolled | Cracking | Structures Monitoring | III.A3.TP-25 | 3.5.1-54 | A |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Manways, hatches/ plugs, manhole covers and hatch covers | FLB, PB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-26<br>III.A3.TP-26<br>III.A4.TP-26<br>III.A5.TP-26 | 3.5.1-66 | A |
| Manways, hatches/ plugs, manhole covers and hatch covers | FLB, PB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Increase in porosity and permeability, cracking, loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-28<br>III.A3.TP-28<br>III.A4.TP-28<br>III.A5.TP-28 | 3.5.1-67 | A |
| Manways, hatches/ plugs, manhole covers and hatch covers | FLB, PB, SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking | Structures Monitoring | III.A1.TP-25<br>III.A3.TP-25<br>III.A4.TP-25<br>III.A5.TP-25 | 3.5.1-54 | A |
| Manways, hatches/ plugs, manhole covers and hatch covers | FB | Concrete | Air – indoor uncontrolled | Loss of material | Fire Protection<br>Structures Monitoring | VII.G.A-91 | 3.3.1-62 | A |
| Manways, hatches/ plugs, manhole covers and hatch covers | FB | Concrete | Air – indoor uncontrolled | Cracking | Fire Protection<br>Structures Monitoring | VII.G.A-90 | 3.3.1-60 | A |
| Manways, hatches/ plugs, manhole covers and hatch covers | FB | Concrete | Air – outdoor | Cracking, loss of material | Fire Protection<br>Structures Monitoring | VII.G.A-92 | 3.3.1-61 | A |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Manways, hatches/ plugs, manhole covers and hatch covers | FB | Concrete | Air – outdoor | Loss of material | Fire Protection<br>Structures Monitoring | VII.G.A-93 | 3.3.1-62 | A |
| Missile shields | MB | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A7.TP-26 | 3.5.1-66 | A |
| Missile shields | MB | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Increase in porosity and permeability, cracking, loss of material (spalling, scaling) | Structures Monitoring | III.A7.TP-28 | 3.5.1-67 | A |
| Missile shields | MB | Concrete | Air – indoor uncontrolled | Cracking | Structures Monitoring | III.A7.TP-25 | 3.5.1-54 | A |
| Structural fire barriers; walls, ceilings, floor slabs, curbs, dikes | FB | Concrete | Air – indoor uncontrolled | Cracking | Fire Protection<br>Structures Monitoring | VII.G.A-90 | 3.3.1-60 | A |
| Structural fire barriers; walls, ceilings, floor slabs, curbs, dikes | FB | Concrete | Air – indoor uncontrolled | Loss of material | Fire Protection<br>Structures Monitoring | VII.G.A-91 | 3.3.1-62 | A |

**Table 3.5.2-4: Bulk Commodities**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural fire barriers; walls, ceilings, floor slabs, curbs, dikes | FB | Concrete | Air – outdoor | Cracking, loss of material | Fire Protection<br>Structures Monitoring | VII.G.A-92 | 3.3.1-61 | A |
| Support pedestals | SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking, loss of bond, and loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-26<br>III.A3.TP-26<br>III.A4.TP-26<br>III.A5.TP-26 | 3.5.1-66 | A |
| Support pedestals | SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Increase in porosity and permeability, cracking, loss of material (spalling, scaling) | Structures Monitoring | III.A1.TP-28<br>III.A3.TP-28<br>III.A4.TP-28<br>III.A5.TP-28 | 3.5.1-67 | A |
| Support pedestals | SNS, SRE, SSR | Concrete | Air – indoor uncontrolled<br>Air – outdoor | Cracking | Structures Monitoring | III.A1.TP-25<br>III.A3.TP-25<br>III.A4.TP-25<br>III.A5.TP-25 | 3.5.1-54 | A |
| Compressible joints and seals | SNS, SSR | Elastomers | Air – indoor uncontrolled<br>Air – outdoor | Loss of sealing | Structures Monitoring | III.A6.TP-7 | 3.5.1-72 | A |
| Compressible joints and seals | SNS, SSR | Elastomers | Exposed to fluid environment | Loss of sealing | Structures Monitoring | III.A6.TP-7 | 3.5.1-72 | A |

**Table 3.5.2-4: Bulk Commodities**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Fire stops | FB | Cerablanket, Ceraboard Cerafiber, Kaowool blanket, Kaowool bulk fiber, Thermo-lag | Air – indoor uncontrolled | Loss of material, Change in material properties, Cracking/ delamination, separation | Fire Protection | -- | -- | J |
| Fire wrap | FB | Cerablanket, Ceraboard Cerafiber, Kaowool blanket, Kaowool bulk fiber, Thermo-lag | Air – indoor uncontrolled | Loss of material, Change in material properties, Cracking/ delamination, separation | Fire Protection | -- | -- | J |
| Insulation (includes jacketing, wire mesh, tie wires, straps, clips) | SNS | Fiberglass, calcium silicate | Air – indoor uncontrolled | Loss of material, Change in material properties | Structures Monitoring | -- | -- | J |
| Insulation (includes jacketing, wire mesh, tie wires, straps, clips) | IN | Fiberglass, calcium silicate | Air – indoor uncontrolled | Reduced thermal insulation resistance | External Surfaces Monitoring | VIII.S-401 | 3.4.1-64 | A |

| Table 3.5.2-4: Bulk Commodities | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Insulation (includes jacketing, wire mesh, tie wires, straps, clips) | SNS | Aluminum | Air – indoor uncontrolled | None | None | VII.J.AP-36 | 3.3.1-113 | C |
| Insulation (includes jacketing, wire mesh, tie wires, straps, clips) | SNS | Stainless steel | Air – indoor uncontrolled | None | None | VII.J.AP-17 | 3.3.1-120 | C |
| Penetration seals | FB | Elastomers | Air – indoor uncontrolled | Increased hardness, shrinkage, loss of strength | Fire Protection | VII G.A-19 | 3.3.1-57 | A |
| Penetration seals | EN, FLB, PB, SNS | Elastomers | Air – indoor uncontrolled<br>Air – outdoor | Loss of sealing | Structures Monitoring | III.A6.TP-7 | 3.5.1-72 | A |
| Roof membranes | EN, SNS | Elastomers | Air – outdoor | Loss of sealing | Structures Monitoring | III.A6.TP-7 | 3.5.1-72 | C |
| Seals and gaskets (doors, manways and hatches) | FLB, PB, SSR | Elastomers | Air – indoor uncontrolled<br>Air – outdoor | Loss of sealing | Structures Monitoring | III.A6.TP-7 | 3.5.1-72 | A |
| Vibration isolators | SNS, SSR | Elastomers | Air – indoor uncontrolled | Reduction or loss of isolation function | Structures Monitoring | III.B4.TP-44 | 3.5.1-94 | E |

# 3.6 ELECTRICAL AND INSTRUMENTATION AND CONTROLS

## 3.6.1 Introduction

This section provides the results of the aging management review for RBS electrical components that were subject to aging management review. Consistent with the methods described in NEI 95-10, the electrical and I&C aging management reviews focus on commodity groups rather than systems. The following electrical commodity groups requiring aging management review are addressed in this section.

- High-voltage insulators
- Non-EQ insulated cables and connections
  - Cable connections (metallic parts)
  - Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements
  - Electrical cables not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits
  - Fuse holders (insulation material)
  - Inaccessible power (≥ 400 V) cables (e.g., installed underground in conduit, duct bank or direct buried) not subject to 10 CFR 50.49 EQ requirements
- Switchyard bus and connections
- Transmission conductors and connections

Table 3.6.1, Summary of Aging Management Programs for Electrical and I&C Components Evaluated in Chapter VI of NUREG-1801, provides the summary of the aging management reviews and the programs evaluated in NUREG-1801 for the electrical and I&C components. This table uses the format described in the introduction to Section 3. Hyperlinks are provided to the program evaluations in Appendix B.

## 3.6.2 Results

Table 3.6.2, Electrical and I&C Components—Summary of Aging Management Evaluation, summarizes the results of aging management reviews and the NUREG-1801 comparison for electrical and I&C components.

### 3.6.2.1 Materials, Environments, Aging Effects Requiring Management, and Aging Management Programs

The following sections list the materials, environments, aging effects requiring management, and aging management programs for electrical and I&C components subject to aging management review. Programs are described in Appendix B. Further details are provided in Table 3.6.2.

**Materials**

Electrical and I&C components subject to aging management review are constructed of the following materials.

- Aluminum
- Cement
- Galvanized metals
- Insulation material – various organic polymers
- Porcelain
- Steel and steel alloys
- Various metals used for bus and electrical connections

**Environments**

Electrical and I&C components subject to aging management review are exposed to the following environments.

- Air – indoor controlled
- Air – indoor uncontrolled
- Air – outdoor
- Heat, moisture, or radiation and air
- Significant moisture

**Aging Effects Requiring Management**

The following aging effects associated with electrical and I&C components require management.

- Increased resistance of connection
- Reduced insulation resistance (IR)

**Aging Management Programs**

The following aging management programs will manage the effects of aging on electrical and I&C components.

- Non-EQ Electrical Cable Connections
- Non-EQ Inaccessible Power Cables ($\geq$ 400 V)
- Non-EQ Insulated Cables and Connections
- Non-EQ Sensitive Instrumentation Circuits Test Review

### 3.6.2.2 Further Evaluation of Aging Management as Recommended by NUREG-1800

NUREG-1800 indicates that further evaluation is necessary for certain aging effects and other issues. Section 3.6.2.2 of NUREG-1800 discusses these aging effects and other issues that require further evaluation. The following sections, numbered corresponding to the discussions in NUREG-1800, explain the RBS approach to these areas requiring further evaluation. Programs are described in Appendix B of this application.

#### 3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

Electrical equipment environmental qualification (EQ) analyses may be TLAAs as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). The evaluation of EQ TLAAs are addressed in Section 4.4. EQ components are subject to replacement based on a qualified life. Therefore, in accordance with 10 CFR 54.21(a)(1)(ii), EQ components are not subject to aging management review.

#### 3.6.2.2.2 Degradation of Insulator Quality due to Presence of Any Salt Deposits and Surface Contamination, and Loss of Material due to Mechanical Wear

The discussion in NUREG-1800 concerns effects of these aging mechanisms on high voltage insulators.

*Degradation of Insulator Quality due to Presence of Any Salt Deposits and Surface Contamination*

High voltage insulators are subject to aging management review if they are necessary for the alternate AC (AAC) source for SBO or recovery of offsite power following an SBO. Other high voltage insulators are not subject to aging management review since they do not perform a license renewal intended function.

The high voltage insulators evaluated for RBS license renewal are those used to support uninsulated, high-voltage electrical components such as transmission conductors and switchyard buses that are in the scope of license renewal.

Various airborne materials such as dust, salt and industrial effluents can contaminate insulator surfaces. The buildup of surface contamination is gradual and in most cases removed by rainfall. The glazed insulator surface facilitates contamination removal. A large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover.

A corrective action program report in 2004 documented arcing on the 230 kV insulators one span out from the main transformer structure. An additional report in 2004 documented the observation of corona (the partial ionization of the air surrounding an insulator due to irregularities in the insulator or contamination on the insulator) and arcing on several 230 kV insulators. The report stated that arcing occurred only when the cooling tower plume was in the area.

Another event in 2004 documented an extremely dense fog at RBS. This fog wetted the contamination layer on the 230 kV system, and the A-phase of RSS1 arced to ground across the bottom insulator of disconnect switch YWC-SW21216. This switch is located on the southernmost tower in RBS Transformer Yard #1. Subsequent testing of two RSS1 insulators in RBS Transformer Yard #1 found equivalent salt deposit density levels of 0.061 $mg/cm^2$ and 0.090 $mg/cm^2$. Testing performed by Columbia Nuclear Station has found that the maximum equivalent salt deposit density level that high voltage insulators can be subjected to without flashing over is 0.05 $mg/cm^2$. The RSS1 insulators which were tested after this event were over this limit.

It has been common to see increased precipitation from the circulating water cooling tower drift during the summer months; however, in 2004 the amount of precipitation from the cooling tower drift was significantly greater than in prior years. This was attributed to damaged and missing drift eliminators in the cooling towers. The increased precipitation from the cooling tower drift in conjunction with the lack of significant rainfall (which would have aided in cleaning insulators) in the summer of 2004 led to the deposition of a contamination layer on the 230 kV insulators. (According to the National Weather Service, from July 2004 through September 2004, Baton Rouge received 6.56 inches of rain. This is only 41 percent of the normal average rainfall for these months.) According to chemical analysis performed by the RBS chemistry department, this contamination layer consisted of chemicals found in the circulating water, including sodium chloride ($NaCl$), sodium sulfate ($NaSO_4$) and calcium sulfate ($CaSO_4$). When the contamination layer on the insulators is wetted (by cooling tower drift or fog), it becomes conductive due to the ionization of the deposited salts by the water.

The initiating event that led to the loss of RSS1 and the reactor trip on October 1, 2004, was the degradation of the cooling tower drift eliminators. The degraded condition of the drift eliminators allowed excessive moisture carryover from the cooling towers to the transformer yard, thereby causing the insulators in the transformer yard to become contaminated. This was confirmed by analysis of the insulator contaminant makeup as well as measurement of the equivalent salt deposit density.

Immediate corrective actions included replacement of damaged 230 kV insulators, replacement of damaged bus work, replacement of damaged current transformers in the Fancy Point Switchyard, cleaning and inspection of 230 kV insulators and bushings on transformers, and performance of tests on the bushings (Megger / Doble / Power Factor) of the transformers.

Additional actions included installing test insulators to monitor contamination levels using the equivalent salt deposit density to determine when insulator cleaning is required. The corrective actions taken also included guidance to aid in the monitoring and assessment of corona and arcing that was being observed in the transformer yard and transmission towers.

In 2006, a condition was observed (230 kV insulator arcing) that was a trigger point for using the additional guidance developed in 2004. Audible indication was noted on the second tower south of the transformer yard and west of the clarifiers. No visual signs of corona were noted with the naked eye, but corona activity was observed with the coronal camera. The arcing noted with the coronal camera was across the bells of the insulators only. The sets of insulators with arcing were located on the eastern side of the tower. Only two bells on each of the insulators indicated arcing. Weather conditions were light fog with a light cooling tower drift sporadically reaching the affected tower area. The first tower south of the transformer yard was also checked for visual signs of corona with none noted. This tower was also more in line with cooling tower drift.

Operations monitored these insulators and responded in accordance with procedural criteria for 230 kV insulator arcing. The procedural trigger point provides early warning of insulator contamination, and the guidance provides the station with monitoring and cleaning instructions, such that the insulators maintain their function without failure. The 230 kV towers were inspected, and as a result of this inspection, the insulators on the tower with the noted condition were cleaned.

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. RBS is not located near the seacoast or near other sources of airborne particles. The operating experience noted for RBS high voltage insulators is based on local weather events, not aging. Operations monitors the high voltage insulators and responds in accordance with procedural criteria for 230 kV insulator arcing. Therefore, reduced insulation resistance due to surface contamination is not an applicable aging effect for high-voltage insulators at RBS.

_Loss of Material due to Mechanical Wear_

Loss of material due to mechanical wear is a potential aging effect for strain and suspension insulators subject to movement. Although this aging effect is possible, industry experience has shown transmission conductors do not normally swing. When subjected to a substantial wind, movement will subside after a short period. Wear has not been apparent during routine inspections and is not a credible aging effect. The assessment for transmission conductors for loss of material (wear) in Section 3.6.2.2.3 provides additional information on this topic.

Wind loading could cause transmission conductor vibration or sway. Wind loading that can cause a transmission line and insulators to vibrate is considered in the design and installation of transmission conductors at RBS. Loss of material (wear) and fatigue that could be caused by transmission conductor vibration or sway are not applicable aging effects in that they would not cause a loss of intended function if left unmanaged for the period of extended operation.

There are no aging effects requiring management for RBS high-voltage insulators.

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

Transmission conductors are uninsulated, stranded electrical cables used outside buildings in high voltage applications. The transmission conductor commodity group includes the associated fastening hardware but excludes the high-voltage insulators. Major active equipment assemblies include their associated transmission conductor terminations.

Transmission conductors are subject to aging management review if they are necessary for recovery of offsite power following an SBO. At RBS, transmission conductors from the RBS 230 kV switchyard to the preferred station transformers (1RTX-XSR1C and 1RTX-XSR1D) support recovery from an SBO. These RBS transmission conductors consist of aluminum conductor, alloy reinforced (ACAR) and aluminum conductor, galvanized steel reinforced (ACSR) construction as stated below. Other transmission conductors are not subject to aging management review since they do not perform a license renewal intended function.

The RBS transmission conductor Line 1 (most eastern) consists of five double circuit H-frame structures, six spans (ranging from 375 feet to 951 feet) and a substation tower on each end energized to 230 kV. The most eastern circuit of the double circuit has three phases of 1024.5 thousand circular mils (MCM) 24/13 ACAR conductors. The most western circuit of the double circuit has three phases of triple bundle 1024.5 MCM 24/13 ACAR conductor. The total length of Line 1 is 4195 feet.

The RBS transmission conductor Line 2 (most western) consists of four single circuit H-frame structures, five spans (ranging from 503 feet to 1077 feet) and a substation tower on each end. The conductor is three phases of 795 MCM 26/7 ACSR energized at 230 kV. The total length of Line 2 is 3738 feet.

Switchyard bus is uninsulated, un-enclosed, rigid electrical conductors used in medium- and high-voltage applications. Switchyard bus includes the hardware used to secure the bus to high-voltage insulators. Switchyard bus establishes electrical connections to disconnect switches, switchyard breakers, and transformers.

Switchyard bus is subject to aging management review if it is necessary for recovery of offsite power following an SBO. At RBS, switchyard bus from the 230 kV switchyard breakers to the 230 kV transmission conductors support recovery from an SBO. Other switchyard bus does not require aging management review since it does not perform a license renewal intended function.

*Loss of Material due to Wind Induced Abrasion and Fatigue*

Wind loading could cause transmission conductor vibration or sway. Wind loading that can cause a transmission line and insulators to vibrate is considered in the design and installation of transmission conductors at RBS. Loss of material (wear) and fatigue that could be caused by transmission conductor vibration or sway are not aging effects requiring management in that they would not cause a loss of intended function if left unmanaged for the period of extended operation.

Switchyard bus is connected to active equipment by short sections of flexible conductors such that the rigid bus does not normally vibrate, since it is supported by insulators and ultimately by static, structural components such as concrete footings and structural steel. Vibration issues occur early in plant life and as a result of inadequate design, installation, or maintenance. The flexible conductors withstand the minor vibrations associated with the active switchyard components. Flexible conductors are part of the switchyard bus commodity group. Vibration is not applicable since flexible connectors connecting switchyard bus to active components eliminate the potential for vibration.

A review of industry operating experience and NRC generic communications related to the aging of transmission conductors verified that no additional aging effects exist. A review of plant-specific operating experience did not identify any unique aging effects for transmission conductors.

Therefore, loss of material due to wear of transmission conductors is not an aging effect requiring management at RBS.

Therefore, loss of material due to wear of switchyard bus is not an aging effect requiring management at RBS.

*Loss of Conductor Strength due to Corrosion*

The aging effect loss of conductor strength (corrosion) applies to aluminum conductor steel reinforced (ACSR) transmission conductors. The most prevalent mechanism contributing to loss of conductor strength of an ACSR transmission conductor is corrosion, which includes corrosion of the steel core and aluminum strand pitting. For ACSR transmission conductors, degradation begins as a loss of zinc from the galvanized steel core wires. RBS ACAR conductors are similar in construction to the ACSR design except that the core is an aluminum alloy that gives the conductor better corrosion resistance.

RBS ACAR conductors, unlike ACSR, are not susceptible to environmental influences, such as sulfur dioxide ($SO_2$) concentration in the air. When aluminum corrodes, it forms a protective oxide layer that protects the underlying material from further corrosion. ACSR conductors are susceptible to environmental influences, such as $SO_2$ concentration in the air. When the steel core of an ACSR conductor loses its galvanized coating, it will continually corrode, causing a decrease in ultimate strength. Therefore, the RBS ACAR transmission conductors are not susceptible to the same corrosion phenomenon as ACSR transmission conductors.

Corrosion in ACSR conductors is a very slow acting mechanism, and the corrosion rates depend largely on air quality, which includes suspended particles chemistry, $SO_2$ concentration in air, precipitation, fog chemistry, and meteorological conditions. Tests performed by Ontario Hydroelectric showed a 30 percent loss of composite conductor strength of an 80-year-old ACSR conductor due to corrosion. The License Renewal Electrical Handbook (LREH) makes statements relative to transmission conductor aged strengths based upon testing performed by Ontario Hydroelectric.

Although the RBS ACAR transmission conductors are not susceptible to the same corrosion phenomenon as ACSR transmission conductors, the findings from the Ontario Hydroelectric study of ACSR transmission conductors are conservatively applied to the RBS ACAR transmission conductors, so it is postulated that the RBS ACAR transmission conductors corrode at the same rate as comparable ACSR transmission conductors over 80 years.

The Ontario Hydroelectric study is considered to bound the RBS configuration and corrosion rate because the aluminum alloy core is more corrosion resistant than galvanized steel. The example presented in the Electric Power Research Institute (EPRI) LREH compares a 4/0 ACSR conductor to the results of the Ontario Hydroelectric study. The same comparison is made here for the RBS transmission conductors.

There is a set percentage of composite conductor strength established at which a transmission conductor is replaced. As illustrated below, there is ample strength margin to maintain the RBS transmission conductor intended function through the period of extended operation.

The National Electrical Safety Code (NESC) requires that tension on installed conductors be a maximum of 60 percent of the ultimate conductor strength. The NESC also sets the tension a conductor must be designed to withstand under heavy load conditions, which includes consideration of ice, wind and temperature. These requirements are reviewed concerning the specific conductors included in this AMR. The following evaluation of the conductor type with the smallest ultimate strength margin (4/0 ACSR) in the NESC illustrates the conservative nature of the design of RBS transmission conductors required for offsite power recovery.

The ultimate strength and the strength specified to meet the NESC heavy load tension conditions of 4/0 ACSR are 8350 lbs and 2761 lbs, respectively. The margin between the strength necessary to meet the NESC heavy load conditions and the ultimate strength is 5589 lbs; i.e., there is 67 percent of ultimate strength.

The Ontario Hydroelectric study showed a 30 percent loss of composite conductor strength in an 80-year-old conductor. In the case of the 4/0 ACSR transmission conductors, a 30 percent loss of ultimate strength would mean that there would still be a 37 percent ultimate strength margin between what is required by the NESC and the actual conductor strength. The 4/0 ACSR conductor type has the lowest initial design margin of transmission conductors included in the aging management review. This illustrates with reasonable assurance that transmission conductors will have ample strength through the period of extended operation.

A review of industry operating experience and NRC generic communications related to the aging of transmission conductors verified that no additional aging effects exist. A review of plant-specific operating experience did not identify any unique aging effects for transmission conductors.

Therefore, loss of conductor strength is not an aging effect requiring management for transmission conductors.

*Increased Resistance of Connection due to Oxidation*

Corrosion due to surface oxidation for aluminum switchyard bus and connections is not applicable since switchyard bus connections requiring aging management review are welded connections. However, the flexible conductors, which are welded to the switchyard bus, are bolted to the other switchyard components. These steel and steel-alloy switchyard component connections are included in the infrared inspection of the 230 kV switchyard connections, which verifies the effectiveness of the connection design and installation practices. RBS performs infrared inspections of the 230 kV switchyard connections and transformer yard connections to verify the integrity of the connections at least once a year. This inspection and the absence of plant specific operating experience verifies that this aging effect is not significant for RBS.

Increased connection resistance due to surface oxidation is a potential aging mechanism but is not significant enough to cause a loss of intended function. The components in the switchyard are exposed to precipitation, but these components experience only minor oxidation, which does not affect the ability of the connections to perform their intended function. At RBS, switchyard connection surfaces are coated with an anti-oxidant compound (i.e., a grease-type sealant) prior to tightening the connection to prevent the formation of oxides on the metal surface and to prevent moisture from entering the connections, thus reducing the chances of corrosion. Based on operating experience (RBS and the industry), this method of installation provides a corrosion-resistant low electrical resistance connection. In addition, the infrared inspection of the 230 kV switchyard verifies that this aging effect is not significant for RBS. This discussion is applicable for bolted connections of transmission conductors and switchyard bus.

Therefore, increased connection resistance due to general corrosion resulting from oxidation of switchyard connection metal surfaces is not an aging effect requiring management at RBS.

*Increased Resistance of Connection due to Loss of Pre-load*

Increased connection resistance due to loss of pre-load (torque relaxation) for switchyard connections is not an aging effect requiring management. The LREH does not list this as an applicable aging effect. The design of the transmission conductor bolted connections precludes torque relaxation as confirmed by plant-specific operating experience. The RBS operating experience review did not identify any failures of switchyard connections. The design of switchyard bolted connections includes Bellville washers and an anti-oxidant compound (No-Ox grease). The type of bolting plate and the use of Bellville washers is the industry standard to preclude torque relaxation. Transmission conductor and switchyard bus bolted connections use stainless steel (Alloy 304) bolts, nuts and washers including Belleville washers. This combined with the proper sizing of the conductors eliminates the need to consider this aging mechanism; therefore, increased connection resistance due to loss of pre-load is not an aging effect requiring management. This discussion is applicable for bolted connections of transmission conductors and switchyard bus.

In-scope transmission conductors at RBS are limited to the connections from the 230 kV switchyard to preferred station service transformers (1RTX-XSR1C and 1RTX-XSR1D) for the off-site power recovery paths. RBS performs infrared inspection of the 230 kV switchyard connections as part of a repetitive preventive maintenance task to verify the integrity of the connections. These routine inspections and the absence of plant specific operating experience verifies that this aging effect is not significant for RBS.

Based on this information, increased connection resistance due to loss of pre-load of transmission conductor and switchyard bus connections is not an aging effect requiring management for RBS.

There are no applicable aging effects that could cause loss of the intended function of the transmission conductors for the period of extended operation.

There are no aging effects requiring management for RBS transmission conductors and switchyard bus connections.

#### 3.6.2.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

See Appendix B Section B.0.3 for discussion of RBS quality assurance procedures and administrative controls for aging management programs.

3.6.2.2.5 Ongoing Review of Operating Experience

See Appendix B Section B.0.4 for discussion of RBS operating experience review programs.

### 3.6.2.3 Time-Limited Aging Analysis

The only TLAAs identified for the electrical and I&C commodity components are evaluations for environmental qualification (EQ) associated with 10 CFR 50.49. The EQ TLAAs are evaluated in Section 4.4.

## 3.6.3 Conclusion

Electrical and I&C components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.21(a)(1). Aging management programs selected to manage aging effects for the electrical and I&C components are identified in Section 3.6.2.1 and in the following tables. A description of aging management programs is provided in Appendix B of this application, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Based on the demonstrations provided in Appendix B, the effects of aging associated with electrical and I&C components will be managed such that there is reasonable assurance the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

**Table 3.6.1**
**Summary of Aging Management Programs for the Electrical and I&C Components Evaluated in Chapter VI of NUREG-1801**

**Table 3.6.1: Electrical and I&C Components**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.6.1-1 | Electrical equipment subject to 10 CFR 50.49 EQ requirements composed of various polymeric and metallic materials exposed to adverse localized environment caused by heat, radiation, oxygen, moisture, or voltage | Various aging effects due to various mechanisms in accordance with 10 CFR 50.49 | EQ is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.4, "Environmental Qualification (EQ) of Electrical Equipment," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1)(i) and (ii).<br>See Chapter X.E1, "Environmental Qualification (EQ) of Electric Components," of this report for meeting the requirements of 10 CFR 54.21(c)(1)(iii). | Yes, TLAA | EQ equipment is not subject to aging management review because the equipment is subject to replacement based on a qualified life. EQ analyses are evaluated as potential TLAAs in Section 4.4.<br>See Section 3.6.2.2.1. |

**Table 3.6.1: Electrical and I&C Components**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.6.1-2 | High-voltage insulators composed of porcelain; malleable iron; aluminum; galvanized steel; cement exposed to air – outdoor | Loss of material due to mechanical wear caused by wind blowing on transmission conductors | A plant-specific aging management program is to be evaluated | Yes, plant specific | NUREG-1801 aging effects are not applicable to RBS. See Section 3.6.2.2.2 for further evaluation. |
| 3.6.1-3 | High-voltage insulators composed of porcelain; malleable iron; aluminum; galvanized steel; cement exposed to air – outdoor | Reduced insulation resistance due to presence of salt deposits or surface contamination | A plant-specific aging management program is to be evaluated for plants located such that the potential exists for salt deposits or surface contamination (e.g., in the vicinity of salt water bodies or industrial pollution) | Yes, plant specific | NUREG-1801 aging effects are not applicable to RBS. See Section 3.6.2.2.2 for further evaluation. |
| 3.6.1-4 | Transmission conductors composed of aluminum; steel exposed to air – outdoor | Loss of conductor strength due to corrosion | A plant-specific aging management program is to be evaluated for ACSR | Yes, plant specific | NUREG-1801 aging effects are not applicable to RBS. See Section 3.6.2.2.3 for further evaluation. |
| 3.6.1-5 | Transmission connectors composed of aluminum; steel exposed to air – outdoor | Increased resistance of connection due to oxidation or loss of pre-load | A plant-specific aging management program is to be evaluated | Yes, plant specific | NUREG-1801 aging effects are not applicable to RBS. See Section 3.6.2.2.3 for further evaluation. |

**Table 3.6.1: Electrical and I&C Components**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.6.1-6 | Switchyard bus and connections composed of aluminum; copper; bronze; stainless steel; galvanized steel exposed to air – outdoor | Loss of material due to wind-induced abrasion; Increased resistance of connection due to oxidation or loss of pre-load | A plant-specific aging management program is to be evaluated | Yes, plant specific | NUREG-1801 aging effects are not applicable to RBS. See Section 3.6.2.2.3 for further evaluation. |
| 3.6.1-7 | Transmission conductors composed of aluminum; steel exposed to air – outdoor | Loss of material due to wind-induced abrasion | A plant-specific aging management program is to be evaluated for ACAR and ACSR | Yes, plant specific | NUREG-1801 aging effects are not applicable to RBS. See Section 3.6.2.2.3 for further evaluation. |
| 3.6.1-8 | Insulation material for electrical cables and connections (including terminal blocks, fuse holders, etc.) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to adverse localized environment caused by heat, radiation, or moisture | Reduced insulation resistance due to thermal/ thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion | Chapter XI.E1, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements" | No | Consistent with NUREG-1801. The Non-EQ Insulated Cables and Connections Program will manage the effects of aging. This program includes inspection of non-EQ electrical and I&C penetration cables and connections.<br>RBS EQ electrical and I&C penetration assemblies are covered under the EQ program. |

**Table 3.6.1: Electrical and I&C Components**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.6.1-9 | Insulation material for electrical cables and connections used in instrumentation circuits that are sensitive to reduction in conductor insulation resistance (IR) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to adverse localized environment caused by heat, radiation, or moisture | Reduced insulation resistance due to thermal/ thermoxidative degradation of organics, radiolysis, and photolysis (UV sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion | Chapter XI.E2, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits" | No | Consistent with NUREG-1801. The Non-EQ Sensitive Instrumentation Circuits Test Review Program will manage the effects of aging. This program includes review of calibration results or surveillance findings for instrumentation circuits. |
| 3.6.1-10 | Conductor insulation for inaccessible power cables greater than or equal to 400 volts (e.g., installed in conduit or direct buried) composed of various organic polymers (e.g., EPR, SR, EPDM, XLPE) exposed to adverse localized environment caused by significant moisture | Reduced insulation resistance due to moisture | Chapter XI.E3, "Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements" | No | Consistent with NUREG-1801. The Non-EQ Inaccessible Power Cables (≥ 400 V) Program will manage the effects of aging. Includes inspection and testing of power cables exposed to significant moisture as required. |

| Table 3.6.1: Electrical and I&C Components | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.6.1-11 | Metal enclosed bus: enclosure assemblies composed of elastomers exposed to air – indoor, controlled or uncontrolled or air – outdoor | Surface cracking, crazing, scuffing, dimensional change (e.g. "ballooning" and "necking"), shrinkage, discoloration, hardening and loss of strength due to elastomer degradation | Chapter XI.E4, "Metal Enclosed Bus," or Chapter XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components" | No | NUREG-1801 aging effects are not applicable to RBS. A review of RBS documents indicated that metal enclosed bus are either part of an active device or located in circuits that perform no intended function. Therefore, metal enclosed bus at RBS is not subject to aging management review. |
| 3.6.1-12 | Metal enclosed bus: bus/ connections composed of various metals used for electrical bus and connections exposed to air – indoor, controlled or uncontrolled or air – outdoor | Increased resistance of connection due to the loosening of bolts caused by thermal cycling and ohmic heating | Chapter XI.E4, "Metal Enclosed Bus" | No | NUREG-1801 aging effects are not applicable to RBS. A review of RBS documents indicated that metal enclosed bus are either part of an active device or located in circuits that perform no intended function. Therefore, metal enclosed bus at RBS is not subject to aging management review. |
| 3.6.1-13 | Metal enclosed bus: insulation; insulators composed of porcelain; xenoy; thermo-plastic organic polymers exposed to air – indoor, controlled or uncontrolled or air – outdoor | Reduced insulation resistance due to thermal/ thermoxidative degradation of organics/ thermoplastics, radiation-induced oxidation, moisture/ debris intrusion, and ohmic heating | Chapter XI.E4, "Metal Enclosed Bus" | No | NUREG-1801 aging effects are not applicable to RBS. A review of RBS documents indicated that metal enclosed bus are either part of an active device or located in circuits that perform no intended function. Therefore, metal enclosed bus at RBS is not subject to aging management review. |

**Table 3.6.1: Electrical and I&C Components**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.6.1-14 | Metal enclosed bus: external surface of enclosure assemblies composed of steel exposed to air – indoor, uncontrolled or air – outdoor | Loss of material due to general, pitting, and crevice corrosion | Chapter XI.E4, "Metal Enclosed Bus," or Chapter XI.S6, "Structures Monitoring" | No | NUREG-1801 aging effects are not applicable to RBS. A review of RBS documents indicated that metal enclosed bus are either part of an active device or located in circuits that perform no intended function. Therefore, metal enclosed bus at RBS is not subject to aging management review. |
| 3.6.1-15 | Metal enclosed bus: external surface of enclosure assemblies composed of galvanized steel; aluminum exposed to air – outdoor | Loss of material due to pitting and crevice corrosion | Chapter XI.E4, "Metal Enclosed Bus," or Chapter XI.S6, "Structures Monitoring" | No | NUREG-1801 aging effects are not applicable to RBS. A review of RBS documents indicated that metal enclosed bus are either part of an active device or located in circuits that perform no intended function. Therefore, metal enclosed bus at RBS is not subject to aging management review. |

| Table 3.6.1: Electrical and I&C Components | | | | | |
|---|---|---|---|---|---|
| **Item Number** | **Component** | **Aging Effect/ Mechanism** | **Aging Management Programs** | **Further Evaluation Recommended** | **Discussion** |
| 3.6.1-16 | Fuse holders (not part of active equipment): metallic clamps composed of various metals used for electrical connections exposed to air – indoor, uncontrolled | Increased resistance of connection due to chemical contamination, corrosion, and oxidation (in an air, indoor controlled environment, increased resistance of connection due to chemical contamination, corrosion and oxidation do not apply); fatigue due to ohmic heating, thermal cycling, electrical transients | Chapter XI.E5, "Fuse Holders" | No | NUREG-1801 aging effects are not applicable to RBS. A review of RBS documents indicated that fuse holders utilizing metallic clamps are either located in circuits that perform no license renewal intended function, or are part of an active component. Therefore, fuse holders with metallic clamps at RBS are not subject to aging management review. |
| 3.6.1-17 | Fuse holders (not part of active equipment): metallic clamps composed of various metals used for electrical connections exposed to air – indoor, controlled or uncontrolled | Increased resistance of connection due to fatigue caused by frequent manipulation or vibration | Chapter XI.E5, "Fuse Holders"<br>No aging management program is required for those applicants who can demonstrate these fuse holders are located in an environment that does not subject them to environmental aging mechanisms or fatigue caused by frequent manipulation or vibration | No | NUREG-1801 aging effects are not applicable to RBS. A review of RBS documents indicated that fuse holders utilizing metallic clamps are either located in circuits that perform no license renewal intended function, or are part of an active component. Therefore, fuse holders with metallic clamps at RBS are not subject to aging management review. |

**Table 3.6.1: Electrical and I&C Components**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.6.1-18 | Cable connections (metallic parts) composed of various metals used for electrical contacts exposed to air – indoor, controlled or uncontrolled or air – outdoor | Increased resistance of connection due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation | Chapter XI.E6, "Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements" | No | Consistent with NUREG-1801. The one-time inspection program (Non-EQ Electrical Cable Connections Program) will verify the absence of aging effects requiring management. |
| 3.6.1-19 | PWR only | | | | |
| 3.6.1-20 | Transmission conductors composed of aluminum exposed to air – outdoor | Loss of conductor strength due to corrosion | None - for Aluminum Conductor Aluminum Alloy Reinforced (ACAR) | No | Consistent with NUREG-1801. |
| 3.6.1-21 | Fuse holders (not part of active equipment): insulation material, metal enclosed bus: external surface of enclosure assemblies composed of insulation material: bakelite; phenolic melamine or ceramic; molded polycarbonate; other, galvanized steel; aluminum, steel exposed to air – indoor, controlled or uncontrolled | None | None | NA – No AEM or AMP | Consistent with NUREG-1801. |

## Notes for Tables 3.6.2

Generic notes

A. Consistent with component, material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

B. Consistent with component, material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

C. Component is different, but consistent with material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP is consistent with NUREG-1801 AMP description.

D. Component is different, but consistent with material, environment, aging effect, and AMP listed for NUREG-1801 line item. AMP has exceptions to NUREG-1801 AMP description.

E. Consistent with NUREG-1801 material, environment, and aging effect but a different AMP is credited or NUREG-1801 identifies a plant-specific AMP.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes

601. RBS fuse holders with metallic fuse clips are either part of an active component or located in circuits that perform no license renewal intended function and thus are not subject to aging management review. Therefore, fuse holders (metallic clamp) at RBS do not have aging effects that require an aging management program.

**Table 3.6.2**
**Electrical and I&C Components**
**Summary of Aging Management Evaluation**

**Table 3.6.2: Electrical and I&C Components**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Cable connections (metallic parts) | CE | Various metals used for electrical connections | Air – indoor controlled or uncontrolled or Air – outdoor | Increased resistance of connection | Non-EQ Electrical Cable Connections | VI.A.LP-30<br>VI.A-1 (LP-12) | 3.6.1-18 | A |
| Insulation material for electrical cables and connections (including terminal blocks, fuse holders, etc.) not subject to 10CFR50.49 EQ requirements (RBS electrical and I&C penetration conductors and connections are EQ) | IN | Insulation material – various organic polymers | Heat, moisture, or radiation and air | Reduced insulation resistance (IR) | Non-EQ Insulated Cables and Connections | VI.A.LP-33<br>VI.A-2 (L-01) | 3.6.1-8 | A |
| Insulation material for electrical cables not subject to 10 CFR 50.49 EQ requirements used in instrumentation circuits | IN | Insulation material – various organic polymers | Heat, moisture, or radiation and air | Reduced insulation resistance (IR) | Non-EQ Sensitive Instrumentation Circuits Test Review | VI.A.LP-34<br>VI.A-3 (L-02) | 3.6.1-9 | A |

| Table 3.6.2: Electrical and I&C Components | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Fuse holders (not part of active equipment): insulation material | IN | Insulation material – various organic polymers | Air – indoor controlled or uncontrolled | None | None | VI.A.LP-24<br>VI.A-7 (LP-02) | 3.6.1-21 | A |
| Fuse holders (not part of active equipment): metallic clamps | CE | Various metals used for electrical connections | Air – indoor controlled or uncontrolled | None | None | VI.A.LP-31<br>VI.A-8 (LP-01) | 3.6.1-17 | I, 601 |
| Fuse holders (not part of active equipment): metallic clamps | CE | Various metals used for electrical connections | Air – indoor controlled or uncontrolled | None | None | VI.A.LP-23<br>VI.A-8 (LP-01) | 3.6.1-16 | I, 601 |
| High voltage insulators (high voltage insulators for SBO recovery) | IN | Porcelain, galvanized metal, cement | Air – outdoor | None | None | VI.A.LP-32<br>VI.A-10 (LP-11) | 3.6.1-2 | I |
| High voltage insulators (high voltage insulators for SBO recovery) | IN | Porcelain, galvanized metal, cement | Air – outdoor | None | None | VI.A.LP-28<br>VI.A-9 (LP-07) | 3.6.1-3 | I |

| Table 3.6.2: Electrical and I&C Components | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Conductor Insulation for inaccessible power cables (≥ 400 V) not subject to 10 CFR 50.49 EQ requirements | IN | Insulation material – (various organic polymers) | Significant moisture | Reduced insulation resistance (IR) | Non-EQ Inaccessible Power Cables (≥ 400 V) | VI.A.LP-35<br>VI.A-4 (L-03) | 3.6.1-10 | A |
| Switchyard bus and connections (switchyard bus for SBO recovery) | CE | Aluminum, steel, steel alloy | Air – outdoor | None | None | VI.A.LP-39<br>VI.A-15 (LP-9) | 3.6.1-6 | I |
| Transmission conductors (transmission conductors for SBO recovery) | CE | Aluminum, steel, steel alloy | Air – outdoor | None | None | VI.A.LP-38<br>VI.A-16 (LP-08) | 3.6.1-4 | I |
| Transmission conductors (transmission conductors for SBO recovery) | CE | Aluminum, steel, steel alloy | Air – outdoor | None | None | VI.A.LP-47<br>VI.A-16 (LP-08) | 3.6.1-7 | I |
| Transmission connectors (transmission connectors for SBO recovery) | CE | Aluminum, steel, steel alloy | Air – outdoor | None | None | VI.A.LP-48<br>VI.A-16 (LP-08) | 3.6.1-5 | I |

| Table 3.6.2: Electrical and I&C Components | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Component Type** | **Intended Function** | **Material** | **Environment** | **Aging Effect Requiring Management** | **Aging Management Programs** | **NUREG-1801 Item** | **Table 1 Item** | **Notes** |
| Transmission connectors (transmission connectors for SBO recovery) | CE | Aluminum conductor aluminum alloy reinforced (ACAR) | Air – outdoor | None | None | VI.A.LP-46<br>VI.A-16 (LP-08) | 3.6.1-20 | A |

# 4.0 TIME-LIMITED AGING ANALYSES

This section provides the results of the evaluation of each identified time-limited aging analysis (TLAA) and exemption in accordance with 10 CFR 54.21(c).

Section 4.1 provides the 10 CFR 54 definition and requirements for TLAAs and a review of the process used for identifying and evaluating TLAAs and exemptions for RBS.

Subsequent sections describe the evaluation of TLAAs within the following categories.

- Section 4.2, Reactor Vessel Neutron Embrittlement
- Section 4.3, Metal Fatigue
- Section 4.4, Environmental Qualification (EQ) Analyses of Electric Equipment
- Section 4.5, Concrete Containment Tendon Prestress
- Section 4.6, Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analysis
- Section 4.7, Other Plant-Specific TLAAs

References for Section 4 are provided in Section 4.8.

## 4.1 IDENTIFICATION OF TIME-LIMITED AGING ANALYSES

TLAAs are defined in 10 CFR 54.3.

> *Time-limited aging analyses*, for the purposes of this part, are those licensee calculations and analyses that:
>
> (1) Involve systems, structures, and components within the scope of license renewal, as delineated in §54.4(a);
>
> (2) Consider the effects of aging;
>
> (3) Involve time-limited assumptions defined by the current operating term, for example, 40 years;
>
> (4) Were determined to be relevant by the licensee in making a safety determination;
>
> (5) Involve conclusions or provide the basis for conclusions related to the capability of the system, structure, and component to perform its intended functions, as delineated in §54.4(b); and
>
> (6) Are contained or incorporated by reference in the CLB [current licensing basis].

A list of TLAAs is required by 10 CFR 54.21(c) in an application for a renewed license, and 10 CFR 54.21(c)(2) requires a list of exemptions to 10 CFR 50 based on TLAA in the application for a renewed license.

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(c) An evaluation of time-limited aging analyses.

(1) A list of time-limited aging analyses, as defined in §54.3, must be provided. The applicant shall demonstrate that—

(i) The analyses remain valid for the period of extended operation;

(ii) The analyses have been projected to the end of the period of extended operation; or

(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

(2) A list must be provided of plant-specific exemptions granted pursuant to 10 CFR 50.12 and in effect that are based on time-limited aging analyses as defined in §54.3. The applicant shall provide an evaluation that justifies the continuation of these exemptions for the period of extended operation.

### 4.1.1 Identification of TLAAs

The process used to identify TLAAs for RBS is consistent with the guidance provided in NEI 95-10 (Ref. 4-1). Calculations and analyses that potentially meet the definition of TLAAs in 10 CFR 54.3 were identified by searching CLB documents including the following:

- Updated Safety Analysis Report (USAR).
- Technical Specifications and Bases.
- Technical Requirements Manual.
- Facility Operating License.
- 5 Percent Power Uprate License Amendment Request.
- 1.7 Percent Thermal Power Optimization License Amendment Request.
- BWRVIP documents referenced in the USAR or in docketed licensing correspondence.
- Industry topical reports (relevant documents referenced in the USAR or in docketed licensing correspondence).
- Fire Protection Program documents.
- Inservice Inspection Program documents.
- Relevant General Electric Hitachi (GEH) reports.
- Relevant NRC safety evaluation reports (SERs).
- Docketed licensing correspondence.

Industry documents that list generic TLAAs were also reviewed to provide additional assurance of the completeness of the plant-specific list. These documents included NEI 95-10 (Ref. 4-1); NUREG-1800 (Ref. 4-2); NUREG-1801 (Ref. 4-3); and EPRI Report TR-105090 (Ref. 4-4).

Table 4.1-1 provides a summary listing of the TLAAs applicable to RBS. Table 4.1-2 identifies the TLAAs listed in NUREG-1800 that are applicable to RBS.

### 4.1.2 Identification of Exemptions

The search for exemptions for RBS was accomplished through a review of the documents listed in Section 4.1.1. No exemptions that will remain in effect for the period of extended operation are based on a TLAA.

**Table 4.1-1**
**List of RBS TLAAs and Resolution**

| TLAA Description | Resolution Option | LRA Section |
|---|---|---|
| **Reactor Vessel Neutron Embrittlement** | | 4.2 |
| Reactor vessel fluence | Analysis projected<br>10 CFR 54.21(c)(1)(ii) | 4.2.1 |
| Adjusted reference temperature | Analysis projected<br>10 CFR 54.21(c)(1)(ii) | 4.2.2 |
| Pressure-temperature limits | Aging effects managed<br>10 CFR 54.21(c)(1)(iii) | 4.2.3 |
| Upper-shelf energy | Analysis projected<br>10 CFR 54.21(c)(1)(ii) | 4.2.4 |
| Reactor vessel circumferential weld inspection relief | Aging effects managed<br>10 CFR 54.21(c)(1)(iii) | 4.2.5 |
| Reactor vessel axial weld failure probability | Analysis projected<br>10 CFR 54.21(c)(1)(ii) | 4.2.6 |
| Reactor pressure vessel core reflood thermal shock analysis | Analysis projected<br>10 CFR 54.21(c)(1)(ii) | 4.2.7 |
| **Metal Fatigue** | | 4.3 |
| Reactor pressure vessel | Aging effects managed<br>10 CFR 54.21(c)(1)(iii) | 4.3.1.1 |
| Reactor pressure vessel internals | Aging effects managed<br>10 CFR 54.21(c)(1)(iii) | 4.3.1.2 |
| Reactor recirculation pumps | Aging effects managed<br>10 CFR 54.21(c)(1)(iii) | 4.3.1.3 |
| Control rod drives | Aging effects managed<br>10 CFR 54.21(c)(1)(iii) | 4.3.1.4 |
| Class 1 piping and in-line components | Aging effects managed<br>10 CFR 54.21(c)(1)(iii) | 4.3.1.5 |
| Non-Class 1 piping and in-line components | Analyses remain valid<br>10 CFR 54.21(c)(1)(i) | 4.3.2.1 |
| Non-Class 1 non-piping components | Analyses remain valid<br>10 CFR 54.21(c)(1)(i) | 4.3.2.2 |

**Table 4.1-1 (Continued)**
**List of RBS TLAAs and Resolution**

| TLAA Description | Resolution Option | LRA Section |
|---|---|---|
| Effects of reactor water environment on fatigue life | Aging effects managed<br>10 CFR 54.21(c)(1)(iii) | 4.3.3 |
| **Environmental Qualification (EQ) Analyses of Electrical Equipment** | | 4.4 |
| Environmental qualification analyses of electrical equipment | Aging effects managed<br>10 CFR 54.21(c)(1)(iii) | 4.4 |
| **Concrete Containment Tendon Prestress** | | 4.5 |
| Concrete containment tendon prestress analysis | Not a TLAA. RBS containment design does not include tendons. | 4.5 |
| **Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analysis** | | 4.6 |
| Containment components | Aging effects managed<br>10 CFR 54.21(c)(1)(iii) | 4.6 |
| **Other Plant-Specific TLAAs** | | 4.7 |
| Erosion of main steam line flow restrictors | Analysis projected<br>10 CFR 54.21(c)(1)(ii) | 4.7.1 |
| Postulation of HELB locations | Aging effects managed<br>10 CFR 54.21(c)(1)(iii) | 4.7.2 |
| Fluence effects for reactor vessel internals | Analysis projected<br>10 CFR 54.21(c)(1)(ii) | 4.7.3 |
| Crane load cycles | Analyses remain valid<br>10 CFR 54.21(c)(1)(i) | 4.7.4 |

**Table 4.1-2**
**Comparison of RBS TLAAs to NUREG-1800 TLAAs**

| NUREG-1800 TLAA Description | Applicable to RBS (Yes/No) | LRA Section |
|---|---|---|
| ***NUREG-1800 Table 4.1-2*** | | |
| Reactor vessel neutron embrittlement | Yes | 4.2 |
| Metal fatigue | Yes | 4.3 |
| Environmental qualification of electrical equipment | Yes | 4.4 |
| Concrete containment tendon prestress | No. RBS containment design does not include tendons. | N/A |
| Inservice local metal containment corrosion analyses | No. RBS utilizes a Mark III containment with no specific corrosion TLAA. | N/A |
| ***NUREG-1800 Table 4.1-3*** | | |
| Intergranular separation in the heat-affected zone of reactor vessel low-alloy steel under austenitic stainless steel (SS) cladding. | No. Review of RBS records and USAR revealed no TLAA associated with reactor pressure vessel intergranular separation. | N/A |
| Low-temperature overpressure protection analyses | No. Low-temperature overpressure protection is not applicable to BWRs. | N/A |
| Fatigue analysis for the main steam supply lines to the turbine-driven auxiliary feedwater pumps | No. RBS is a BWR that does not have a steam-driven auxiliary feedwater pump. | N/A |
| Fatigue analysis of the reactor coolant pump flywheel | No. RBS is a BWR and the reactor recirculation pumps do not have flywheels. | N/A |
| Fatigue analysis of polar crane | Yes. Crane specifications were evaluated as a TLAA. | 4.7.4 |
| Flow-induced vibration endurance limit for the reactor vessel internals | No. Evaluations are not based on the current operating term such as 40 years and are therefore not TLAAs. | N/A |
| Transient cycle count assumptions for the reactor vessel internals | Yes | 4.3.1.2 |
| Ductility reduction of fracture toughness for the reactor vessel internals | Yes | 4.7.3 |

**Table 4.1-2 (Continued)**
**Comparison of RBS TLAAs to NUREG-1800 TLAAs**

| NUREG-1800 TLAA Description | Applicable to RBS (Yes/No) | LRA Section |
|---|---|---|
| Leak before break | No. RBS does not credit leak before break. | N/A |
| Fatigue analysis for the containment liner plate | Yes | 4.6 |
| Containment penetration pressurization cycles | Yes | 4.6 |
| Metal corrosion allowance | No. Corrosion allowances for metallic components were reviewed, and no TLAAs were identified. | N/A |
| High-energy line-break postulation based on fatigue cumulative factor | Yes | 4.7.2 |
| Inservice flaw growth analyses that demonstrate structure stability for 40 years | No. No ASME Section XI flaw growth analyses that demonstrate structure stability for 40 years were identified at RBS. | N/A |

## 4.2 REACTOR VESSEL NEUTRON EMBRITTLEMENT

The regulations governing reactor vessel integrity are in 10 CFR 50. Section 50.60 requires that light-water reactors meet the fracture toughness, pressure-temperature limits, and material surveillance program requirements for the reactor coolant pressure boundary set forth in Appendices G and H of 10 CFR 50 (Ref. 4-5, 4-6). The RBS analyses that address the effects of neutron irradiation embrittlement on the reactor vessel for 40 years are TLAAs and either have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) or will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii) as summarized below.

The period of extended operation for RBS will extend until August 29, 2045. Power history through the end of the period of extended operation was estimated assuming a 95 percent capacity factor. The resulting power history is equivalent to approximately 53.4 EFPY. Consequently, using 54 EFPY to evaluate reactor vessel neutron embrittlement TLAAs for the end of the period of extended operation is appropriate.

RBS calculated fluence for 54 EFPY and determined the changes in adjusted reference temperature (ART), upper shelf energy (USE), pressure-temperature (P-T) limits, and probability of failure of circumferential and axial welds of the reactor pressure vessel (RPV) beltline materials for extended power uprate conditions.

### 4.2.1 Reactor Vessel Fluence

Fluence is calculated based on a time-limited assumption defined by the operating term. Therefore, analyses that evaluate reactor vessel neutron embrittlement based on calculated fluence are TLAAs.

The predicted peak high energy (> 1 million electron-volts [MeV]) neutron fluence for 54 EFPY is 8.35E+18 neutrons per square centimeter ($n/cm^2$) at the vessel inner surface. Neutron fluence for the welds, shells and nozzles of the RPV beltline region was determined using the General Electric Hitachi (GEH) method for neutron flux calculation documented in report NEDC-32983P-A (Ref. 4-20) and approved by the NRC. The method adheres to the guidance provided in RG 1.190 (Ref. 4-8). Results of the fluence evaluation are shown in Table 4.2-1. (Ref. 4-16, 4-20)

USAR Figure 5.3-1 identifies the vessel assembly configuration, and USAR Figure 5.3-6 denotes the weld seams and plate identifiers in the original beltline region. Regulations in 10 CFR 50 Appendix G define the beltline as the region of the reactor pressure vessel that directly surrounds the effective height of the active core and adjacent regions of the RPV that are predicted to experience sufficient neutron irradiation damage to be considered in the selection of the most limiting material with regard to radiation damage. In addition, 10 CFR 50 Appendix H requires material surveillance testing only for ferritic materials with neutron fluence exceeding 1.0E+17 $n/cm^2$. The beltline is thus considered to include the reactor pressure vessel ferritic materials with projected 54 EFPY fluence that exceeds 1.0E+17 n/cm$^2$. The elevation range within which the projected fluence exceeds 1.0E+17 n/cm$^2$ for 54 EFPY is 191.26 to 385.46 inches relative to the bottom of the vessel. The beltline region for 54 EFPY includes plates and welds in shell rings 1, 2 and 3. Nozzles N6 and N12 will exceed a fluence of 1.0E+17 n/cm$^2$ at 54 EFPY. No other nozzles are projected to exceed 1.0E+17 n/cm$^2$ during the period of extended operation.

The neutron fluence calculation results are inputs into fracture toughness analyses that consider the effects of aging due to exposure to neutron irradiation and are evaluated as TLAAs. The effects of aging due to neutron irradiation are considered in the neutron embrittlement TLAAs for the reactor vessel (e.g., upper-shelf energy analysis and P-T limits analysis). The neutron fluence analysis has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

**Table 4.2-1**
**Peak Fluence at 54 EFPY**

| | |
|---|---|
| **Shell 3 and Axial Welds, Circumferential Weld AC** | |
| Thickness in inches = 5.41 | 54 EFPY Peak I.D. fluence = 3.43E+17 n/cm$^2$ |
| | 54 EFPY Peak ¼T[(a)] fluence = 2.48E+17 n/cm$^2$ |
| **Shell 2 and Axial Welds** | |
| Thickness in inches = 5.41 | 54 EFPY Peak I.D. fluence = 8.35E+18 n/cm$^2$ |
| | 54 EFPY Peak ¼T fluence = 6.04E+18 n/cm$^2$ |
| **Shell 1 and Axial Welds, Circumferential Weld AB** | |
| Thickness in inches = 5.813 | 54 EFPY Peak I.D. fluence = 7.89E+17 n/cm$^2$ |
| | 54 EFPY Peak ¼T fluence = 5.57E+17 n/cm$^2$ |
| **N12 Nozzles (water level instrumentation nozzles)** | |
| Thickness in inches = 5.41 | 54 EFPY Peak I.D. fluence = 2.69E+18 n/cm$^2$ |
| | 54 EFPY Peak ¼T fluence = 1.94E+18 n/cm$^2$ |
| **N6 Nozzles (RHR/LPCI nozzles)** | |
| Thickness in inches = 5.41 | 54 EFPY Peak I.D. fluence = 1.20E+17 n/cm$^2$ |
| | 54 EFPY Peak ¼T fluence = 8.67E+16 n/cm$^2$ |

a. One-fourth of the way through the vessel wall measured from the internal surface of the vessel.

## 4.2.2 Adjusted Reference Temperature

A key parameter that characterizes the fracture toughness of a material is the initial reference nil-ductility transition temperature ($RT_{NDT}$) determined in accordance with the 1998 Edition of the ASME Boiler and Pressure Vessel Code, including 2000 Addenda, Section III, paragraph NB-2331. The $RT_{NDT}$ increases with increasing neutron irradiation of the material. The effects of neutron radiation on $RT_{NDT}$ are reflected in the reference temperature change ($\Delta RT_{NDT}$). The ART is calculated by adding $\Delta RT_{NDT}$ to initial $RT_{NDT}$ with an appropriate margin for uncertainties ($RT_{NDT}$ + $\Delta RT_{NDT}$ + margin) as defined by RG 1.99, Revision 2 (Ref. 4-7).

Table 4.2-2 shows the results of the ART evaluations. (Ref. 4-20)

The ART values for all beltline materials are calculated using fluence values determined with an NRC-approved method that complies with RG 1.190 (Ref. 4-8). Axial weld heat 5P6756/Linde 124 (T) in Shell #2 is the limiting material with an ART of 110.7°F (Ref. 4-18).

The RBS reactor vessel N12 water level instrumentation nozzles are fabricated from stainless steel. Therefore, the nozzle itself (non-ferritic) does not require evaluation for changes in ductility from neutron embrittlement.

The RBS reactor vessel N6 RHR/LPCI nozzles are fabricated from SA-508 Class 2 carbon steel material. The N6 forging copper content was selected to be the maximum permitted as defined by the RBS purchase specifications, and the nickel content was obtained from the plant-specific certified material test report. The N6 nozzles are not the limiting components for the 54 EFPY ART evaluations.

Although the TLAA for adjusted reference temperatures has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii), this will be formally completed as part of the established process for generation of updated P-T operating limits under the Reactor Vessel Surveillance Program (Section B.1.37).

**Table 4.2-2**
**RBS Beltline ART Values for 54 EFPY**

| Component | Heat | % Copper (Cu) | % Nickel (Ni) | Chemistry Factor (CF) | Adjusted CF | Initial $RT_{NDT}$ °F | ¼T Fluence n/cm$^2$ | 54 EFPY $\Delta RT_{NDT}$ °F | $\delta_I$[a] | $\delta_\Delta$[b] | Margin °F | 54 EFPY Shift °F | 54 EFPY ART °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plant-Specific Chemistries** | | | | | | | | | | | | | |
| Shell Plate 3 | C2904-2 | 0.11 | 0.65 | 75 | | 10 | 2.48E+17 | 14.7 | 0 | 7.3 | 14.7 | 29.3 | 39.3 |
| | C3001-2 | 0.04 | 0.66 | 26 | | -40 | 2.48E+17 | 5.1 | 0 | 2.5 | 5.1 | 10.2 | -29.8 |
| | C2929-2 | 0.12 | 0.64 | 84 | | -50 | 2.48E+17 | 16.4 | 0 | 8.2 | 16.4 | 32.8 | -17.2 |
| Shell Plate 2 | C3054-1 | 0.09 | 0.70 | 58 | | -20 | 6.04E+18 | 49.8 | 0 | 17.0 | 34.0 | 83.8 | 63.8 |
| | C3054-2 | 0.09 | 0.70 | 58 | | 10 | 6.04E+18 | 49.8 | 0 | 17.0 | 34.0 | 83.8 | 93.8 |
| | C3138-2 | 0.08 | 0.63 | 51 | | 0 | 6.04E+18 | 43.8 | 0 | 17.0 | 34.0 | 77.8 | 77.8 |
| Shell Plate 1 | C2904-1 | 0.11 | 0.65 | 75 | | 10 | 5.57E+17 | 23.2 | 0 | 11.6 | 23.2 | 46.4 | 56.4 |
| | C2879-1 | 0.12 | 0.61 | 83 | | 10 | 5.57E+17 | 25.8 | 0 | 12.9 | 25.8 | 51.6 | 61.6 |
| Axial Welds Shell 3 BJ, BK, BM | 5P5657/Linde 124/0931 (S)[c] | 0.07 | 0.71 | 95 | | -60 | 2.48E+17 | 18.6 | 0 | 9.3 | 18.6 | 37.3 | -22.7 |
| | 5P5657/Linde 124/0931 (T)[c] | 0.04 | 0.89 | 54 | | -60 | 2.48E+17 | 10.6 | 0 | 5.3 | 10.6 | 21.2 | -38.8 |
| Axial Welds Shell 2 BE, BF, BG | 5P6756/Linde 124/0342 (S) | 0.08 | 0.93 | 108 | | -60 | 6.04E+18 | 92.7 | 0 | 28.0 | 56.0 | 148.7 | 88.7 |
| | 5P6756/Linde 124/0342 (T) | 0.09 | 0.92 | 122 | | -50 | 6.04E+18 | 104.7 | 0 | 28.0 | 56.0 | 160.7 | 110.7 |

**Table 4.2-2 (Continued)**
**RBS Beltline ART Values for 54 EFPY**

| Component | Heat | % Copper (Cu) | % Nickel (Ni) | Chemistry Factor (CF) | Adjusted CF | Initial $RT_{NDT}$ °F | ¼T Fluence n/cm$^2$ | 54 EFPY $\Delta RT_{NDT}$ °F | $\delta_I$[a] | $\delta_\Delta$[b] | Margin °F | 54 EFPY Shift °F | 54 EFPY ART °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Axial Welds Shell 1 BA, BB | 5P5657/Linde 124/0931 (S) | 0.07 | 0.71 | 95 | | -60 | 5.57E+17 | 29.5 | 0 | 14.7 | 29.5 | 58.9 | -1.1 |
| | 5P5657/Linde 124/0931 (T) | 0.04 | 0.89 | 54 | | -60 | 5.57E+17 | 16.7 | 0 | 8.4 | 16.7 | 33.5 | -26.5 |
| Circumferential Shell 2 to Shell 3 AC | 5P6771/Linde 124/0342 (S) | 0.03 | 0.88 | 41 | | -30 | 2.48E+17 | 8.0 | 0 | 4.0 | 8.0 | 16.1 | -13.9 |
| | 5P6771/Linde 124/0342 (T) | 0.04 | 0.95 | 54 | | -20 | 2.48E+17 | 10.6 | 0 | 5.3 | 10.6 | 21.2 | 1.2 |
| Circumferential Shell 1 to Shell 2 AB | 4P7216/Linde 124/0751 (S) | 0.06 | 0.85 | 82 | | -50 | 5.57E+17 | 25.4 | 0 | 12.7 | 25.4 | 50.8 | 0.8 |
| | 4P7216/Linde 124/0751 (T) | 0.04 | 0.83 | 54 | | -80 | 5.57E+17 | 16.7 | 0 | 8.4 | 16.7 | 33.5 | -46.5 |
| | 4P7465/Linde 124/0751 (S) | 0.02 | 0.82 | 27 | | -60 | 5.57E+17 | 8.4 | 0 | 4.2 | 8.4 | 16.7 | -43.3 |
| | 4P7465/Linde 124/0751 (T) | 0.02 | 0.80 | 27 | | -60 | 5.57E+17 | 8.4 | 0 | 4.2 | 8.4 | 16.7 | -43.3 |
| N6 nozzle forgings | Q2QL4W | 0.10 | 0.86 | 67 | | -20 | 8.67E+16 | 6.7 | 0 | 3.3 | 6.7 | 13.3 | -6.7 |

**Table 4.2-2 (Continued)
RBS Beltline ART Values for 54 EFPY**

| Component | Heat | % Copper (Cu) | % Nickel (Ni) | Chemistry Factor (CF) | Adjusted CF | Initial $RT_{NDT}$ °F | ¼T Fluence $n/cm^2$ | 54 EFPY $\Delta RT_{NDT}$ °F | $\delta_I$ (a) | $\delta_\Delta$ (b) | Margin °F | 54 EFPY Shift °F | 54 EFPY ART °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N6 nozzle weld | 5P6771/Linde 124/0342 (S) | 0.03 | 0.88 | 41 | | -30 | 8.67E+16 | 4.1 | 0 | 2.0 | 4.1 | 8.2 | -21.8 |
| | 5P6771/Linde 124/0342 (T) | 0.04 | 0.95 | 54 | | -20 | 8.67E+16 | 5.4 | 0 | 2.7 | 5.4 | 10.7 | -9.3 |
| N12 forging(d) N12 weld(d) | C3054-2 Inconel 182 | 0.09 | 0.70 | 58 | | 10 | 1.94E+18 | 32.6 | 0 | 16.3 | 32.6 | 65.3 | 75.3 |
| **Best Estimate Chemistries from BWRVIP-135** | | | | | | | | | | | | | |
| Shell #2 | C3054-2 | 0.08 | 0.673 | 51 | | 10 | 6.04E+18 | 43.8 | 0 | 17.0 | 34.0 | 77.8 | 87.8 |
| Shell #3 BJ, BK, BM | 5P5657/Linde 124/0931 (S) | 0.034 | 0.824 | 46 | | -60 | 2.48E+17 | 9.1 | 0 | 4.5 | 9.1 | 18.1 | -41.9 |
| | 5P5657/Linde 124/0931 (T) | 0.034 | 0.824 | 46 | | -60 | 2.48E+17 | 9.1 | 0 | 4.5 | 9.1 | 18.1 | -41.9 |
| Shell #2 BE, BF, BG | 5P6756/Linde 124/0342(S) | 0.08 | 0.936 | 108 | | -60 | 6.04E+18 | 92.7 | 0 | 28 | 56 | 148.7 | 88.7 |
| | 5P6756/Linde 124/0342 (T) | 0.08 | 0.936 | 108 | | -50 | 6.04E+18 | 92.7 | 0 | 28 | 56 | 148.7 | 98.7 |

**Table 4.2-2 (Continued)**
**RBS Beltline ART Values for 54 EFPY**

| Component | Heat | % Copper (Cu) | % Nickel (Ni) | Chemistry Factor (CF) | Adjusted CF | Initial $RT_{NDT}$ °F | ¼T Fluence n/cm$^2$ | 54 EFPY $\Delta RT_{NDT}$ °F | $\delta_I$[(a)] | $\delta_\Delta$[(b)] | Margin °F | 54 EFPY Shift °F | 54 EFPY ART °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Shell #2 to Shell #3: AC | 5P6771/Linde 124/0342 (S) | 0.034 | 0.934 | 46 | | -30 | 2.48E+17 | 9.1 | 0 | 4.5 | 9.1 | 18.1 | -11.9 |
| | 5P6771/Linde 124/0342 (T) | 0.034 | 0.934 | 46 | | -20 | 2.48E+17 | 9.1 | 0 | 4.5 | 9.1 | 18.1 | -1.9 |
| Shell #1 BA, BB | 5P5657/Linde 124/0931(S) | 0.034 | 0.824 | 46 | | -60 | 5.57E+17 | 14.3 | 0 | 7.2 | 14.3 | 28.6 | -31.4 |
| | 5P5657/Linde 124/0931 (T) | 0.034 | 0.824 | 46 | | -60 | 5.57E+17 | 14.3 | 0 | 7.2 | 14.3 | 28.6 | -31.4 |
| Shell #1 to Shell #2: AB | 4P7216/Linde 124/0751 (S) | 0.038 | 0.820 | 51 | | -50 | 5.57E+17 | 15.9 | 0 | 8.0 | 15.9 | 31.9 | -18.1 |
| | 4P7216/Linde 124/0751 (T) | 0.038 | 0.820 | 51 | | -80 | 5.57E+17 | 15.9 | 0 | 8.0 | 15.9 | 31.9 | -48.1 |
| | 4P7465/Linde 124/0751 (S) | 0.02 | 0.807 | 27 | | -60 | 5.57E+17 | 8.4 | 0 | 4.2 | 8.4 | 16.7 | -43.3 |
| | 4P7465/Linde 124/0751 (T) | 0.02 | 0.807 | 27 | | -60 | 5.57 E+17 | 8.4 | 0 | 4.2 | 8.4 | 16.7 | -43.3 |

**Table 4.2-2 (Continued)**
**RBS Beltline ART Values for 54 EFPY**

| Component | Heat | % Copper (Cu) | % Nickel (Ni) | Chemistry Factor (CF) | Adjusted CF | Initial $RT_{NDT}$ °F | ¼T Fluence n/cm$^2$ | 54 EFPY $\Delta RT_{NDT}$ °F | $\delta_I$ [(a)] | $\delta_\Delta$ [(b)] | Margin °F | 54 EFPY Shift °F | 54 EFPY ART °F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Integrated Surveillance Program for BWRVIP-135** | | | | | | | | | | | | | |
| Plate[(e)] | C3054-2 | 0.08 | 0.673 | 51 | | 10 | 6.04E+18 | 43.8 | 0 | 17.0 | 34.0 | 77.8 | 87.8 |
| Weld[(f)] | 5P6756/Linde 124/0342 (S) | 0.08 | 0.936 | | 154 | -60 | 6.04E+18 | 132.2 | 0 | 14.0 | 28.0 | 160.2 | 100.2 |
| Weld[(f)] | 5P6756/Linde 124/0342 (T) | 0.08 | 0.936 | | 154 | -50 | 6.04E+18 | 132.2 | 0 | 14.0 | 28.0 | 160.2 | 110.2 |

a. $\delta_I$: Standard deviation on initial $RT_{NDT}$
b. $\delta_\Delta$: Standard deviation on $RT_{NDT}$
c. S = single wire; T= tandem wire
d. The N12 water level instrumentation nozzles are in the beltline region. Because the forging is fabricated from stainless steel, the ART is calculated using the plate heats where the nozzles are located. The weld connecting the forging to the vessel shell is Inconel 182 material and is not required to be evaluated.
e. The ISP plate material is not the vessel target material but does lie within the beltline region (lower intermediate shell). Therefore, this material is considered in determining the limiting ART. Only one set of surveillance data is available; therefore, upon testing of a second ISP capsule, the CF can be reviewed.
f. The ISP weld material is considered the vessel target material and lies within the beltline region. Therefore, this material is considered in determining the limiting ART.
The adjusted CF is determine to be the [RG 1.99 CF (vessel material/RG 1.99 CF surveillance material)] × CF (fitted). For this material, adjusted CF = [108°F/82°F] × 116.9°F = 154°F. The surveillance data is credible; therefore, $\delta_\Delta$ is reduced as permitted by RG 1.99.

### 4.2.3 Pressure-Temperature Limits

Appendix G of 10 CFR 50 requires that the reactor vessel remain within established pressure-temperature (P-T) limits. These limits are calculated using fluence and materials data, including data obtained through the Reactor Vessel Surveillance Program (Section B.1.37).

The provisions of 10 CFR 50 Appendix G require RBS to operate within the licensed P-T limit curves. These curves are maintained and updated as necessary to maintain plant operation consistent with 10 CFR 50. The RBS P-T limit curves will be updated as necessary, including through the period of extended operation, in conjunction with the Reactor Vessel Surveillance Program (Section B.1.37).

The effects of aging associated with the P-T limits will be managed for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

### 4.2.4 Upper Shelf Energy

USE is evaluated for beltline materials. Fracture toughness criteria in 10 CFR 50 Appendix G require that beltline materials maintain USE no less than 50 foot-pounds (ft-lb) during operation of the reactor unless it is demonstrated that lower values of Charpy upper-shelf energy will provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code. The 54 EFPY USE values for the beltline materials were determined using methods consistent with RG 1.99, Revision 2. The value of peak ¼T fluence was used. (Ref. 4-5, 4-7, 4-18)

BWRVIP-135, Revision 3, and BWRVIP-74-A discuss the use of equivalent margin analysis (EMA) methods to qualify the beltline materials for USE. This is not necessary for most of the RBS beltline materials, as they can be shown to maintain 50 ft-lb using RG 1.99 Positions 1.2 and 2.2, as appropriate. However, for two of the plate materials in Shell #1, insufficient information is available to determine the initial (unirradiated) upper shelf energy. Heats C2904-1 and C2879-1 have an average transverse Charpy test result of 54 ft-lb at a maximum of 50 percent shear. Therefore, EMA methods were applied. As indicated in Table 4.2-3, the decrease in USE at 54 EFPY meets the requirements set forth in BWRVIP-74-A.

The USE and EMA calculations presented in Tables 4.2-3 and 4.2-4 demonstrate that all beltline materials meet the 10 CFR 50 Appendix G criteria through 54 EFPY.

The TLAA for USE has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

**Table 4.2-3**
**RBS USE Data for 54 EFPY**

| Material[a] | Heat Number | Initial Transverse USE (ft-lb) | % Cu | 54 EFPY ¼T Fluence ($n/cm^2$) | % Decrease USE | 54 EFPY Transverse USE[b] (ft-lb) |
|---|---|---|---|---|---|---|
| **Plates** | | | | | | |
| Shell Plate 3[c] | C2904-2 | 60 | 0.11 | 2.48E+17 | 8.5 | 54.9 |
| | C3001-2 | 69 | 0.04 | 2.48E+17 | 5.0 | 65.6 |
| | C2929-2 | 58 | 0.12 | 2.48E+17 | 9.0 | 52.8 |
| Shell Plate 2 | C3054-1 | 100 | 0.09 | 6.04E+18 | 16.5 | 83.5 |
| | C3054-2 | 94 | 0.09 | 6.04E+18 | 16.5 | 78.5 |
| | C3138-2 | 117 | 0.08 | 6.04E+18 | 15.0 | 99.5 |
| Shell Plate 1[d] | C2904-1 | 54 | 0.11 | 5.57E+17 | 10.5 | 48.3 |
| | C2879-1 | 54 | 0.12 | 5.57E+17 | 11.0 | 48.1 |
| **Axial Welds[e]** | | | | | | |
| Shell #3: BJ, BK, BM | 5P5657/Linde 124/0931 (S) | 88 | 0.07 | 2.48E+17 | 9.0 | 80.1 |
| | 5P5657/Linde 124/0931 (T) | 89 | 0.04 | 2.48E+17 | 7.5 | 82.3 |
| Shell #2: BE, BF, BG | 5P6756 Linde 124/0342 (S) | 88 | 0.08 | 6.04E+18 | 20.0 | 70.4 |
| | 5P6756 Linde 124/0342 (T) | 88 | 0.09 | 6.04E+18 | 21.0 | 69.5 |

**Table 4.2-3 (Continued)**
**RBS USE Data for 54 EFPY**

| Material[a] | Heat Number | Initial Transverse USE (ft-lb) | % Cu | 54 EFPY ¼T Fluence (n/cm$^2$) | % Decrease USE | 54 EFPY Transverse USE[b] (ft-lb) |
|---|---|---|---|---|---|---|
| Shell #1: BA, BB | 5P5657/Linde 124/0931 (S) | 88 | 0.07 | 5.57E+17 | 11.0 | 78.3 |
| | 5P5657/Linde 124/0931 (T) | 89 | 0.04 | 5.57E+17 | 9.0 | 81.0 |
| **Circumferential Welds[f]** | | | | | | |
| Shell #2 to Shell #3: AC | 5P6771/Linde 124/0342 (S) | 90 | 0.03 | 2.48E+17 | 7.0 | 83.7 |
| | 5P6771/Linde 124/0342 (T) | 85 | 0.04 | 2.48E+17 | 7.5 | 78.6 |
| Shell #1 to Shell #2: AB | 4P7216/Linde 124/0751 (S) | 91 | 0.06 | 5.57E+17 | 10.5 | 81.4 |
| | 4P7216/Linde 124/0751 (T) | 99 | 0.04 | 5.57E+17 | 9.0 | 90.1 |
| Shell #1 to Shell #2: AB | 4P7465/Linde 124/0751 (S) | 111 | 0.02 | 5.57E+17 | 7.5 | 102.7 |
| | 4P7465/Linde 124/0751 (T) | 115 | 0.02 | 5.57E+17 | 7.5 | 106.4 |
| **Nozzles** | | | | | | |
| N12 forging[g] | C3054-2 | 94 | 0.09 | 1.94E+18 | 12.5 | 82.3 |
| N12 weld[g] | Inconel 182 | 94 | 0.09 | 1.94E+18 | 12.5 | 82.3 |
| N6 forging[h] | Q2QL4W | 78 | 0.10 | 8.67E+16 | 6.5 | 72.9 |
| N6 weld | 5P96771/Linde 124/0342 (S) | 90 | 0.03 | 8.67E+16 | 5.5 | 85.1 |
| | 5P96771/Linde 124/0342 (T) | 85 | 0.04 | 8.67E+16 | 6.0 | 79.9 |

**Table 4.2-3 (Continued)**
**RBS USE Data for 54 EFPY**

| Material[a] | Heat Number | Initial Transverse USE (ft-lb) | % Cu | 54 EFPY ¼T Fluence (n/cm$^2$) | % Decrease USE | 54 EFPY Transverse USE[b] (ft-lb) |
|---|---|---|---|---|---|---|
| **Best Estimate Chemistries from BWRVIP-135** | | | | | | |
| Shell #2 | C3054-2 | 94 | 0.08 | 6.04E+18 | 15.0 | 79.9 |
| Shell #3: BJ, BK, BM | 5P5657/Linde 124/0931 (S) | 88 | 0.034 | 2.48E+17 | 7.5 | 81.4 |
| | 5P5657/Linde 124/0931 (T) | 89 | 0.034 | 2.48E+17 | 7.5 | 82.3 |
| Shell #2: BE, BF, BG | 5P6756/Linde 124/0342 (S) | 88 | 0.08 | 6.04E+18 | 20.0 | 70.4 |
| | 5P6756/Linde 124/0342 (T) | 88 | 0.08 | 6.04E+18 | 20.0 | 70.4 |
| Shell #2 to Shell #3: AC | 5P6771/Linde 124/0342 (S) | 90 | 0.034 | 2.48E+17 | 7.5 | 83.3 |
| | 5P6771/Linde 124/0342 (T) | 85 | 0.034 | 2.48E+17 | 7.5 | 78.6 |
| Shell #1: BA, BB | 5P5657/Linde 124/0931 (S) | 88 | 0.034 | 5.57E+17 | 8.5 | 80.5 |
| | 5P5657/Linde 124/0931 (T) | 89 | 0.034 | 5.57E+17 | 8.5 | 81.4 |
| Shell #1 to Shell #2: AB | 4P7216/Linde 124/0751 (S) | 91 | 0.038 | 5.57E+17 | 9.0 | 82.8 |
| | 4P7216/Linde 124/0751 (T) | 99 | 0.038 | 5.57E+17 | 9.0 | 90.1 |
| Shell #1 to Shell #2: AB | 4P7465/Linde 124/0751 (S) | 111 | 0.02 | 5.57E+17 | 7.5 | 102.7 |
| | 4P7465/Linde 124/0751 (T) | 115 | 0.02 | 5.57E+17 | 7.5 | 106.4 |

**Table 4.2-3 (Continued)**
**RBS USE Data for 54 EFPY**

| Material[a] | Heat Number | Initial Transverse USE (ft-lb) | % Cu | 54 EFPY ¼T Fluence ($n/cm^2$) | % Decrease USE | 54 EFPY Transverse USE[b] (ft-lb) |
|---|---|---|---|---|---|---|
| **Integrated Surveillance Program from BWRVIP-135[i]** | | | | | | |
| Plate | C3054-2 | 95.3 | 0.08 | 6.04E+18 | 15.0 | 81.0 |
| Weld | 5P6756/Linde 124/0342 (S) | 104.4 | 0.08 | 6.04E+18 | 20.0 | 83.5 |
| | 5P6756/Linde 124/0342 (T) | 104.4 | 0.08 | 6.04E+18 | 20.0 | 83.5 |

a. Regulatory Guide 1.99, Revision 2, Position 1.2 applies to all materials.
b. USE = Initial Transverse USE × [1 - (% decrease / 100)]
c. Due to the lack of sufficient unirradiated data, the unirradiated USE is conservatively based on 50% shear results.
d. Due to the lack of sufficient unirradiated data, the unirradiated USE is conservatively based on 50% shear results. Reducing this value by 10.0% results in a 54 EFPY USE less than 50 ft-lbs. Therefore, a USE EMA was performed. As the 10% decrease is less than the maximum permitted reduction of 23.5% from BWRVIP-74-A and the maximum plate decrease for RBS is 19%, both bounded by the BWRVIP-74-A requirement, the Shell 1 plates remain qualified for USE. See Table 2.2-4.
e. Use of shielded-metal arch weld (SMAW) Heat 492L4871 was limited to seam patches. Certified material test reports indicate that no SMAW weld material is present at either the ¼T or ¾T location. Therefore, this heat is not required to be evaluated as part of the beltline region.
f. Welds AB and AC occur within the extended beltline region, defined as experiencing a fluence > 1.0E+17 $n/cm^2$.
g. The N12 water level instrumentation nozzle occurs in the beltline region. Because the forging and weld are non-ferritic materials, the USE is calculated using the limiting plate heat where the nozzles occur.
h. Due to the lack of sufficient unirradiated data, the unirradiated USE is conservatively based on 60% shear results.
i. The material is evaluated using the ISP unirradiated USE to illustrate the difference and that the material is acceptable.

## Table 4.2-4
## Equivalent Margin Analysis

### 60-Year License (54 EFPY)

### BWR/3-6 Plate

**ISP Surveillance Plate USE (Heat C3054-2)**

%Cu = 0.08

Unirradiated USE = 95.3 ft-lb

1st capsule measured USE = 100.6 ft-lb

1st capsule fluence = 1.16E+18 n/cm$^2$

1st capsule measured % decrease = -5.6 (Charpy curves)

1st capsule RG 1.99 predicted % decrease = 10.2 (RG 1.99, Rev. 2, Figure 2)

**Limited Beltline Plate USE**

% Cu = 0.12

54 EFPY ¼T fluence = 6.04E+18 n/cm$^2$

RG 1.99 predicted % decrease = 19.0 (RG 1.99, Rev. 2, Figure 2)

Adjusted % decrease = N/A (RG 1.99, Rev. 2, Position 2.2)

**19.0% ≤ 23.5%**

Therefore, vessel plates meet the criteria for equivalent margin analysis. (Ref. 4-18)

### 4.2.5 Reactor Vessel Circumferential Weld Inspection Relief

Relief from reactor vessel circumferential weld inservice inspection (ISI) examination requirements was granted on July 14, 2006 (Ref. 4-12, 4-13, 4-14). The relief request is based on BWRVIP-05 and the guidance provided in Generic Letter (GL) 98-05. The NRC safety evaluation report (SER) stated the relief request was applicable for the remaining term of the operating license.

Relief from RPV circumferential weld examination is based on probabilistic assessments that predict an acceptably low probability of failure. The circumferential weld examination relief analysis includes evaluation of the adjusted reference temperature of the reactor vessel beltline and therefore meets the TLAA definition.

The operations-specific training and procedures to minimize the potential for RPV cold over-pressurization events have been implemented.

To validate the circumferential weld inspection relief for the period of extended operation, Table 4.2-5 provides a comparison of the RBS RPV limiting circumferential weld parameters to those used in the NRC analysis for the first two key assumptions defined as (1) the neutron fluence is the estimated end-of-life mean fluence at the inside surface rather than ¼T, and (2) the chemistry values are mean values based on vessel types.

For RBS, the chemistry values are better (lower) than those used in the NRC analysis for plants fabricated by Chicago Bridge and Iron (CB&I); therefore, the chemistry factor (CF) is lower. As a result, the value of $\Delta RT_{NDT}$ is lower than the value from the NRC analysis, and although the unirradiated $RT_{NDT}$ values are higher, the mean $RT_{NDT}$ values are less than the value for the NRC analysis.

The mean $RT_{NDT}$ values at 54 EFPY are less than the 64 EFPY mean $RT_{NDT}$ provided by the NRC (Ref. 4-22). Although a conditional failure probability has not been calculated, the fact that the RBS values at the end of the period of extended operation are less than the 64 EFPY value provided by the NRC leads to the conclusion that the RBS RPV conditional failure probability is bounded by the NRC analysis. Therefore, the RPV beltline circumferential weld inspection relief analysis remains valid for the period of extended operation. (Ref. 4-18)

Axial weld examinations are completed on essentially 100 percent of the axial welds. Examinations to date have not revealed an active mechanistic mode of degradation in the axial welds. In accordance with BWRVIP-05 SER, examination of the circumferential welds will be performed if axial weld examinations reveal an active mechanistic mode of degradation.

Circumferential weld inspection relief, if necessary for the period of extended operation, will be requested through a reapplication under the 10 CFR 50.55a process. Therefore, this is categorized in accordance with 10 CFR 54.21(c)(1)(iii).

**Table 4.2-5**
**RBS Circumferential Weld Evaluation for 54 EFPY**

| Parameter Description | NRC Staff Assessment for 64 EFPY[a] | RBS 54 EFPY Weld AB[b] | RBS 54 EFPY Weld AC[c] |
|---|---|---|---|
| Weld copper content, % | 0.10 | 0.06 | 0.034 |
| Weld nickel content, % | 0.99 | 0.85 | 0.934 |
| Weld chemistry factor (CF) | 134.9 | 82 | 46 |
| Neutron fluence at the end of the requested relief period, $n/cm^2$ | 1.02E+19 | 0.079E+19 | 0.034E+19 |
| Initial reference temperature ($RT_{NDT}$), °F | -65 | -50 | -20 |
| Increase in reference temperature ($\Delta RT_{NDT}$), °F[d] | 135.6 | 30.4 | 11.0 |
| Mean adjusted reference temperature (ART), °F | 70.6 | -19.6 | -9.0 |
| P (F/E) NRC[e] | 1.78E-5 | [f] | [f] |

a. From Table 2.6-5 of Ref. 4-22, with corrected CF from Ref. 4-11.
b. Weld AB occurs within the extended beltline region, defined as experiencing a fluence > 1.0E+17 $n/cm^2$. Therefore, Weld AB, which is approximately 7 inches below the active core, is presented, conservatively using the value of peak fluence at 54 EFPY.
c. Weld AC occurs within the extended beltline region, defined as experiencing a fluence > 1.0E+17 $n/cm^2$. Therefore, Weld AC, which is approximately 20 inches above the active core, is presented, conservatively using the value of peak fluence at 54 EFPY.
d. $\Delta RT_{NDT} = CF \times f^{(0.28 - 0.10 \log f)}$
e. P (F/E) stands for "Probability of a failure event."
f. Although a conditional failure probability has not been calculated, the fact that the RBS values at the end of the period of extended operation are less than the 64 EFPY value provided by the NRC leads to the conclusion that the RBS RPV conditional failure probability is bounded by the NRC analysis, consistent with the requirements defined in GL 98-05.

### 4.2.6 Reactor Vessel Axial Weld Failure Probability

The NRC SER for BWRVIP-74-A (Ref. 4-21) evaluated the failure frequency of axially oriented welds in BWR reactor vessels. Applicants for license renewal must evaluate axially oriented RPV welds to show that their failure frequency remains below the value calculated in the BWRVIP-74 SER. The SER states that an acceptable way to do this is to show 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 the SER.

Table 4.2-6 provides the RBS reactor vessel limiting axial weld parameters for comparison to those used by the NRC analysis documented in BWRVIP-74-A. This table uses inner surface fluence rather than ¼T fluence and no margin for $RT_{NDT}$. (Ref. 4-18)

**Table 4.2-6**
**Effects of Irradiation of RBS Reactor Vessel Axial Weld Properties**

| Parameter Description | NRC Staff Assessment for 32 EFPY (Axial Welds) | RBS 54 EFPY Shell 1 | RBS 54 EFPY Shell 2 | RBS 54 EFPY Shell 3 |
|---|---|---|---|---|
| | Mod 2 | CB&I RPV | CB&I RPV | CB&I RPV |
| Weld copper content, % | 0.219 | 0.07 | 0.09 | 0.07 |
| Weld nickel content, % | 0.996 | 0.71 | 0.92 | 0.71 |
| Weld chemistry factor (CF) | 231.1 | 95 | 122 | 95 |
| Fluence at clad/weld interface ($10^{19}$ n/cm$^2$) | 0.148 | 0.079 | 0.835 | 0.034 |
| $RT_{NDT(U)}$, °F | -2 | -60 | -50 | -60 |
| $\Delta RT_{NDT}$ without margin (°F)[(a)] | 116 | 35.3 | 115.8 | 22.5 |
| Mean $RT_{NDT}$ (°F) | 114 | -24.7 | 65.8 | -37.5 |
| Vessel failure frequency | 5.02E-06 | (b) | (b) | (b) |

a. $\Delta RT_{NDT} = CF \times f^{(0.28 - 0.10 \log f)}$

b. Although a vessel failure frequency has not been calculated, the fact that the RBS mean $RT_{NDT}$ values at 54 EFPY are less than the 32 EFPY value provided by the NRC leads to the conclusion that the RBS RPV vessel failure frequency is less than that provided in the NRC analysis, consistent with the requirements defined in GL 98-05.

The projected 54 EFPY RBS mean $RT_{NDT}$ values are less than the 32 EFPY mean $RT_{NDT}$ provided by the NRC (Ref. 4-11). Although a vessel failure frequency has not been calculated, the fact that the RBS values at the end of the period of extended operation are less than the 32 EFPY value provided by the NRC leads to the conclusion that the RBS RPV axial weld failure probability is less than the value from the NRC analysis, consistent with the requirements of Ref. 4-11. Therefore, RPV beltline axial weld failure probability remains acceptable through the period of extended operation.

The ART table for RBS reactor vessel beltline materials is included as Table 4.2-2.

The reactor vessel axial weld failure probability TLAA has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

### 4.2.7 Reactor Pressure Vessel Core Reflood Thermal Shock Analysis

General Electric Report NEDO-10029 is referenced in USAR Section 5.3. NEDO-10029 addressed the concern for brittle fracture of the RPV 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 effects of neutron embrittlement at the end of 40 years. Because this analysis bounded only 40 years of operation, reflood thermal shock of the RPV has been identified as a TLAA for RBS requiring evaluation for the period of extended operation.

In addition to NEDO-10029 that is listed in the USAR, a more recent analysis of the BWR-6 vessels (Ref. 4-10) is appropriate for the RBS RPV because it evaluates the bounding LOCA event for a BWR-6 vessel design, which is a main steam line break.

This analysis shows that when the peak stress intensity occurs at approximately 300 seconds after the LOCA, the temperature inside the vessel wall is approximately 380°F. The maximum ART value calculated for the RBS RPV beltline material is 110.7°F. Using the equation for $K_{IC}$ (material resistance to fracture) presented in Appendix A of ASME Section XI and the maximum ART value, the material reaches upper shelf at 215°F. The minimum 380°F temperature predicted for the thermal shock event at the time of peak stress intensity remains well above the 215°F value at which the material would transition from the upper shelf. Therefore, the revised analysis has projected the TLAA through the period of extended operation.

The RPV core reflood thermal shock TLAA has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

## 4.3 METAL FATIGUE

Fatigue analyses are considered TLAAs for Class 1 and non-Class 1 mechanical components. Fatigue is an age-related degradation mechanism caused by cyclic stressing of a component by either mechanical or thermal stresses.

The aging management reviews (Section 3) for RBS identify mechanical components that are within the scope of license renewal and are subject to aging management review. When TLAA – metal fatigue is identified in the aging management program column of the tables in Section 3, the associated fatigue analyses are evaluated in this section. In accordance with 10 CFR 54.21(c)(1), a license renewal applicant's evaluation of TLAAs must determine whether

(i) the analyses remain valid for the period of extended operation,

(ii) the analyses have been projected to the end of the period of extend operation, or

(iii) the effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

Section 4.3.1 provides a description of the evaluation of RBS Class 1 component fatigue analyses. Evaluation of fatigue analyses of non-class 1 mechanical components is described in Section 4.3.2. Section 4.3.3 discusses evaluation of the effects of the reactor coolant system environment on fatigue, also known as environmentally assisted fatigue.

### 4.3.1 <u>Class 1 Fatigue</u>

Fatigue evaluations were performed in the design of RBS Class 1 components in accordance with their design requirements. ASME Section III fatigue evaluations are contained in analyses and stress reports, and because they are based on a number of transient cycles assumed for a 40-year operating term, these evaluations are considered TLAAs.

Design cyclic loadings and thermal conditions for the Class 1 components are defined by the applicable design specifications for each component. The original design specifications provided the set of transients used in the design of the components. The transients for use in the reanalysis for environmentally assisted fatigue are identified in Table 4.3-1. See Section 4.3.3 for additional information on the evaluation of environmentally assisted fatigue.

RBS utilizes cycle counting, cycle-based fatigue monitoring, and stress-based fatigue monitoring.

<u>Cycle Counting</u>

Plant data such as reactor pressure, feedwater temperature, jet pump flow rate, and generator output are monitored and saved in computer files for evaluation during periodic cycle tracking activities. During these activities, the accrued numbers of cycles for the transients shown in Table 4.3-1 are logged. The numbers of cycles that have occurred are compared to limits corresponding to the assumed values used in associated fatigue analyses.

Cycle-Based Fatigue Monitoring

Cycle-based fatigue monitoring counts the cycles that have occurred and computes a usage factor for a given location based on the usage attributable to each individual transient cycle. The use of cycle-based fatigue allows a conservative determination of the usage (CUF) that has occurred at a specific location based on the actual number of transients that have occurred assuming that the usage that is associated with each of these transients is the fatigue usage for the design transient severity. This is a determination of the actual fatigue usage in contrast to cycle counting, which simply demonstrates that the fatigue analysis remains valid. During periodic cycle tracking activities, the cumulative fatigue usage at cycle-based fatigue locations is projected to ensure corrective action is initiated prior to exceeding an allowable usage value.

Stress-Based Fatigue Monitoring

Stress-based fatigue monitoring is used where more refined fatigue usage determination is necessary because of the more severe thermal duty experienced by specific components. The stress-based fatigue approach utilizes computer-based analyses and actual plant data to calculate the stress that occurs during each transient and the associated fatigue usage. The calculated CUF is projected to ensure corrective action is initiated prior to exceeding an allowable usage factor. RBS uses stress-based fatigue monitoring on the feedwater nozzles.

The Fatigue Monitoring Program tracks and evaluates transient cycles and requires corrective actions if limits are approached. The Fatigue Monitoring Program ensures that the numbers of transient cycles experienced by the plant remain within the numbers of cycles assumed in the fatigue analysis. Further details on the Fatigue Monitoring Program are provided in LRA Appendix B, Section B.1.18.

Based on the numbers of cycles accrued through February 28, 2015, Entergy projected the numbers of cycles expected through the end of 60 years of operation. Table 4.3-1 shows the projected values through the period of extended operation and identifies the value for use in the reanalysis for environmentally assisted fatigue. The Fatigue Monitoring Program (Section B.1.18) will ensure that the accrued numbers of cycles of all design transients will remain below the numbers of cycles evaluated in the environmentally assisted fatigue (EAF) analyses.

**Table 4.3-1**
**RBS Cycles**

| Event Name | Startup through 2/28/2015 | Maximum 60-Yr Projection[a] | Value for Use in EAF Analyses |
|---|---|---|---|
| Boltup | 21 | 44 | 49 |
| Design hydrotest | 20 | 44 | 49 |
| Leak check (to 400 psig) | 0 | 0 | 1 |
| Startup | 72 | 153 | 168 |
| Turbine roll | 91 | 191 | 200 |
| Partial FW heater bypass | 2 | 5 | 70 |
| SCRAM | 57 | 121 | 128 |
| Reduction to 0% power | 81 | 169 | 180 |
| Hot standby | 82 | 180 | 190 |
| Shutdown | 72 | 151 | 160 |
| Vessel floodup | 20 | 42 | 49 |
| Unbolt | 21 | 44 | 49 |
| Loss of feedpumps | 3 | 7 | 8 |
| Blowdown scram | 0 | 0 | 8 |
| LPCS injection | 1 | 2 | 10 |
| HPCS injection | 30 | 67 | 73 |
| RCIC injection | 82 | 189 | 208 |
| SLC injection | 0 | 0 | 1 |
| LPCI A injection | 8 | 18 | 20 |
| LPCI B injection | 5 | 11 | 20 |
| LPCI C injection | 0 | 0 | 20 |
| Single SRV actuation | 556 | 1233 | 1295 |
| Multiple SRV actuation | 24 | 53 | 58 |
| Operating basis earthquake | 0 | 0 | 1 |
| RWCU system trip | 80 | 167 | 175 |

a. The 60-year projected number of cycles was calculated by two different methods. Method 1 was a linear projection including all cycles since plant startup. Method 2 was a linear projection based on the number of occurrences between 4/15/94 and 2/28/15. For conservatism, the higher value from the two projection methods was used.

### 4.3.1.1 Reactor Pressure Vessel

The reactor pressure vessel shown on USAR Figure 5.3-1 is a vertical, cylindrical pressure vessel of welded construction. As described in USAR Section 5.3.3.1, the vessel was designed, fabricated, tested, inspected, and stamped in accordance with the ASME Section III, Class I, 1971 requirements including the Summer 1973 Addenda.

As identified in USAR Section 5.3.3.1.4.5, a second piston ring and triple thermal sleeves were incorporated into the RBS feedwater nozzle design for thermal fatigue concerns. The triple thermal sleeve design on feedwater nozzle 4A was later replaced with a tuning fork design.

Stress-based fatigue analyses are used to monitor the RBS feedwater nozzles. Table 4.3-1 identifies the transients necessary to track to ensure the continuing validity of fatigue analyses for other RPV locations. The Fatigue Monitoring Program (Section B.1.18) will manage the effects of aging due to fatigue on the reactor vessel in accordance with 10 CFR 54.21(c)(1)(iii).

### 4.3.1.2 Reactor Pressure Vessel Internals

The BWR Vessel Internals Program manages aging effects, including cracking due to fatigue for the reactor vessel internals. The program performs inspections and flaw evaluations in accordance with the guidelines of applicable BWRVIP reports. This program manages the aging effects of cracking, loss of preload, loss of material, and reduction in fracture toughness for BWR vessel internal components in a reactor coolant environment.

For reactor vessel internals components with fatigue TLAAs, the effects of aging due to fatigue will be managed by the BWR Vessel Internals Program for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii). For further information, see Section B.1.10, BWR Vessel Internals Program.

### 4.3.1.3 Reactor Recirculation Pumps

As described in USAR Section 3.9.3.1.6B, the recirculation pumps are designed in accordance with the ASME Code, Section III, considering the transients identified in USAR Section 3.9.1.1.11B.

The transients required to be tracked are shown in Table 4.3-1. Transient cycles are monitored in accordance with the Fatigue Monitoring Program (Section B.1.18), which assures that action is taken if the accrued number of cycles of a transient approaches the analyzed number of cycles. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the reactor recirculation pumps in accordance with 10 CFR 54.21(c)(1)(iii).

#### 4.3.1.4 Control Rod Drives

The Class 1 portions of the control rod drives were analyzed for fatigue.

The transients required to be tracked are shown in Table 4.3-1. Transient cycles are monitored using the Fatigue Monitoring Program (Section B.1.18), which assures that action is taken if the accrued number of cycles of a transient approaches the analyzed number of cycles. As such, the Fatigue Monitoring Program will manage the effects of aging due to fatigue on the control rod drives in accordance with 10 CFR 54.21(c)(1)(iii).

#### 4.3.1.5 Class 1 Piping and In-Line Components

ASME Section III Class 1 piping is shown on the following LRA drawings.

| System (System Code) | LRA Drawing(s) |
|---|---|
| Nuclear boiler instrumentation system (051/058) | LRA-PID-25-01A<br>LRA-PID-25-01G |
| Control rod drive hydraulic system (052) | LRA-PID-36-01A<br>LRA-PID-36-01B |
| Reactor recirculation system (053) | LRA-PID-25-01A<br>LRA-PID-25-01C<br>LRA-PID-25-01D<br>LRA-PID-25-01E<br>LRA-PID-25-01F<br>LRA-PID-26-03A<br>LRA-PID-32-09C |
| Feedwater system (107/501) | LRA-PID-03-01A<br>LRA-PID-25-01A<br>LRA-PID-06-01B |
| Main steam system (109) | LRA-PID-03-01A<br>LRA-PID-03-01B<br>LRA-PID-03-01C<br>LRA-PID-32-05B |
| Remote shutdown (200) | LRA-PID-25-01A |
| Standby liquid control system (201) | LRA-PID-03-01A<br>LRA-PID-27-16A |
| Pressure relief system (202) | LRA-PID-03-01B<br>LRA-PID-25-01A |

| System (System Code) | LRA Drawing(s) |
|---|---|
| High pressure core spray system (203) | LRA-PID-27-04A |
| Residual heat removal-LPCI system (204) | LRA-PID-25-01A<br>LRA-PID-27-07A<br>LRA-PID-27-07B<br>LRA-PID-27-07C |
| Low pressure core spray system (205) | LRA-PID-27-05A |
| Leak detection system (207) | LRA-PID-03-01A<br>LRA-PID-26-03A<br>LRA-PID-27-04A<br>LRA-PID-27-07A<br>LRA-PID-27-07C<br>LRA-PID-32-09B |
| MSIV positive leakage control system (208) | LRA-PID-03-01A<br>LRA-PID-27-20A |
| Reactor core isolation cooling system (209) | LRA-PID-27-06A |
| Reactor protection system (508) | LRA-PID-25-01A |
| Reactor water cleanup and filter system (601) | LRA-PID-26-03A |
| Floor and equipment drains system (609) | LRA-PID-32-05B<br>LRA-PID-32-09B<br>LRA-PID-32-09C<br>LRA-PID-32-09N |
| Reactor plant sampling system (610) | LRA-PID-21-02B |

This RBS ASME Class 1 piping specifications identified that ASME Class 1 piping must be analyzed for the cycles identified on General Electric transient cycle drawings. Detailed fatigue analyses were generated to analyze multiple locations within the ASME Class 1 boundary on each system. See Section 4.3.3 for discussion of the environmentally assisted fatigue analyses for Class 1 piping and in-line components. The Fatigue Monitoring Program (Section B.1.18) will monitor the accrued cycles and utilize cycle-based fatigue monitoring and stress-based fatigue monitoring. The Fatigue Monitoring Program will manage the effects of aging due to fatigue on the ASME Section III piping in accordance with 10 CFR 54.21(c)(1)(iii).

### 4.3.2 Non-Class 1 Fatigue

The aging management reviews for RBS identify non-Class 1 mechanical components that are within the scope of license renewal and subject to aging management review. Based on exposure to mechanical and thermal cycling, specific components are subject to fatigue as identified in the aging management reviews.

The non-Class 1 fatigue screening document in Appendix H of the EPRI Mechanical Tools was used to determine locations susceptible to fatigue cracking in non-Class 1 systems at RBS. The first step in the screening process was to identify non-Class 1 components that may have normal or upset condition operating temperature in excess of 220°F for carbon steel or 270°F for stainless steel. These values are based on recommendations in the EPRI Fatigue Management Handbook (TR-104534), as summarized in the EPRI Mechanical Tools. The components that were identified in the aging management reviews as above the threshold for fatigue are further evaluated for fatigue in the following sections.

The components identified for fatigue are grouped into one of the two major categories of (1) piping and in-line components (tubing, piping, traps, thermowells, valve bodies, etc.) or (2) non-piping components (tanks, vessels, heat exchangers, pump casings, turbine casings, expansion joints, etc.). Sections 4.3.2.1 and 4.3.2.2 present the results of the review for piping (including in-line components) and non-piping components, respectively.

#### 4.3.2.1 Piping and In-Line Components

The impact of thermal cycles on non-Class 1 components is addressed in the calculation of the allowable stress range. The design of ASME III Code Class 2 and 3 or ANSI B31.1 piping systems incorporates a stress range reduction factor for piping design with respect to thermal stresses. In general, a stress range reduction factor of 1.0 in the stress analyses applies for up to 7,000 thermal cycles. The allowable stress range is reduced by a stress range reduction factor if the number of thermal cycles exceeds 7,000.

Thermal cycles for the non-Class 1 systems have been evaluated for 60 years of plant operation. For many plant systems, significant temperature cycles are coincident with plant heatups and cooldowns, which are limited to well below 7,000 cycles as shown in Table 4.3-1. Systems with transients that are independent of plant heatups and cooldowns are discussed below with references to the LRA table in Section 3 that documents the results of the aging management review.

- Table 3.2.2-1, Pressure Relief System (piping downstream of SRVs)
  The number of SRV actuations is tracked as shown in Table 4.3-1 and will remain below 7,000 cycles.

- Table 3.2.2-3, Residual Heat Removal System
  Cycles of the RHR system occur when the system is placed in service during the cooldown of the plant during a plant shutdown. Plant shutdowns are tracked as shown in Table 4.3-1 with a limit of less than 7,000 cycles, and therefore, RHR cycles will not exceed 7,000 cycles.

- Table 3.2.2-5, Reactor Core Isolation Cooling System
  The RCIC turbine is tested approximately quarterly and system operation following a plant trip would be limited to less than a few hundred additional cycles. Therefore, the total number of cycles will remain below 7,000 cycles.

- Table 3.2.2-7, Containment Penetrations
  This includes containment penetrations in the RWCU system. The RWCU system cycles during plant startups and shutdowns and during system isolations, which will not result in the total number of cycles exceeding 7,000.

- Table 3.3.2-1, Control Rod Drive System
  The CRD system experiences temperature changes during a plant trip, but plant trips will remain less than 7,000.

- Table 3.3.2-7, Fire Protection – Water System
  The fire pump diesel engines are tested periodically (approximately monthly) and automatic actuations are infrequent, which will not result in the total number of cycles exceeding 7,000.

- Table 3.3.2-9, Combustible Gas Control System
  The combustible gas control system heat tracing is normally energized, and therefore, the piping is expected to experience less than 7,000 cycles.

- Table 3.3.2-10, Standby Diesel Generator System
  The standby diesel generators are tested periodically (approximately monthly) and automatic actuations are infrequent, which will not result in the total number of cycles exceeding 7,000.

- Table 3.3.2-11, High Pressure Core Spray Diesel Generator System
  The high pressure core spray diesel generator is tested periodically (approximately monthly) and automatic actuations are infrequent, which will not result in the total number of cycles exceeding 7,000.

- Table 3.3.2-18-19, Reactor Water Cleanup System (Nonsafety-Related Affecting Safety-Related)
  The RWCU system cycles during plant startups and shutdowns and during system isolations, which will not result in the total number of cycles exceeding 7,000.

- Table 3.3.2-18-22, Sampling System (Nonsafety-Related Affecting Safety-Related)
  The sampling system for radwaste uses a continuous flow sample stream that is not isolated between samples. The total number of cycles will remain significantly below 7,000 cycles during the period of extended operation.

These individual system evaluations indicate that 7,000 thermal cycles will not be exceeded through 60 years of operation. Therefore, the non-Class 1 piping and in-line components stress calculations remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

#### 4.3.2.2 Non-Piping Components

Non-class 1 components other than piping components require fatigue analyses if they were built to a section of the code such as ASME Section III, NC-3200 or ASME Section VIII, Division 2. A review of the non-Class 1 components other than piping (tanks, vessels, heat exchangers, pump casings, turbine casings) did not identify any non-Class 1 components subject to aging management review that were built to these codes.

The ECCS suction strainers (Table 3.2.2-2, High Pressure Core Spray System; Table 3.2.2-3, Residual Heat Removal System; and Table 3.2.2-4, Low Pressure Core Spray System) were evaluated for fatigue as part of the design. The strainers were evaluated for loadings from SRV operation and earthquake cycles. The allowable number of cycles was far in excess of anticipated cycles. Therefore, these analyses for strainers are valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

A review of the design was completed for metal flex hoses and expansion joints identified in the aging management reviews. Design specifications and calculations were identified with fatigue analyses for a bounding number of cycles, which were identified as TLAAs. Expansion joints that included fatigue analyses are identified in the Section 3 system tables. Evaluation of the analyses for each of these systems determined the number of analyzed cycles was adequate for 60 years of operation. Therefore, these metal flex hose and expansion joint fatigue TLAAs remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

### 4.3.3 Effects of Reactor Water Environment on Fatigue Life

Industry test data indicate that certain environmental effects (such as temperature and dissolved oxygen content) in the primary systems of light water reactors could result in greater susceptibility to fatigue than would be predicted by fatigue analyses based on the ASME Section III design fatigue curves. The ASME design fatigue curves were based on laboratory tests in air at low temperatures. Although the fatigue curves derived from laboratory tests were adjusted to account for effects such as data scatter, size, and surface finish, these adjustments may not be sufficient to account for actual reactor water operating environments.

As reported in SECY-95-245, the NRC believes that no immediate staff or licensee action is necessary to deal with the environmentally assisted fatigue issue. In addition, the staff concluded that it could not justify requiring a backfit of the environmental fatigue data to operating plants. However, the NRC concluded that, because metal fatigue effects increase with service life, environmentally assisted fatigue should be evaluated for any proposed extended period of operation for license renewal.

NUREG/CR-6260 addresses the application of environmental correction factors to fatigue analyses (CUFs) and identifies locations of interest for consideration of environmental effects (Ref. 4-9). Section 5.6 of NUREG/CR-6260 identified the following component locations to be the most sensitive to environmental effects for newer vintage General Electric plants. These locations and the associated RBS specific locations are identified in Table 4.3-2.

(1) Reactor vessel shell and lower head

(2) Reactor vessel feedwater nozzle

(3) Reactor recirculation piping (including inlet and outlet nozzles)

(4) Core spray line reactor vessel nozzle and associated Class 1 piping

(5) Residual heat removal nozzles and associated Class 1 piping

(6) Feedwater line Class 1 piping

The Fatigue Monitoring Program includes an enhancement to complete the environmentally assisted fatigue evaluation (see Section B.1.18). The Fatigue Monitoring Program will manage the effects of aging due to fatigue, including environmentally assisted fatigue, for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

**Table 4.3-2**
**NUREG/CR-6260 Locations**

| NUREG/CR-6260 Generic Location | | Plant-Specific Location | Material Type |
|---|---|---|---|
| 1 | Reactor vessel shell and lower head | Reactor vessel shell steam-water interface<br>Control rod drive nozzle | Low alloy steel<br>Inconel |
| 2 | Reactor vessel feedwater nozzles | Feedwater nozzles | Low alloy steel<br>Stainless steel<br>Inconel<br>Carbon steel |
| 3 | Reactor recirculation piping including inlet and outlet nozzles | Recirculation inlet nozzle<br>Recirculation outlet nozzle<br>Recirculation piping | Low alloy steel<br>Stainless steel<br>Inconel |
| 4 | Core spray line reactor vessel nozzle and associated Class 1 piping | High pressure core spray Class 1 piping and reactor vessel nozzle<br>Low pressure core spray Class 1 piping and reactor vessel nozzle | Low alloy steel<br>Stainless steel<br>Inconel<br>Carbon steel |
| 5 | Residual heat removal nozzles and associated Class 1 piping | Residual heat removal reactor vessel nozzles<br>Residual heat removal Class 1 piping | Low alloy steel<br>Stainless steel<br>Inconel<br>Carbon steel |
| 6 | Feedwater line Class 1 piping | Feedwater line Class 1 piping | Carbon steel |

## 4.4 ENVIRONMENTAL QUALIFICATION (EQ) ANALYSES OF ELECTRIC EQUIPMENT

All operating plants must meet the requirements of 10 CFR 50.49, which defines the scope of electrical components to be included in an EQ program and also provides the requirements an EQ program must meet. Qualification is based on environmental and service conditions during normal plant operation and also those conditions postulated for plant accidents. A record of qualification for in-scope components must be prepared and maintained in auditable form. Equipment qualification evaluations for EQ components that specify a qualification of at least 40 years, but less than 60 years, are considered TLAAs for license renewal.

The RBS Environmental Qualification (EQ) of Electric Components Program (EQ Program) (Section B.1.16) manages component thermal, radiation, and cyclic aging, as applicable, through aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation. The RBS EQ Program ensures that EQ components are maintained in accordance with their qualification basis.

The RBS EQ Program implements RBS commitments for 10 CFR 50.49. The program is consistent with NUREG-1801, Section X.E1 "Environmental Qualification (EQ) of Electrical Components." The RBS EQ Program will manage the effects of aging on the intended functions of EQ components that are the subject of EQ TLAAs for the period of extended operation in accordance with 10 CFR 54.21(c)(iii).

## 4.5 CONCRETE CONTAINMENT TENDON PRESTRESS

This section is not applicable since the RBS containment design does not include tendons.

## 4.6 CONTAINMENT LINER PLATE, METAL CONTAINMENTS, AND PENETRATIONS FATIGUE ANALYSIS

RBS utilizes a BWR Mark III containment. As described in USAR Section 3.8.2.4.1, fatigue analysis requirements for the steel containment cylinder and dome are evaluated in accordance with the requirements of ASME B&PV Code Section III, Division I, Subsection NE. Fatigue analysis requirements for the floor liner plate are evaluated in accordance with the requirements of ASME B&PV Code, Section III, Division 2. Further review of the containment dynamic loading effects are contained in USAR Appendix 6A.

The containment penetrations are described in USAR Section 3.8.2.1.2. The piping penetrations consist of sleeved penetrations for high temperature piping and unsleeved penetrations for low temperature piping. Detailed fatigue calculations were generated for the containment penetrations at RBS. The pipe and flued heads of the penetrations are evaluated as part of the piping pressure boundary. Critical locations of the penetration within the ASME Code Class MC boundary were evaluated for fatigue. The electrical penetrations were evaluated, and stresses were found to be so low that fatigue analysis was not required.

Containment structural components including the personnel airlocks, polar crane, equipment hatch, drywell airlock, drywell combination door/hatch assembly, and drywell head were evaluated for fatigue. The normal and upset loading conditions considered for fatigue of the primary containment components include earthquakes and effects from SRV lifts. The earthquakes and SRV lifts are tracked as shown in Table 4.3-1. Loads that would occur during an accident such as a loss of coolant accident or main steam line break were also evaluated.

As shown on USAR Figure 3.8-4, expansion joints (bellows) are utilized on sleeved penetrations. The specification required these be qualified for 14,000 cycles due to pipe thermal loads, 500 operating basis earthquake (OBE) cycles, and 20,000 SRV lift cycles. Plant startups, OBE cycles, and SRV cycles are tracked, and as shown in Section 4.3.2, the associated systems will not exceed 7000 cycles. Therefore, the analyses for the bellows are adequate for the period of extended operation.

As shown in USAR Figures 3.8-8 and 9.1-20 and LRA drawing LRA-PID-34-04A, bellows are utilized on the fuel transfer tube. As shown in USAR Figure 9.1-20 and USAR Table 9.1-3, the upper bellows are safety-related. This bellows is designed for seismic events that are tracked (none have occurred) and 150 cycles of flexing (some of which occur during the installation of the fuel transfer tube blind flange).

RBS will manage the aging effects due to fatigue for the containment components using the Fatigue Monitoring Program in accordance with 10 CFR 54.21(c)(1)(iii). For additional information see Appendix B, Section B.1.18.

## 4.7 OTHER PLANT-SPECIFIC TLAAS

### 4.7.1 Erosion of Main Steam Line Flow Restrictors

Regarding the stainless steel main steam flow restrictors, USAR Section 5.4.4.4 states, "Only very slow erosion will occur with time." The section later conservatively postulates that even with an erosion rate of 0.004 inches per year, the increase in choked flow after 40 years would be no more than 5 percent. The analysis of main steam flow restrictor erosion is evaluated as a TLAA.

Entergy evaluated the erosion rate for the main steam flow restrictors. The evaluation considered the specific material for the flow restrictors and determined the expected erosion rate. The evaluation determined the expected erosion rate would be much less than the conservative value in the USAR. Using the lower expected erosion rate, the increase in flow restrictor diameter after 60 years would result in a choked flow increase of less than the 5 percent value identified as acceptable in USAR Section 5.4.4.4. (Ref. 4-15)

This analysis has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

### 4.7.2 Postulation of HELB Locations

USAR Section 3.6.2.1.5.1A indicates that the determination of intermediate high energy line break (HELB) locations relied on an evaluation of cumulative usage factors (CUFs). As long as other stress criteria were also met, a break is not postulated at a location if the CUF is less than 0.1. Usage factors, as calculated in the design fatigue analyses, are based on numbers of design transient cycles assumed for the original 40-year life of the plant. Therefore, the analysis of cumulative usage factors used in the selection of postulated high energy line break locations is considered a TLAA.

The Fatigue Monitoring Program (Section B.1.18) will identify if the numbers of cycles are approaching the analyzed numbers of cycles. If the cycle limit will be exceeded, the program requires a review of the design calculations based on an assumed cycle limit to determine the necessary corrective actions.

Therefore, the fatigue calculations used for determining the intermediate HELB locations are evaluated in accordance with 10 CFR 54.21(c)(1)(iii). The Fatigue Monitoring Program (Section B.1.18) will manage the associated effects of aging.

### 4.7.3 Fluence Effects for Reactor Vessel Internals

The design specification for the reactor vessel internals components includes requirements beyond the ASME design requirements for austenitic stainless steel base metal components exposed to greater than $1 \times 10^{21}$ nvt (> 1 MEV) or weld metal exposed to greater than

$5 \times 10^{20}$ nvt (> 1 MEV), where *nvt* equals neutron density (*n*) multiplied by neutron velocity (*v*), multiplied by time (*t*).

The effects of fluence for 60 years of operation (54 EFPY) were analyzed for the reactor vessel internals components included in the design specification. Location-specific fluence levels were determined. The internal core support structure components were then evaluated against the fluence criteria in the design specification. The evaluation determined that the RBS internal core support structure components meet the design specification for operating conditions through 54 EFPY. (Ref. 4-17)

Therefore, this analysis has been projected through the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

### 4.7.4 Crane Load Cycles Analysis

Cranes that were designed to Crane Manufacturer's Association of America Specification #70 (CMAA-70) (Ref. 4-19) have an expected range of lifting cycles specified as part of their design. While there is no analysis that involves time-limited assumptions defined by the current operating term, for example, 40 years, fatigue evaluations are nevertheless evaluated as TLAAs for cranes that were designed to CMAA-70.

A review of the cranes at RBS was performed to determine which cranes were designed to CMAA-70. The spent fuel cask trolley crane and reactor building polar crane included CMAA-70 Service Class A1 in their design specification. The fuel building bridge crane includes CMAA-70 Service Class B in its design specification. The number of load cycles for which a crane is qualified under CMAA-70 Service Class A1 and B is based on load class and load cycles. The minimum range is 20,000 to 100,000 cycles. The estimated number of lifts for each crane at the end of the period of extended operation is shown in the following table.

| Crane | Total Estimated Lifts through Period of Extended Operation |
|---|---|
| Spent fuel cask trolley crane | 5,000 |
| Fuel building bridge crane | 40,000 |
| Reactor building polar crane (main hook) | 1,000 |
| Reactor building polar crane (auxiliary hook) | 39,000 |

The total estimated number of lifts for each crane is well below 100,000 cycles.

Therefore, the expected number of lifts is well below the value specified in CMAA-70, and the crane fatigue evaluation remains valid for the period of extended operation consistent with 10 CFR 54.21(c)(1)(i).

## 4.8 REFERENCES

4-1 NEI 95-10, *Industry Guidelines for Implementing the Requirements of 10 CFR 54 – The License Renewal Rule*, Revision 6, June 2005.

4-2 NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*, Revision 2, December 2010.

4-3 NUREG-1801, *Generic Aging Lessons Learned (GALL) Report*, Revision 2, December 2010.

4-4 EPRI Report TR-105090, *Guidelines to Implement the License Renewal Technical Requirements of 10 CFR 54 for Integrated Plant Assessments and Time-Limited Aging Analyses*, November 1995.

4-5 10 CFR 50 Appendix G, Fracture Toughness Requirements.

4-6 10 CFR 50 Appendix H, Reactor Vessel Material Surveillance Program Requirements.

4-7 NRC Regulatory Guide 1.99, Radiation Embrittlement of Reactor Vessel Materials, Revision 2.

4-8 NRC Regulatory Guide 1.190, Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence, March 2001.

4-9 NUREG/CR-6260 (INEL 95/0045), *Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components,* February 1995.

4-10 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 (Accession No. 9110110105 in the NRC's Public Legacy Library).

4-11 BWRVIP-05 SER (Final), NRC letter from G. C. Lainas to C. Terry, Niagara Mohawk Power Company, BWRVIP Chairman, "Supplement to Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC No. MA3395)," March 7, 2000.

4-12 RBC-50417, River Bend Station Unit 1 – Relief Request RBS-ISI-004 for Alternative to Section 50.55a of Title 10 of the Code of Federal Regulations (10 CFR) for Examination Requirements of Category B1.11 Reactor Pressure Vessel Welds (TAC No. MC8201), letter dated July 14, 2006.

4-13 CNRO-2005-00036, Request for Alternative to 10 CFR 50.55a Examination Requirements of Category B1.11 Reactor Vessel Welds, letter dated August 24, 2005.

4-14 CNRO-2006-00010, Request for Alternative to 10 CFR 50.55a Examination Requirements of Category B1.11 Reactor Vessel Welds, letter dated February 8, 2006.

4-15 RBS-ME-16-00008, "GEH 003N4606, Rev. 0, River Bend Station Unit 1 Main Steam Line Flow Restrictors, April 2016 (Proprietary)."

4-16 RBS-NE-17-00002, "GEH 003N2078, Rev.0, Entergy Operations, Inc., River Bend Nuclear Station Plant License Renewal Fluence Projection, March 2017 (Proprietary)."

4-17 RBS-NE-17-00004, "GEH 003N9941, Rev. 0, Entergy Corporation, Inc. River Bend Nuclear Station, Fluence Effect Evaluation on RPV Internal Components, March 2017 (Proprietary)."

4-18 RBS-NE-17-00003, "GEH 003N8442, Rev. 0, Pressure-Temperatures Limit Report for Entergy Operations, Inc., River Bend Station, March 2017 (Proprietary)."

4-19 CMAA Specification 70, Specifications for Electric Overhead Traveling Cranes, Copyright 1975.

4-20 NEDC-32983P-A, Revision 2, "General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations," dated January 2006 (Proprietary).

4-21 BWRVIP-74-A: BWR Vessel and Internals Project BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal, EPRI 1008872, June 2003 (Proprietary).

4-22 "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations (BWRVIP-05)," for the BWR Owners Group, EPRI, Palo Alto, CA (TR-105697) (Proprietary), September 28, 1995, with supplementing letters of June 24 and October 29, 1996; May 16, June 4, June 13, and December 18, 1997; and January 13 and July 28, 1998.