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# 1.0 ADMINISTRATIVE INFORMATION

A listing of the acronyms used in this application is provided in Section 1.12.

## 1.1 INTRODUCTION AND GENERAL INFORMATION

Pursuant to Part 54 of Title 10 of the Code of Federal Regulations (10 CFR 54), this application seeks renewal for an additional 20 year term of the facility operating license for Beaver Valley Power Station (BVPS) Unit 1 (DPR-66) and Unit 2 (NPF-73). The Unit 1 operating license currently expires at midnight, January 29, 2016. The Unit 2 operating license currently expires at midnight, May 27, 2027. Since BVPS is submitting this application prior to 20 years before the expiration of the operating license for Unit 2, BVPS submitted to the U.S. Nuclear Regulatory Commission (NRC) a request for an exemption from the requirement of 10 CFR 54.17(c),[1] which was subsequently granted.[2] The application includes renewal of the source, by-product, and special nuclear materials licenses that are combined in the facility operating licenses.

The application is organized in accordance with the U.S. Nuclear Regulatory Commission Regulatory Guide 1.188, "Standard Format and Content For Applications to Renew Nuclear Power Plant Operating Licenses," July 2001, and is consistent with the guidance provided by NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," Revision 4, October 2003.

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 renewed facility operating licenses for BVPS Units 1 and 2.

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

## 1.2 NAME OF APPLICANT

FirstEnergy Corp. (owner)

FirstEnergy Nuclear Operating Company (operator)

[1] Letter from Lew W. Myers (FENOC) to the NRC Document Control Desk, No. L-01-145, dated December 17, 2001, "Request for Exemption from the Requirements of 10 CFR 54.17(c)"
[2] Letter from Daniel Collins (NRC) to Mr. L. W. Myers (FENOC), dated May 10, 2002, "Beaver Valley Power Station, Unit No. 2 – Exemption from the Requirements of 10 CFR Part 54, Section 54.17(c) Regarding Schedule for License Renewal Application (TAC NO. MB3634)"

## 1.3 ADDRESS OF APPLICANT

**Address of FirstEnergy Corp.:**

FirstEnergy Corp.
76 South Main Street
Akron, Ohio 44308

**Address of Beaver Valley Power Station**

FirstEnergy Nuclear Operating Company
Beaver Valley Power Station
Post Office Box 4
Shippingport, Pennsylvania 15077

## 1.4 DESCRIPTION OF BUSINESS OR OCCUPATION OF APPLICANT

FirstEnergy Corp. is a registered public utility holding company headquartered in Akron, Ohio. The company's seven electric utility operating companies comprise the nation's fifth largest investor-owned electric company, serving 4.4 million customers within approximately 36,100 square miles of Ohio, Pennsylvania, and New Jersey. FirstEnergy also provides natural gas service to more than 2,000 industrial and commercial customers in the midwest. Additionally, company subsidiaries provide facilities services such as heating, ventilating, air conditioning, refrigeration, process piping, plumbing, electrical, building controls and systems, and facility management and are involved in telecommunications. The company owns nearly $33 billion in assets and produces approximately $12 billion in annual revenues.

FirstEnergy Nuclear Operating Company operates FirstEnergy Corp.'s nuclear generating facilities.

## 1.5 ORGANIZATION AND MANAGEMENT OF APPLICANT

FirstEnergy Nuclear Operating Company and FirstEnergy Corp. are not owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government. FirstEnergy Nuclear Operating Company and FirstEnergy Corp. make this application on their own behalf and are not acting as an agent or representative of any other person.

The names and business addresses of FirstEnergy Corp. directors and principal officers are listed below. All persons listed are U.S. citizens.

## FirstEnergy Corp. – Directors

| | |
|---|---|
| Anthony J. Alexander | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Paul T. Addison | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Dr. Carol A. Cartwright | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| William T. Cottle | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Ernest J. Novak, Jr. | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Russell W. Maier | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Wesley M. Taylor | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Robert N. Pokelwaldt | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Paul J. Powers | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Catherine A. Rein | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Robert C. Savage | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| George M. Smart | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |

| | |
|---|---|
| Jesse T. Williams, Sr. | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Dr. Patricia K. Woolf | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |

## First Energy Corp./FirstEnergy Nuclear Operating Company

### Principal Officers

FirstEnergy Corp.

| | |
|---|---|
| Anthony J. Alexander<br>President and Chief Executive Officer | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Richard R. Grigg<br>Executive Vice President and Chief Operating Officer | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Richard H. Marsh<br>Senior Vice President and Chief Financial Officer | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Leila L. Vespoli<br>Senior Vice President and General Counsel | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Harvey L. Wagner<br>Vice President, Controller and Chief Accounting Officer | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| David W. Whitehead<br>Corporate Secretary | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Thomas C. Navin<br>Treasurer | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Paulette R. Chatman<br>Assistant Controller | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |

| | |
|---|---|
| Jeffrey R. Kalata<br>Assistant Controller | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Randy Scilla<br>Assistant Treasurer | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Jacqueline S. Cooper<br>Assistant Corporate Secretary | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Edward J. Udovich<br>Assistant Corporate Secretary | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |

<u>FirstEnergy Nuclear Operating Company</u>

| | |
|---|---|
| Anthony J. Alexander<br>Chief Executive Officer | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Gary R. Leidich<br>President and Chief Nuclear Officer | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Richard H. Marsh<br>Senior Vice President and Chief Financial Officer | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Harvey L. Wagner<br>Vice President and Controller | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Leila L. Vespoli<br>Senior Vice President and General Counsel | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Joseph J. Hagan<br>Senior Vice President | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Lew W. Myers<br>Chief Operating Officer | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |

| | |
|---|---|
| L. William Pearce<br>Vice President, Beaver Valley | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Mark B. Bezilla<br>Vice President, Davis Besse | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Richard L. Anderson<br>Vice President, Perry | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Edward J. Udovich<br>Assistant Corporate Secretary | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Jacqueline S. Cooper<br>Assistant Corporate Secretary | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Randy Scilla<br>Assistant Treasurer | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Jeffrey R. Kalata<br>Assistant Controller | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Paulette R. Chatman<br>Assistant Controller | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Thomas C. Navin<br>Treasurer | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| David W. Whitehead<br>Corporate Secretary | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |
| Jeannine M. Rinckel<br>Vice President-Oversight | FirstEnergy Corp.<br>76 South Main Street<br>Akron, Ohio 44308 |

## 1.6 CLASS AND PERIOD OF LICENSE SOUGHT

FENOC requests renewal of the Class 104b operating license for BVPS Unit 1 and the Class 103 operating license for BVPS Unit 2 (license numbers DPR-66 and NPF-73, respectively) for a period of 20 years beyond the expiration of the current licenses. License renewal would extend the operating license for Unit 1 from midnight, January 29, 2016, until midnight, January 29, 2036 and for Unit 2 from midnight, May 27, 2027, until midnight, May 27, 2047. This application includes a request for renewal of those NRC source material, special nuclear material, and byproduct material licenses that are currently subsumed into or combined with the current operating license. The facility will continue to be known as the Beaver Valley Power Station and will continue to generate electric power during the renewal period.

## 1.7 ALTERATION SCHEDULE

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

## 1.8 REGULATORY AGENCIES HAVING JURISDICTION AND APPROPRIATE NEWS PUBLICATIONS

Regulatory Agencies Having Jurisdiction:

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

Securities and Exchange Commission
Headquarters
450 Fifth Street, NW
Washington, DC 20549

The Public Utilities Commission of Ohio
180 East Broad Street
Columbus, Ohio 43215-3793

Pennsylvania Public Utility Commission
PO Box 3265
Harrisburg, PA 17105-3265

News Publications:

Newsroom
Beaver County Times
400 Fair Ave.
Beaver, PA 15009

Newsroom
Pittsburgh Post Gazette
34 Boulevard of the Allies
Pittsburgh, PA 15222

Newsroom
The News
P.O. Box 629
1181 Airport Road
Aliquippa, PA 15001

Newsroom
Valley Tribune
P.O. Box 471
Ellwood City, PA 16117

News Director
WBVP-AM Radio
P.O. Box 719
1316 Seventh Avenue
Beaver Falls, PA 15010

News Director
WMBA-AM Radio
761 Merchant Street
Ambridge, PA 15003

News Director
WWVA-Radio
1015 Main Street
Wheeling, WV 26003

Newsroom
Weirton Daily Times
114 Lee Avenue
Weirton, WV 26062

News Director
WEIR-Radio
2307 Pennsylvania Avenue
Weirton, WV 26062

News Director
WOHI/WELA-Radio
15655 State Road 170
P.O. Box 2050
East Liverpool, OH 43920

News Director
WSOM/WQXK-Radio
4040 Simon Road
Youngstown, OH 44512

News Director
WYTV-Television
3800 Shady Run
Youngstown, OH 44502

Newsroom
Tribune Review
622 Cabin Hill Drive
Greensburg, PA 15601

News Director
WTRF-TV
96 16th Street
Wheeling, WV 26003

Newsroom
Hancock County Courier
Jefferson Street
New Cumberland, WV 26047

Newsroom
The Intelligencer
1500 Main Street
Wheeling, WV 26003

News Director
WKWK-Radio
1015 Main Street
Wheeling, WV 26003

News Director
WKBN-Radio
3930 Sunset Blvd.
Youngstown, OH 44512

News Director
WFMJ-Television
101 West Boardman Street
Youngstown, OH 44503

Newsroom
East Liverpool Evening Review
210 E. 4th Street
East Liverpool, OH 43920

Newsroom
Morning Journal
308 W. Maple Street
Lisbon, OH 44432

Newsroom
Youngstown Vindicator
P.O. Box 780
Youngstown, OH 44501-0780

News Director
WTOV Television
9 Red Donley Plaza
P.O. Box 9999
Steubenville, OH 43952

News Director
WPGH-Fox 53 Television
750 Ivory Avenue
Pittsburgh, PA 15214

News Director
KDKA-AM Radio
1 Gateway Center
Pittsburgh, PA 15222

News Director
WPXI Television
11 Television Street
Pittsburgh, PA 15214

Newsroom
Butler Eagle
114 W. Diamond St.
Butler, PA 16001

Newsroom
Salem News
161 N. Lincoln Avenue
Salem, OH 44460

News Director
WQED-TV
4802 5th Avenue
Pittsburgh, PA 15213

News Director
WOVK Radio
1015 Main Street
Wheeling, WV 26003

News Director
KDKA Television
1 Gateway Center
Pittsburgh, PA 15222

News Director
KQV News Radio
650 Smithfield Street
Center City Towers, Suite 620
Pittsburgh, PA 15222

News Director
WTAE Television
400 Ardmore Boulevard
Pittsburgh, PA 15221

## 1.9 CONFORMING CHANGES TO THE STANDARD INDEMNITY AGREEMENT

10 CFR 54.19(b) requires that license renewal applications must include "…conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." The current indemnity agreement for BVPS does not

contain a specific expiration term for the operating license. Therefore, conforming changes to account for the expiration term of the proposed renewed license are not necessary.

## 1.10 RESTRICTED DATA AGREEMENT

10 CFR 54.17(f) requires that if the license renewal application contains Restricted Data or other defense information, it must be prepared in such a manner that all Restricted Data and other defense information are separated in accordance with 10 CFR 50.33(j). This application does not contain any "Restricted Data," as that term is defined in the Atomic Energy Act of 1954, as amended, or other defense information, and it is not expected that any such information will become involved in these licensed activities.

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

## 1.11 DESCRIPTION OF BEAVER VALLEY POWER STATION

Beaver Valley Power Station Units 1 and 2 are two Westinghouse pressurized water reactors and associated equipment, located on the southern shore of the Ohio River in Beaver County, Pennsylvania, approximately 22 miles northwest of Pittsburgh and 5 miles east of East Liverpool, Ohio.

## 1.12 ACRONYM LISTING

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

| Acronym | Definition |
|---|---|
| AC | Alternating Current |
| ACRS | Advisory Committee on Reactor Safeguards |
| ACSR | Aluminum Conductor Steel Reinforced |
| ACU | Air Conditioning Unit |
| ADDS | Alarm and Data Display System |
| AE | Aging Effects |
| AEL | Asset Equipment List |
| AERM | Aging Effect Requiring Management |
| AFW | Auxiliary Feedwater |
| AMP | Aging Management Program |
| AMR | Aging Management Review |
| AMSAC | ATWS Mitigating System Actuation Circuitry |
| ARERAS | Atmospheric Radioactive Effluent Release Assessment System |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| ATWS | Anticipated Transient Without Scram |
| B&W | Babcock and Wilcox |

| Acronym | Definition |
|---|---|
| BIT | Boron Injection Tank |
| BTP | Branch Technical Position |
| BVPS | Beaver Valley Power Station |
| BWR | Boiling Water Reactor |
| CASS | Cast Austenitic Stainless Steel |
| CCR | Primary Component and Neutron Shield Tank Cooling Water System |
| CDF | Core Damage Frequency |
| CE | Combustion Engineering |
| CFR | Code of Federal Regulations |
| CIA | Containment Isolation Phase A |
| CIB | Containment Isolation Phase B |
| CLASL | Carbon Steel, Low Alloy Steel |
| CLB | Current Licensing Basis |
| CO2 | Carbon Dioxide |
| CR | Condition Report |
| CRD | Control Rod Drive |
| CRDM | Control Rod Drive Mechanisms |
| CVCS | Chemical and Volume Control System |
| CVN | Charpy V-Notch |
| CVS | Containment Vacuum System |
| DBA | Design Basis Accident |
| DBD | Design Basis Document |
| DBE | Design Basis Event |
| DC | Direct Current |
| DE | Designated Engineer |
| DG | Diesel Generator |
| DLC | Duquesne Light Company |
| DOE | Department of Energy |
| DPU | Database Processing Unit |
| DRMS | Digital Radiation Monitoring System |
| DWS | Domestic Water System |
| EAF | Environmentally Assisted Fatigue |
| ECC | Emergency Communications Console |
| ECCS | Emergency Core Cooling Systems |
| EDG | Emergency Diesel Generator |
| EEQML | Electrical Equipment Qualification Material List |
| EFPY | Effective Full Power Years |
| EOF | Emergency Operations Facility |
| EOL | End of Life |
| EOLE | End of License Extension |
| EPP | Emergency Preparedness Plan |
| EPRI | Electric Power Research Institute |
| EQ | Environmental Qualification |
| ERF | Emergency Response Facility |

| Acronym | Definition |
|---|---|
| ERFS | Emergency Response Facility Substation |
| ESF | Engineered Safety Features |
| FAC | Flow-Accelerated Corrosion |
| FENOC | FirstEnergy Nuclear Operating Company |
| FERC | Federal Energy Regulatory Commission |
| FP | Fire Protection |
| GALL | Generic Aging Lessons Learned |
| GDC | General Design Criterion |
| GSI | Generic Safety Issue |
| GWST | Gaseous Waste Storage Tank |
| GWT | Ground Water Table |
| HELB | High Energy Line Break |
| HEPA | High Efficiency Particulate Air |
| HHSI | High Head Safety Injection |
| HPSI | High Pressure Safety Injection |
| HVAC | Heating, Ventilation, Air Conditioning |
| HX | Heat Exchanger |
| I&C | Instrumentation and Controls |
| IAEA | International Atomic Energy Agency |
| IASCC | Irradiation Assisted Stress Corrosion Cracking |
| IGA | Intergranular Attack |
| IGSCC | Intergranular Stress Corrosion Cracking |
| IPA | Integrated Plant Assessment |
| IR | Insulation Resistance |
| ISI | Inservice Inspection |
| KV | Kilovolt |
| LBB | Leak Before Break |
| LHSI | Low Head Safety Injection |
| LMS | Leakage Monitoring System |
| LOCA | Loss of Coolant Accident |
| LPSI | Low Pressure Safety Injection |
| LR | License Renewal |
| LRA | License Renewal Application |
| LSV | Loop Stop Valves |
| LTOP | Low Temperature Overpressure Protection |
| LWS | Liquid Waste System |
| MCC | Motor Control Center |
| MIC | Microbiologically Influenced Corrosion |
| MR | Maintenance Rule |
| MRP | Materials Reliability Program |
| NaOH | Sodium Hydroxide |
| NEI | Nuclear Energy Institute |
| NRC | Nuclear Regulatory Commission |
| NRR | Nuclear Reactor Regulation |

| Acronym | Definition |
|---|---|
| NSR | Non-Safety Related |
| NSS | Nuclear Shift Supervisor |
| NSSS | Nuclear Steam Supply System |
| ODSCC | Outside Diameter Stress Corrosion Cracking |
| OE | Operating Experience |
| OM | Operation Manual |
| OTI | One-Time Inspection |
| P/T | Pressure/Temperature |
| PAB | Primary Auxiliary Building |
| PASS | Post Accident Sample System |
| PAX | Private Automatic Exchange |
| PCA | Potentially Contaminated Area |
| PDM | Plasma Display Modules |
| PDTT | Primary Drain Transfer Tanks |
| PDWST | Primary Demineralized Water Storage Tank |
| PORV | Power Operated Relief Valve |
| PSMS | Plant Safety Monitoring System |
| PTS | Pressurized Thermal Shock |
| PWR | Pressurized Water Reactor |
| PWSCC | Primary Water Stress Corrosion Cracking |
| QA | Quality Assurance |
| QC | Quality Control |
| RCP | Reactor Coolant Pump |
| RCPB | Reactor Coolant Pressure Boundary |
| RCS | Reactor Coolant System |
| RG | Regulatory Guide |
| RHR | Residual Heat Removal |
| RIS | Regulatory Issue Summary |
| RPS | Reactor Protection System |
| RPU | Remote Processing Unit |
| RPV | Reactor Pressure Vessel |
| RT | Reference Temperature |
| RV | Reactor Vessel |
| RVI | Reactor Vessel Internals |
| RWST | Refueling Water Storage Tank |
| SAMA | Severe Accident Mitigation Alternatives |
| SBO | Station Blackout |
| SC | Structures and Components |
| SCC | Stress Corrosion Cracking |
| SE | Safety Evaluation |
| SER | Safety Evaluation Report |
| SG | Steam Generators |
| SOC | Statements of Consideration |
| SR | Safety Related |

| Acronym | Definition |
|---|---|
| SRV | Safety Relief Valve |
| SSC | Systems, Structures and Components |
| SWE | Standby Service Water System |
| SWS | Service Water System |
| TID | Total Integrated Dose |
| TLAA | Time Limited Aging Analysis |
| TSC | Technical Support Center |
| UFSAR | Updated Final Safety Analysis Report |
| UPS | Uninterruptible Power Supply |
| USE | Upper Shelf Energy |
| USST | Unit Station Service Transformers |
| UV | Ultraviolet |
| VAC | Volts Alternating Current |
| VDC | Volts Direct Current |
| VHF | Very High Frequency |
| WASS | Wrought Austenitic Stainless Steel |
| WOG | Westinghouse Owners Group |
| WSLR | Within the Scope of License Renewal |

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

A listing of the acronyms used in this application is provided in Section 1.12.

The following table contains the full definition of the intended functions shown in the Section 2 Screening results tables and the Section 3 Aging Management Review (AMR) results tables to represent the intended functions for component types.

**Table 2.0-1**
**Intended Function Definitions**

| Intended Function | Definition |
|---|---|
| Absorb Neutrons | Absorb neutrons to ensure subcriticality |
| Direct Flow | Provide spray shield or curbs for directing flow |
| Electrical Continuity | Provide continuity to deliver electrical signals or power (includes required insulation to accomplish) |
| Electrically Insulate | Provide electrical insulation to ensure continuity of electrical signals or power |
| Filtration | Provide filtration |
| Fire Barrier | Provide rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant |
| Fission Product Barrier | Provide fission product retention barrier to protect public health and safety |
| Flood Protection | Provide flood protection barrier (internal and external flooding event) |
| Flow Control | Control flow, distribute flow, eliminate flow inequalities, or prevent vortices |
| Flow Restriction | Provide restriction to throttle or measure flow (to mitigate design basis or regulated events) |
| Gaseous Discharge Path | Provide path for release of filtered and unfiltered gaseous discharge (vent stacks) |
| Heat Sink | Provide heat sink (includes ultimate heat sink) |
| Heat Transfer | Provide heat transfer |
| HELB Shielding | Provide shielding against high energy line breaks |
| Missile Barrier | Provide missile barrier (internally or externally generated) |
| NSR Functional Support | Provide NSR functional support to satisfy LR criterion 2 or 3 (applies only to NSR equipment) |
| Pipe Whip Restraint | Provide pipe whip restraint |
| Pressure Boundary | Provide pressure-retaining boundary |
| Radiation Shielding | Provide shielding against radiation |
| Shelter/Protection | Provide shelter/protection to safety-related components |
| Structural Support for NSR | Provide structural support to non-safety-related components used for regulated events or whose failure could prevent satisfactory accomplishment of any safety-related functions |
| Structural/Functional Support | Provide structural and / or functional support to safety-related equipment |
| Thermal Shielding | Provide thermal shielding |

## 2.1 SCOPING AND SCREENING METHODOLOGY

Scoping is performed to identify systems, structures, and components (SSCs) that perform functions within the scope of license renewal (WSLR) as required by 10 CFR 54.4. The scoping methodology is described in Section 2.1.1.

Screening is performed to (1) review the SSCs identified as in scope for license renewal in order to identify the specific structures and components (SCs) of those SSCs that support the functions of 10 CFR 54.4, then (2) review those SCs to identify those that are subject to aging management review as required by 10 CFR 54.21(a)(1). The screening methodology is described in Section 2.1.2.

### 2.1.1 Scoping

SSCs that satisfy the criteria of 10 CFR 54.4(a)(1), (2), or (3) are within the scope of license renewal. Specifically, 10 CFR 54.4 states:

> *(a) Plant systems, structures, and components within the scope of this part 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 non-safety-related systems, structures, and components whose failure could prevent satisfactory accomplishment of any of the functions identified in paragraphs (a)(1)(i), (ii), or (iii) of this section.*
>
> (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).*
>
> *(b) The intended functions that these systems, structures, and components must be shown to fulfill in* §54.21 *are those functions that are the bases for including them within the scope of license renewal as specified in paragraphs (a)(1)-(3) of this section.*

The BVPS scoping methodology is described below.

#### 2.1.1.1 Systems and Structures Definition

A definition process was completed for all site systems and structures to ensure that the entire plant was addressed. Potential sources of information included, but were not limited to:

- Design Basis Documents (DBDs)
- Maintenance Rule (MR) Scoping Documents
- Operation Manuals (OMs)
- Plant drawings
- Updated Final Safety Analysis Report (UFSAR)

The process identified and described the system or structure being reviewed. The following information was documented:

- System or structure name
- Description of the system or structure
- Complete list of the functions performed by the system or structure
- Applicable design or licensing basis references for the information obtained

#### 2.1.1.2 Safety-Related criteria pursuant to 10 CFR 54.4(a)(1) (Criterion 1)

The definition for safety-related SSCs used for determining the safety classifications for BVPS is consistent with the first license renewal scoping criterion. The following process was used to identify Safety-Related (SR) SSCs that are in scope for license renewal Criterion 1.

During preparation of this application, the Asset Equipment List (AEL) was used as the equipment database at BVPS. The AEL contains a field that associates the safety classification with the component-level equipment identification number. This classification identifies all of the components at BVPS that are SR. The AEL also identifies the SR structures that exist on the BVPS site.

The AEL and other plant documents that contain information regarding the systems and structures relied upon to remain functional during and following design-basis events were reviewed. Sources of this information included, but were not limited to:

- DBD source documents
- Electrical Equipment Qualification Material List (EEQML)
- MR Scoping Documents
- NRC Safety Evaluation Reports (SERs)
- OMs
- Plant drawings
- UFSAR

Because of plant-unique considerations and preferences, some equipment may have been designated as safety-related that does not perform any of the requirements of Criterion 1 of the LR Rule. This equipment was not considered within the scope of the LR Rule simply because of its classification.

From the documentation reviewed, intended functions were identified, if any, for each system and structure under review.

The following information was documented:

- System or structure function(s) that are intended functions per Criterion 1 of the LR Rule
- The applicable design or licensing basis references used to make the determination

#### 2.1.1.3 Non-Safety Related criteria pursuant to 10 CFR 54.4(a)(2) (Criterion 2)

NSR SSCs whose failure could prevent satisfactory accomplishment of any Criterion 1 intended function are within the scope of LR per Criterion 2 of the LR Rule.

The following steps were used to identify all NSR SSCs whose failure could prevent satisfactory accomplishment of any Criterion 1 intended function.

Plant documents were reviewed to determine if the system or structure under review has an intended function per Criterion 2. Documents such as those listed below were used to make this determination.

- AEL
- DBD source documents
- MR Scoping Documents
- NRC SERs
- OMs
- Plant drawings
- UFSAR

In order to identify such systems and structures, reviewers considered those failures identified in the documentation that makes up the CLB, plant specific operating experience (OE), and industry OE that is specifically applicable to BVPS.

Examples of items that might satisfy Criterion 2 are:

- Alternate/backup systems credited for Design Basis Events (DBEs)
- Equipment credited for internal flooding (barriers, drains)
- Equipment credited for external flooding
- Equipment credited for HELB (pipe whip, jet impingement)
- Equipment credited for preventing damage from internal missiles
- Load handling equipment credited for NUREG-0612

- Seismic II/I supports

While performing scoping activities for Criterion 2, hypothetical failures that could result from system interdependencies that are not part of the plant's CLB and that have not been previously experienced were not considered.

An additional evaluation was performed for identifying NSR piping segments that satisfy the scoping criterion of 10 CFR 54.4(a)(2) (Criterion 2). The pipe failure effects that were considered include spray, flooding, pressure and temperature rise, pipe whip, and jet impingement. Using a preventive approach, the following evaluation was performed to establish which additional NSR piping system and/or segments should be included within scope:

1. For each safety-related structure or area containing NSR piping systems and/or segments, the NSR piping not otherwise within the scope of license renewal (WSLR) based on other scoping criteria was identified. This included the NSR portions of SR piping systems.
2. Of the piping identified, those piping segments containing liquid and/or steam were identified. (Air and gas systems are not a hazard to other plant equipment. Industry operating experience for systems containing air/gas has shown no age-related failures.)
3. Those piping segments were considered WSLR and subject to aging management review.

The following information was documented:

- System or structure function(s) that are intended functions per Criterion 2 of the LR Rule
- The applicable design or licensing basis references used to make the determination

#### 2.1.1.4 Regulated Events scoping pursuant to 10 CFR 54.4(a)(3) (Criterion 3)

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

Reviews were performed of the appropriate reference documents that identify the CLB for compliance with the respective regulation. The system or structure must perform a function that is required for compliance with a particular regulation in order to be within scope for Criterion 3. Mere mention of a system or structure in the documentation does not mean that it was relied upon to demonstrate compliance with the regulation. Also, certain systems or structures may be relied upon for compliance with more than one of the identified regulations.

The following information was documented:

- System or structure function(s) that are intended functions per Criterion 3 of the LR Rule
- The applicable design or licensing basis references used to make the determination

More detail regarding the specific review for each Criterion 3 regulated event follows:

#### 2.1.1.4.1 Fire Protection

10 CFR 50.48 requires each operating nuclear power plant to have a fire protection plan that satisfies the requirement of Criterion 3 of 10 CFR 50 Appendix A, and further requires all nuclear power plants licensed to operate prior to January 1, 1979, to comply with Sections III.G, III.J and III.O of Appendix R to 10 CFR 50. Fire protection scoping involved performing a detailed review on the fire protection documents demonstrating compliance with the requirements of 10 CFR 50.48 for each unit. Clarifications associated with each unit are provided below.

Regarding BVPS Unit 1, Appendix R to 10 CFR Part 50 establishes fire protection features required to satisfy GDC 3 for BVPS Unit 1 as follows:

Section III.G; Safe Shutdown Capability
Section III.J; Emergency Lighting
Section III.O; RCP Oil Collection System

An Appendix R Report, "Updated Fire Protection Appendix R Review," was prepared for BVPS Unit 1, which contains the fire hazards analysis and summarizes the investigative electrical analysis performed for BVPS Unit 1 to determine if fires within a single area could jeopardize the ability to safely shutdown the plant. An NRC Safety Evaluation Report for Appendix R to 10 CFR 50 was issued on January 5, 1983, for BVPS Unit 1. Exemptions for specific fire areas were granted in NRC letters dated March 14, 1983; August 30, 1984; December 4, 1986; and July 27, 1987.

Regarding BVPS Unit 2, Branch Technical Position (BTP) CMEB 9.5-1, which is part of the acceptance criteria of the Standard Review Plan 9.5.1 (NUREG 0800), dated July 1981, provides guidelines acceptable to the NRC for implementing GDC 3 in the development of a Fire Protection Program. The BVPS Unit 2 Fire Protection System (Section 2.3.3.18) was designed using the guidance of that BTP. BVPS Unit 2 utilizes alternatives to the guidance provided in the BTP, with the associated justifications provided in Appendix 9.5A of the UFSAR. A Fire Protection Safety Evaluation Report was issued for BVPS Unit 2 as part of NUREG 1057, the SER related to the operation of BVPS Unit 2.

#### 2.1.1.4.2 Environmental Qualification

Plant information sources were reviewed regarding the SSCs relied upon for compliance with the requirements of 10 CFR 50.49. This regulation requires preparation of a list of electrical components that are required to withstand environmental conditions which may occur during or following a design-basis event. The SSCs satisfying §50.49 are annotated in the AEL and are

contained in the Beaver Valley EEQML. This information was used to determine the Environmental Qualification (EQ) SSCs in scope.

#### 2.1.1.4.3 Pressurized Thermal Shock

10 CFR 50.61, Fracture Toughness Requirements for Protection Against Pressurized Thermal Shock Events, requires that licensees evaluate the reactor vessel beltline materials against specific criteria to ensure protection against brittle fracture. Plant documents were reviewed that contain information regarding any SSCs relied upon for compliance with the requirements of 10 CFR 50.61. The BVPS PTS Evaluation was performed in accordance with Regulatory Guide (RG) 1.154 in order to satisfy 10 CFR 50.61 requirements. No BVPS systems are in scope for PTS. PTS is a TLAA discussed in Section 4.2.1.

#### 2.1.1.4.4 Anticipated Transients Without Scram

10 CFR 50.62, Requirements for Reduction of Risk from Anticipated Transient Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants, requires specific improvements in the design and operation of commercial nuclear power facilities to reduce the likelihood of failure to shut down the reactor following anticipated transients, and to mitigate the consequences of an ATWS event. A detailed review of the applicable plant documents was performed to identify all systems and structures and their intended functions in order to demonstrate compliance with the ATWS regulation. The standard Westinghouse ATWS Mitigating System Actuation Circuitry (AMSAC) system (Section 2.5.6) is installed in both BVPS units.

#### 2.1.1.4.5 Station Blackout

Plant documents were reviewed that contain information regarding the SSCs relied upon for compliance with the requirements of 10 CFR 50.63, Loss of All Alternating Current Power, which requires a plant to be able to withstand, for a specified duration, and recover from, a station blackout (loss of all alternating current power). This regulation requires that a coping evaluation be performed to determine a plant's ability to deal with a station blackout event. The results of BVPS coping evaluations are contained in SBO Shutdown Capability Summary documents that were prepared for each unit. A review of the documents was performed to identify required systems and structures and their intended functions used to demonstrate compliance with the SBO regulation.

For Station Blackout recovery, an additional evaluation was performed to determine and bring into scope the components credited with providing for recovery. Separate reports were generated for scoping, screening, and aging management review. Those additional components are accounted for in the following four systems:

- 480 Volt Station Service System (Section 2.5.3)
- 4KV Station Service System (Section 2.5.4)
- Electrical Grid System (Section 2.5.11)
- Emergency Diesel Generators and Support System (Section 2.3.3.16)

#### 2.1.1.5 General Scoping Discussion

For license renewal purposes, sometimes components in one system were transferred to other systems (the AEL system/component assignments were not changed). This is known as "system realignment." The main reason for doing this is that some systems only had a small number of components WSLR and they were only in scope due to their interaction with systems with many components WSLR. In such cases, it was appropriate to evaluate those few components with the other system. For example, a valve in a system otherwise not WSLR that provides an isolation boundary interface with a system with many components WSLR, would be transferred to the latter system for license renewal purposes.

### 2.1.2 Screening

The requirement to identify SCs subject to AMR is specified in 10 CFR 54.21(a)(1):

*Each application must contain the following information:*

*(a) An integrated plant assessment (IPA). The IPA must—*

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

*(i) That perform an intended function, as described in § 54.4 without moving parts or without a change in configuration or properties. These structures and components include, but are not limited to, the reactor vessel, the reactor coolant system pressure boundary, steam generators, the pressurizer, piping, pump casings, valve bodies, the core shroud, component supports, pressure retaining boundaries, heat exchangers, ventilation ducts, the containment, the containment liner, electrical and mechanical penetrations, equipment hatches, seismic Category 1 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.*

The BVPS screening methodology is described below.

#### 2.1.2.1 LR Boundaries

The initial screening step involves defining the LR physical/functional boundaries of the systems or structures WSLR. Precise boundaries are necessary to assure that all components required to support system and structure intended functions are identified as WSLR.

In general, system boundaries are established by using the component designations extracted from the AEL. The LR boundaries are defined by identifying (with descriptions, highlighted drawings or other suitable methods) the boundaries associated with the intended functions identified for the system or structure.

For mechanical systems, this typically consists of the pressure boundary or functional boundary associated with the system. As described in section 2.1.1.3, BVPS has also chosen to place all NSR fluid (water or steam) components in SR buildings and in SR areas outside of buildings (e.g. Refuleing Water Storage Tank area) within scope for criterion 2.

Using drawings for the system under review, the functional boundaries of the system meeting Criterion 1, 2 or 3 intended functions were highlighted. The NSR components that are in scope for criterion 2 solely because they are located within safety-related buildings or areas (as described in section 2.1.1.3) are not highlighted on system drawings.

For electrical systems, LR boundaries typically consist of the electrical boundary or functional boundary associated with the system. The electrical boundaries of the systems meeting Criterion 1, 2 or 3 intended functions were described, including identification of all Class 1E boundaries that assure the necessary electrical continuity is available for a system to perform its intended function(s).

For structures, LR boundaries typically consist of the physical boundary associated with the structure.

The following information was documented:

- The LR boundaries for each in-scope mechanical system
- Descriptions of electrical and structures LR boundaries
- The applicable design or licensing basis references used to make the determinations

#### 2.1.2.2 Component List

Next, a comprehensive and complete list of components that exist within the LR evaluation boundary for the system or structure under review was developed by performing the following steps.

A list of components was generated from the AEL for the systems and structures determined to be WSLR. Most mechanical and electrical components had already been identified in the AEL. Since certain components were not uniquely identified in the AEL, such as structural components, components were added as necessary to create a complete list for the system or structure under review. For those components in scope for criterion 2 due to their location in safety-related areas, scoping, screening and AMRs were performed on a system basis without establishment of a comprehensive list of components. All NSR fluid (water or steam) components in the SR buildings and areas were included on a commodity basis and evaluated for typical materials and environments present for that system.

Structures are comprised of different materials such as carbon steel, stainless steel, below grade concrete, above grade concrete, and elastomers. Sometimes, a broad term was used to represent a large portion of the structure (e.g., all above ground concrete), but enough distinction was made between structural components to accommodate evaluation of the aging effects. For example, above ground concrete and below ground concrete were identified separately since different AERMs may be applicable for each. It was also important that structural components that perform no intended functions be identified uniquely so that they could be excluded from AMR.

The following sources of potential component information were used:

- DBD source documents
- Equipment specifications
- Maintenance records
- MR scoping documents
- OMs
- Plant drawings
- Training manuals
- Vendor manuals
- UFSAR

<u>Piping System External Surfaces</u>

In order to efficiently evaluate the aging effects (AEs) of piping systems as represented in NUREG-1801, the external surfaces of each piping system were treated as individual components, generally based on the system and the material of construction. For example, external carbon steel surfaces of Engineered Safety Features Systems are treated as components in NUREG-1801 represented by item number V.E.1.1. The aging management of the surfaces are addressed by NUREG-1801 table rows V.E.1-a and V.E.1-b. Thus, it was most efficient to treat external surfaces in a similar fashion for consistent results and ease of regulatory review.

The following information was documented:

- The components within the LR boundary for the system or structure under review
- The applicable design or licensing basis references used to make the determinations

#### 2.1.2.3 Long-Lived Passive SSCs

Paragraph 54.21(a) of the LR Rule states that components subject to an AMR are those structures and components (SCs) that perform an intended function without moving parts or without a change in configuration or properties (passive) and are not subject to replacement based on a qualified life or specified time period (long-lived). The following process was used to identify components subject to AMR.

All structural components within the LR boundaries, with the exception of snubbers (snubbers are active), were assumed to be long-lived and passive. Thus, once they were determined to perform intended functions, they were considered subject to AMR.

For the mechanical and electrical components that are within the LR boundaries of the system or structure under review, determination is made as to which components function with moving parts or with a change in configuration or properties (active components). NUREG-1800 Table 2.1-5, which contains a list of component categories and indicates whether they are generally considered to be passive or active, was used for guidance. Active components do not require an AMR.

Those instruments that form an integral part of the process fluid pressure-retaining boundary, such as level glasses and flow glasses were considered passive and require an AMR.

For the mechanical and electrical components that are within the LR evaluation boundaries of the system under review, components subject to replacement based on a qualified life or specified time period (i.e., not long-lived components) were determined. All components in the EQ Program have a qualified life, thus they are not long-lived. For other components, periodic replacement information was obtained from maintenance activities or records. Components that are not long-lived are not subject to AMR

Some structures and components, when combined, are considered a complex assembly. For purposes of performing an AMR, boundaries of review were clearly established. BVPS results consider certain emergency diesel generator system components to be part of a complex assembly, based on their association with the active diesel engine component.

The following information was documented:

- For each component within the LR boundaries for the system or structure under review, indication as to whether it is passive and whether it is long lived
- The applicable design or licensing basis references used to make these determinations

#### 2.1.2.4 Component Intended Functions

Each component subject to AMR was assigned one or more component intended functions. A component function is an intended function if it must perform that function for the system or structure to be able to perform its intended function(s). For example, pressure boundary failure of a component would cause loss of inventory from the parent system, and the system would subsequently be unable to perform its intended function(s).

The following information was documented:

- The component intended function(s) for the components subject to AMR for the system or structure under review
- The applicable design or licensing basis references used to make these determinations

### 2.1.2.5 Screening of Stored Equipment

A review was performed to identify equipment that: 1) is maintained in storage, 2) is reserved for installation in the plant in response to a design basis accident or regulated event and 3) requires an AMR. In addition to passive components, the review has also considered stored active components that are not routinely inspected, tested and maintained.

The BVPS equipment in storage that performs an intended function and is subject to aging management review includes hardware that is dedicated to mitigating the effects of a fire.

The stored equipment identified as requiring AMR is listed below, along with a reference to the application section that contains the AMR results:

| Component Type | LRA Section Containing AMR Results |
|---|---|
| Cables and Connectors | Table 3.6.2-3; Electrical and Instrumentation and Controls Systems - Electrical Cables and Connections - Summary of Aging Management Evaluation |
| Tubing | Table 3.3.2-12; Auxiliary Systems - Compressed Air - Summary of Aging Management Evaluation |

Tools and supplies used to place the stored equipment in service are inventoried in accordance with 1/2OST-56B.1, "Appendix R Tool Box Contents Verification," and 1/2OST-56B.2, "Appendix R Equipment Inventory Verification."

Fire radios, flashlights, engine driven smoke ejectors and portable electrical generators retained in storage for Appendix R events are tested and maintained in accordance with 1/2OST-33.31, "Fire Brigade Equipment Test".

### 2.1.2.6 General Screening Discussion

Unique Identification of Subcomponents and Parts

Certain components were divided into subcomponents, usually because the aging management scenarios were different due to different materials, different (or no) intended functions, etc. For example, heat exchanger tubes may have a 'heat transfer' intended function while the rest of the heat exchanger does not.

Consumables

The following paragraphs summarize the positions taken regarding four categories of consumables: 1) packing, gaskets, component seals, and O-rings, 2) structural sealants, 3) oil, grease, and component filters, and 4) system filters, fire extinguishers, fire hoses, and air packs.

1. Packing, Gaskets, Component Seals, and O-Rings: These items are considered subcomponents. For piping systems, no component intended functions were attributed to these subcomponents because they are not considered part of the pressure boundary. As stated in ASME, Section III, NB 2121, NC 2121, and ND 2121, packing, gaskets, seals and O-rings are not relied upon for a pressure retaining function in components for which these Code design practices apply. For containment airlocks and hatches, these items are relied on to maintain the pressure boundary of containment, and as such were considered WSLR. Other uses of these items were considered on a case-by-case basis and conclusions regarding their component intended functions were justified.

2. Structural Sealants: Structural sealants may perform functions without moving parts or a change in configuration or properties, and they are not typically replaced on condition. These sealants would be identified as individual components, and if they were determined to perform component intended functions in support of a larger structure then they would be considered WSLR and subject to AMR. No BVPS structural sealants were WSLR.

3. Oil, Grease, and Component Filters: These or other similar materials were considered consumables that are short-lived. They were not identified as subcomponents nor were they subject to AMR since they are periodically replaced.

4. System Filters, Fire Extinguishers, Fire Hoses, and Air Packs: Items in this category of consumables were identified as components. These items are typically replaced based on condition and were addressed without evaluating aging effects by identifying the program that inspects and replaces them. System filter replacement is performed in accordance with the BVPS Preventive Maintenance Program. Fire extinguisher replacement is in accordance with NFPA 10, "Standard for Portable Fire Extinguishers." Fire hose replacement is in accordance with NFPA 1962, "Standard for the Care, Use and Service Testing of Fire Hose Including Couplings and Nozzles." Air packs are replaced in accordance with ANSI Z88.5-1981, "Practices for Respiratory Protection for the Fire Service."

Fuses/Fuse Holders

For license renewal purposes, fuses were assigned to the system which they protect, while the AEL generally assigns fuses to the system which they monitor. Also, for screening of electrical components, fuse holders for fuses that are not part of a larger, active assembly were considered subject to aging management review and included in the Electrical Cables and Connections commodity evaluation.

Commodities

Commodities are groupings of components that perform the same intended functions and may be associated with many plant systems and structures. The commodities requiring AMR for BVPS include:

- Component Supports (Section 2.4.2.3)

- Containment Electrical Penetrations (Section 2.5.7)
- Electrical Busbars (Section 2.5.9)
- Electrical Cables and Connections (Section 2.5.10)
- Fire Barriers (Section 2.4.2.8)

Individual components (e.g., component supports, fire barriers) may not be uniquely identified. They were identified by a generic component (e.g., structural steel in air, fire stop in air) contained in the commodity to which they are associated.

## 2.2 PLANT LEVEL SCOPING RESULTS

The systems, structures, and commodities at BVPS were evaluated as to whether or not they were within the scope of license renewal, using the methodology described in Section 2.1. The SSC list is a combination of all systems discussed in the UFSAR, AEL or Commodities created for License Renewal. The results are shown below in Table 2.2-1. For SSCs noted as within scope of license renewal, the section numbers of this application, where these SSCs are described, are given in parentheses.

**Table 2.2-1**
**Plant Level Scoping Results**
(no/**yes** or **yes**/no reflect Unit 1/Unit 2 results, respectively)

| SSC | Unit(s) | Within Scope of License Renewal? |
|---|---|---|
| 120 VAC Distribution and Lighting System (2.5.1) | 1 and 2 | **yes** |
| 125 VDC Distribution System (2.5.2) | 1 and 2 | **yes** |
| 480 Volt Station Service System (2.5.3) | 1 and 2 | **yes** |
| 4KV Station Service System (2.5.4) | 1 and 2 | **yes** |
| Administration Building | Common | no |
| Alternate Access Facility | Common | no |
| Alternate Intake Structure (2.4.2.1) | Common | **yes** |
| Annunciator System (2.5.5) | 1 and 2 | no/**yes** |
| Area Ventilating Systems - Air Conditioning (2.3.3.1) | 1 | **yes** |
| Area Ventilation Systems - Auxiliary Building (2.3.3.2) | 1 and 2 | no/**yes** |
| Area Ventilation Systems - Control Area (2.3.3.3) | 1 and 2 | **yes** |
| Area Ventilation Systems - Cooling (2.3.3.4) | 1 and 2 | **yes** |
| Area Ventilation Systems - Miscellaneous (2.3.3.5) | 1 and 2 | **yes** |
| Area Ventilation Systems - Reactor Containment Building (2.3.3.6) | 1 and 2 | **yes** |
| Area Ventilation Systems - Condensate Polishing Building | 2 | no |
| Atmospheric Radioactive Effluent Release Assessment System | Common | no |
| ATWS Mitigating System Actuation Circuitry (AMSAC) (2.5.6) | 1 | **yes** |
| Auxiliary Boiler System | 2 | no |
| Auxiliary Boilers Building | 2 | no |
| Auxiliary Building (2.4.2.2) | 1 and 2 | **yes** |
| Auxiliary Feedwater System (2.3.4.1) | 1 and 2 | **yes** |
| Auxiliary Steam and Condensate System (2.3.4.2) | 2 | **yes** |

**Table 2.2-1**
**Plant Level Scoping Results**
(no/**yes** or **yes**/no reflect Unit 1/Unit 2 results, respectively)

| SSC | Unit(s) | Within Scope of License Renewal? |
|---|---|---|
| Auxiliary Steam System (2.3.4.2) | 1 | **yes** |
| Boric Acid Tank Building | 1 | no |
| Boron Recovery and Primary Grade Water System (2.3.3.7) | 1 and 2 | **yes** |
| Building and Yard Drains System (2.3.3.8) | 1 and 2 | **yes** |
| Building Services Hot Water Heater System (2.3.3.9) | 1 and 2 | **yes** |
| Cable Tunnel (2.4.2.7) | 2 | **yes** |
| Chemical Addition Building (2.4.2.7) | 1 | **yes** |
| Chemical and Volume Control System (2.3.3.10) | 1 and 2 | **yes** |
| Chilled Water System (2.3.3.11) | 1 and 2 | **yes** |
| Chlorine Building | 1 | no |
| Circulating Water System | 1 and 2 | no |
| Component Supports (2.4.2.3) | 1 and 2 | **yes** |
| Compressed Air System (2.3.3.12) | 1 and 2 | **yes** |
| Condensate Polishing Building | 2 | no |
| Condensate Polishing System | 2 | no |
| Condensate System (2.3.4.3) | 1 and 2 | **yes**/no |
| Containment Depressurization System (2.3.2.1) | 1 and 2 | **yes** |
| Containment Electrical Penetrations (2.5.7) | 1 and 2 | **yes** |
| Containment System (2.3.3.13 and 2.4.2.4) | 1 and 2 | **yes** |
| Containment Vacuum and Leakage Monitoring System (2.3.3.14) | 1 and 2 | **yes** |
| Control Building (2.4.2.5) | 2 | **yes** |
| Cooling Tower | 1 and 2 | no |
| Cooling Tower Pump House | 1 and 2 | no |
| Cranes and Hoists (2.4.2.6) | 1 and 2 | **yes** |
| Decontamination Building (2.4.2.10) | 1 and 2 | no/**yes** |
| Diesel Generator Building (2.4.2.2) | 1 and 2 | **yes** |
| Discharge Structure | Common | no |
| Domestic Water System (2.3.3.15) | 1 and 2 | **yes** |
| Electric Heat Tracing System (2.5.8) | 1 and 2 | **yes** |
| Electrical Busbars (2.5.9) | 1 and 2 | **yes** |
| Electrical Cables and Connections (2.5.10) | 1 and 2 | **yes** |
| Electrical Grid System (2.5.11) | 1 and 2 | **yes** |
| Emergency Diesel Generators and Support Systems (2.3.3.16) | 1 and 2 | **yes** |
| Emergency Outfall Structure (2.4.2.7) | 2 | **yes** |
| Emergency Response Data System | Common | no |
| Emergency Response Facility (ERF) | Common | no |
| Equipment Hatch Platform (2.4.1) | 1 and 2 | **yes** |
| ERF and Safety Parameter Display | 1 and 2 | no |
| ERF Building – General | Common | no |
| ERF Communications System (2.5.12) | Common | **yes** |
| ERF Domestic Water System | Common | no |

**Table 2.2-1**
**Plant Level Scoping Results**
(no/**yes** or **yes**/no reflect Unit 1/Unit 2 results, respectively)

| SSC | Unit(s) | Within Scope of License Renewal? |
|---|---|---|
| ERF Fire Protection System | Common | no |
| ERF Heating, Ventilating and Air Conditioning System | Common | no |
| ERF Substation | Common | no |
| ERF Substation System (2.3.3.17) | Common | **yes** |
| Essential Yard Structures (2.4.2.7) | 1 and 2 | **yes** |
| Extraction Steam System | 1 and 2 | no |
| Fault Recording System | 1 and 2 | no |
| Fire Barriers (2.4.2.8) | 1 and 2 | **yes** |
| Fire Protection System (2.3.3.18) | 1 and 2 | **yes** |
| Foam House | 1 | no |
| Fuel Building (2.4.2.2, 2.4.2.10, for Unit 1 and Unit 2, respectively) | 1 and 2 | **yes** |
| Fuel Pool Cooling and Purification System (2.3.3.19) | 1 and 2 | **yes** |
| Fuel Transfer System and Tools (2.4.2.6) | 1 and 2 | **yes** |
| Gaseous Waste Disposal System | 1 and 2 | no |
| Gaseous Waste Storage Vault | 1 and 2 | no |
| Generation Distribution Center | Common | no |
| Glycol Heating System (2.3.3.20) | 1 | **yes** |
| Grounding System | 1 and 2 | no |
| Guardhouse | 1 | no |
| Heater Drains System | 1 and 2 | no |
| In Plant Administration Building | Common | no |
| Incore Instrumentation System (2.5.13) | 1 and 2 | **yes** |
| Intake Structure (2.4.2.9) | Common | **yes** |
| Joint Public Information Center | Common | no |
| Liquid Waste Disposal System (2.3.3.21) | 1 and 2 | **yes** |
| Loose Parts Monitoring System | 1 and 2 | no |
| Main Feedwater System (2.3.4.4) | 1 and 2 | **yes** |
| Main Generator and Main Transformer System | 1 and 2 | no |
| Main Steam Valve and Cable Vault Area (2.4.2.10) | 2 | **yes** |
| Main Steam System (2.3.4.5) | 1 and 2 | **yes** |
| Main Turbine and Condenser System (2.3.4.6) | 1 and 2 | **yes** |
| Meteorological Tower | Common | no |
| Meteorological Tower Structure | Common | no |
| Miscellaneous Components | 1 and 2 | no |
| Motorized Doors | 1 and 2 | no |
| Networks and Network Devices | Common | no |
| Non-Essential Yard Structures | Common, 1 and 2 | no |
| North Pipe Trench | Common | no |
| Nuclear Construction Building | Common | no |
| Outbuildings - Waste Handling Building | Common | no |

**Table 2.2-1**
**Plant Level Scoping Results**
(no/**yes** or **yes**/no reflect Unit 1/Unit 2 results, respectively)

| SSC | Unit(s) | Within Scope of License Renewal? |
|---|---|---|
| Paint Shop | Common | no |
| Personnel Walkway | Common | no |
| Pipe Tunnels (2.4.2.7) | 1 and 2 | **yes** |
| Plant Computer System | 1 and 2 | no |
| Plant Process Control System (2.5.14) | 1 and 2 | **yes** |
| Plant Safety Monitoring System (2.5.15) | 2 | **yes** |
| Post Accident Sample System (2.3.3.22) | 1 and 2 | **yes** |
| Post-DBA Hydrogen Control System (2.3.3.23) | 1 and 2 | **yes** |
| Primary Access Facility | Common | no |
| Primary Access Facility System | Common | no |
| Primary Component and Neutron Shield Tank Cooling Water System (2.3.3.24) | 1 and 2 | **yes** |
| Primary Demineralized Water Storage Tank Enclosure (2.4.2.7, 2.4.2.10 for Unit 1 and Unit 2, respectively) | 1 and 2 | **yes** |
| Primary Water Storage Building (2.4.2.2) | 1 | **yes** |
| Radiation Monitoring System (2.3.3.25) | 1 and 2 | **yes** |
| Reactor Containment Building (2.4.1) | 1 and 2 | **yes** |
| Reactor Control and Protection System (2.5.16) | 1 and 2 | **yes** |
| Reactor Coolant System (2.3.1.1) | 1 and 2 | **yes** |
| Reactor Excore Instrumentation System (2.5.17) | 1 and 2 | **yes** |
| Reactor Plant Sample System (2.3.3.26) | 1 and 2 | **yes** |
| Reactor Plant Vents and Drains System (2.3.1.2) | 1 and 2 | **yes** |
| Reactor Vessel (2.3.1.3) | 1 and 2 | **yes** |
| Reactor Vessel Internals (2.3.1.4) | 1 and 2 | **yes** |
| Refueling Water Storage Tank Foundation Mat and Shield Wall (2.4.2.7, 2.4.2.10, for Unit 1 and Unit 2, respectively) | 1 and 2 | **yes** |
| Relay Building (2.4.2.7, also known as the Relay House or Switchyard Control Building) | Common | **yes** |
| Reserve Generator Building | Common | no |
| Residual Heat Removal System (2.3.2.2) | 1 and 2 | **yes** |
| River Water System (2.3.3.27) | 1 | **yes** |
| Safeguards Building (2.4.2.2, 2.4.2.10, for Unit 1 and Unit 2, respectively) | 1 and 2 | **yes** |
| Safety Injection System (2.3.2.3) | 1 and 2 | **yes** |
| SAPS Warehouse | Common | no |
| Security (2.3.3.28) | 1 and 2 | **yes**/no |
| Seismic Instrumentation System | 1 and 2 | no |
| Sequence of Events Computer System | 1 | no |
| Service Building (2.4.2.2) | 1 and 2 | **yes** |
| Service Water System (2.3.3.29) | 2 | **yes** |
| Sewage Treatment Plant | 1 and 2 | no |

**Table 2.2-1**
**Plant Level Scoping Results**
(no/**yes** or **yes**/no reflect Unit 1/Unit 2 results, respectively)

| SSC | Unit(s) | Within Scope of License Renewal? |
|---|---|---|
| Sewage Treatment System | 1 and 2 | no |
| Simulator Addition | Common | no |
| Simulator Building | Common | no |
| Site Engineering Building | Common | no |
| Solid Waste Building (2.4.2.2) | 1 | **yes** |
| Solid Waste Disposal System (2.3.3.30) | 1 and 2 | **yes** |
| South Office Shop Building | Common | no |
| South Office Shop Building System | 2 | no |
| South Pipe Trench | Common | no |
| Station Communications System (2.5.18) | 1 and 2 | **yes** |
| Steam Generator Blowdown System (2.3.4.7) | 1 and 2 | **yes** |
| Storeroom | 1 | no |
| Switchyard (structural components) (2.4.2.7) | Common | **yes** |
| Supplementary Leak Collection and Release System (2.3.3.31) | 1 and 2 | **yes** |
| Training Building | Common | no |
| Turbine Building (2.4.2.11) | 1 and 2 | **yes** |
| Turbine Plant Component Cooling Water System | 1 and 2 | no |
| Turbine Plant Sample System | 1 and 2 | no |
| Valve Pit (2.4.2.10) | 2 | **yes** |
| VHF Radio Building | 1 | no |
| Warehouse | Common | no |
| Warehouse A | Common | no |
| Warehouse B | Common | no |
| Warehouse C | Common | no |
| Warehouse D | Common | no |
| Warehouse Steam Heating System | 1 | no |
| Waste Handling Building | 2 | no |
| Waste Handling Building (Switchyard) | Common | no |
| Water Treating System (2.3.3.32) | 1 and 2 | **yes** |
| Water Treatment Building (2.4.2.11) | 1 | **yes** |
| Yard | 1 and 2 | no |
| Yard Outside Of Protected Area | Common | no |

## 2.3 SCOPING AND SCREENING RESULTS FOR MECHANICAL SYSTEMS

The determination of mechanical systems within the scope of license renewal was made by initially identifying Beaver Valley Power Station mechanical systems and their design functions. Each system was then reviewed to determine those that satisfy one or more of the criteria contained in 10 CFR 54.4. This process is described in Section 2.1 and the results of the mechanical systems review are included in Section 2.2. Section 2.1 also provides the methodology for determining the components that meet the requirements contained in 10 CFR 54.21(a)(1). The components that meet these screening requirements are identified in this section. These identified components require an aging management review for license renewal.

The results are provided below in four subsections:

- Reactor Coolant Systems (2.3.1)
- Engineered Safety Features Systems (2.3.2)
- Auxiliary Systems (2.3.3)
- Steam and Power Conversion Systems (2.3.4)

### 2.3.1 Reactor Coolant Systems

Reactor Coolant Systems are those systems designed to contain and support the nuclear fuel, contain the reactor coolant, and transfer the heat produced in the reactor to the steam and power conversion systems for the production of electricity. The following systems are included in this subsection:

- Reactor Coolant System (2.3.1.1)
- Reactor Plant Vents and Drains System (2.3.1.2)
- Reactor Vessel (2.3.1.3)
- Reactor Vessel Internals (2.3.1.4)

#### 2.3.1.1 Reactor Coolant System

System Description

The purpose of the Reactor Coolant System (RCS) is to remove the thermal energy produced by the reactor core and transfer it to the steam generators. The RCS for each unit is configured with three similar, parallel loops and a pressurizer. Each loop contains an identical reactor coolant pump, a steam generator, inlet and outlet main coolant loop stop valves, and interconnecting piping to various auxiliary or safety systems. Each loop is provided with a bypass line from its cold leg to its hot leg to permit bypassing the reactor vessel while circulating the reactor coolant in the loop with the stop valves closed.

The only differences in the three loops are those penetrations into the reactor coolant piping between the reactor vessel and the respective loop hot leg and loop cold leg stop valves. A surge line from the pressurizer to one loop hot leg source functions to accommodate in-surge and out-surge masses allowing the pressurizer to "float" on the RCS. Two spray lines are provided, one from each of two separate cold leg sources to allow spraying of the pressurizer steam volume with relatively cooler reactor coolant to minimize pressure increases.

The Reactor Coolant System meets 10 CFR 54.4(a)(1) because it provides the water used as the core neutron moderator and reflector and as a solvent for chemical shim control, it serves as a pressure boundary for containing the coolant under operating temperature and pressures, the pressurizer and associated components provide RCS pressure control and limit transients, the reactor vessel level instrumentation system provides for monitoring reactor vessel level during a LOCA, the RCS provides for reactor core cooldown by natural circulation, it provides for the removal of the thermal energy to assure no fuel damage, it provides for the removal of non-condensable gasses, it provides indication of the margin to saturation of the primary coolant, and it contains instrumentation channels that provide inputs to protection systems. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), Environmental Qualification (10 CFR 50.49), and Station Blackout (10 CFR 50.63).

<u>Additional information can be found in the following UFSAR sections:</u>

- BVPS Unit 1 UFSAR, Revision 20, Section 4 - Reactor Coolant System
- BVPS Unit 1 UFSAR, Revision 20, Section 1A.15, Reactor Coolant System Design (Criterion 15)
- BVPS Unit 1 UFSAR, Revision 20, Section 5.2.2.3, Reactor Coolant: System Equipment Supports
- BVPS Unit 1 UFSAR, Revision 20, Section 7.2.1.1.3, Reactor Coolant System Pressurizer Pressure and Level Trips
- BVPS Unit 1 UFSAR, Revision 20, Section 7.2.1.1.4, Reactor Coolant System Low Flow Trips
- BVPS Unit 1 UFSAR, Revision 20, Section 7.6.2, Reactor Coolant System Loop Isolation Valve Interlocks

- BVPS Unit 2 UFSAR, Revision 12, Chapter 5 - Reactor Coolant System and Connected Systems
- BVPS Unit 2 UFSAR, Revision 12, Section 3.1.2.15, Reactor Coolant System Design (Criterion 15)
- BVPS Unit 2 UFSAR, Revision 12, Section 3.6N.2.3.2, Criteria for Protection Against Postulated Pipe Breaks in Reactor Coolant System Piping
- BVPS Unit 2 UFSAR, Revision 12, Section 4.4.3, Description of the Thermal and Hydraulic Design of the Reactor Coolant System

- BVPS Unit 2 UFSAR, Revision 12, Section 7.6.6, Reactor Coolant System Loop Isolation Valve Interlocks
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.2.3.1.7, System Description and Identification – Systems – Reactor Coolant System
- BVPS Unit 2 UFSAR, Revision 12, Section 12.2.1.1.1, Radiation Sources – Contained Sources – Reactor Coolant System
- BVPS Unit 2 UFSAR, Revision 12, Section 15.3, Decrease in Reactor Coolant System Flow Rate

License Renewal Drawings

The RCS aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-406-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Reactor Coolant System
- 8700-RM-406-2, Sheet 2, Revision 15, Valve Operating No. Diagram - Reactor Coolant System
- 8700-RM-406-3, Sheet 3, Revision 4, Valve Operating No. Diagram - Reactor Coolant System
- 8700-RM-406-4, Sheet 4, Revision 2, Valve Operating No. Diagram - Reactor Coolant System
- 8700-RM-409-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Vent and Drain System

Unit 2:

- 10080-RM-406-1, Sheet 1, Revision 17, Valve Operating No. Diagram - Reactor Coolant System
- 10080-RM-406-2, Sheet 2, Revision 14, Valve Operating No. Diagram - Reactor Coolant System
- 10080-RM-406-3, Sheet 3, Revision 4, Valve Operating No. Diagram - Detail
- 10080-RM-409-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Reactor Plant Drains System

Components Subject to AMR

The RCS component types subject to aging management review and their intended functions are shown in Table 2.3.1.1-1 below. The aging management review results for these components are provided in Table 3.1.2-1, Reactor Coolant Systems - Reactor Coolant System - Summary of Aging Management Evaluation.

**Table 2.3.1.1-1**
**Reactor Coolant System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| Element | Pressure Boundary |
| External Surfaces - Piping | Pressure Boundary |
| External Surfaces - Pressurizer | Pressure Boundary |
| External Surfaces - Steam Generators | Pressure Boundary |
| External Surfaces - Valves | Pressure Boundary |
| Heat Exchanger | Heat Transfer<br>Pressure Boundary |
| Orifice | Flow Restriction<br>Pressure Boundary |
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Steam Generator | Flow Control<br>Heat Transfer<br>Pressure Boundary<br>Structural/Functional Support<br>Thermal Shielding |
| Switch | Pressure Boundary |
| Thermowell | Pressure Boundary |
| Valve | Pressure Boundary |
| Vessel (pressurizers) | Pressure Boundary<br>Structural/Functional Support<br>Thermal Shielding |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Reactor Containment Building<br>Unit 2 Reactor Containment Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.1.2 Reactor Plant Vents and Drains System

System Description

The Reactor Plant Vents and Drains System collects potentially radioactive fluids and gases from various systems and discharges them to either the Gaseous Waste System, the Liquid Waste Disposal System, or the Boron Recovery System (Section 2.3.3.7). The Reactor Plant Vents and Drains System is comprised of four subsystems, two for liquids (drains) and two for gases (vents).

The drains are separated into those which contain air (aerated drains) and those which contain hydrogenated reactor coolant fluid (non-aerated drains). Aerated drains are sent to the Liquid Waste System for disposal. Non-aerated drains are sent to the Boron Recovery System for processing and reuse.

Aerated drains are collected in sumps which are located in various areas in and around the containment and the Auxiliary Building. Non-aerated drains are collected in primary drain transfer tanks, one inside containment and one in the Auxiliary Building.

The vents are separated into those which contain air (aerated vents) and those which contain hydrogen and radioactive gases (non-aerated vents). Aerated vents are sent to the gaseous waste dilution air subsystem. Non-aerated vents are sent to the gaseous waste holdup subsystem via the Boron Recovery System degasifiers.

The Reactor Plant Vents and Drains System meets 10 CFR 54.4(a)(1) because portions of the system are part of the reactor coolant pressure boundary, it provides for monitoring of water accumulation in the containment sump, it provides the capability to isolate the safety-related valve stem leakoff header, it contains safety related components that provide the means for assessing plant conditions during and following an accident, and it provides a containment isolation function. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.7, Vent and Drain System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.3.3, Equipment and Floor Drainage System

License Renewal Drawings

The Reactor Plant Vents and Drains System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-406-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Reactor Coolant System
- 8700-RM-407-1, Sheet 1, Revision 18, Valve Operating No. Diagram - Chemical and Volume Control System
- 8700-RM-407-3, Sheet 3, Revision 12, Valve Operating No. Diagram - Chemical and Volume Control System

- 8700-RM-407-4, Sheet 4, Revision 13, Valve Operating No. Diagram - Chemical and Volume Control System
- 8700-RM-409-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Vent and Drain System
- 8700-RM-409-2, Sheet 2, Revision 7, Valve Operating No. Diagram - Vent and Drain System
- 8700-RM-414A-2, Sheet 2, Revision 4, Valve Operating No. Diagram - Sample System

Unit 2:

- 10080-RM-408-1, Sheet 1, Revision 7, Valve Operating No. Diagram - Boron Recovery
- 10080-RM-409-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Reactor Plant Drains System
- 10080-RM-409-2, Sheet 2, Revision 7, Valve Operating No. Diagram - Reactor Plant Drains System

Components Subject to AMR

The Reactor Plant Vents and Drains System component types subject to aging management review and their intended functions are shown in Table 2.3.1.2-1 below. The aging management review results for these components are provided in Table 3.1.2-2, Reactor Coolant Systems – Reactor Plant Vents and Drains System – Summary of Aging Management Evaluation.

**Table 2.3.1.2-1**
**Reactor Plant Vents and Drains System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Piping | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Chemical Addition Building<br>Unit 1 Fuel Building<br>Unit 1 Primary Water Storage Building<br>Unit 1 Reactor Containment Building | NSR Functional Support |

| Component Type | Intended Functions* |
|---|---|
| Unit 1 Safeguards Building<br>Unit 2 Auxiliary Building<br>Unit 2 Decontamination Building<br>Unit 2 Fuel Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Pipe Tunnels<br>Unit 2 Reactor Containment Building<br>Unit 2 Safeguards Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.1.3 Reactor Vessel

System Description

Each Reactor Vessel (RV) is cylindrical, with a welded hemispherical bottom head and a removable, bolted, flanged, hemispherical upper (closure) head. The reactor vessel flange and head are sealed by two hollow metallic o-rings.

The RV closure head contains head adaptors (CRDM housing flanges/tubes). These head adaptors are tubular members, attached by partial penetration welds to the underside of the closure head. The upper end of these adaptors contains acme threads for the assembly of control rod drive mechanisms or instrumentation adapters. The seal arrangement at the upper end of these adaptors consists of a welded flexible canopy seal.

The bottom head of the vessel contains penetration nozzles for connection and entry of the nuclear in-core instrumentation. Each nozzle consists of a tubular member made of an Inconel tube. Each tube is attached to the inside of the bottom head by a partial penetration weld.

Inlet and outlet nozzles are located symmetrically around the vessel. Internal surfaces of the vessel which are in contact with reactor coolant are weld overlaid with stainless steel or, where appropriate, Inconel.

Access to the vessel side insulation is limited by the neutron shield tank. The neutron shield tank is a double-walled, annular tank structure which surrounds and supports the Reactor vessel. When filled with water, this tank provides a neutron shield and a thermal barrier for protection of the surrounding materials.

The Reactor Vessel meets 10 CFR 54.4(a)(1) because it serves as a pressure boundary for containing the reactor coolant under operating conditions, it provides a barrier against the release of radioactivity generated within the reactor, it supports and contains the reactor core and core support structures, it supports and guides reactor controls and instrumentation, and because it provides for venting the vessel head in association with the Reactor Coolant Gas Vent System.

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 4.2.2.1 - Reactor Coolant System – System Design and Operation – Reactor Vessel
- BVPS Unit 1 UFSAR, Revision 20, Section 5.2.2.3.2, Reactor Coolant System Equipment Supports – Description – Reactor Vessel Support
- BVPS Unit 1 UFSAR, Revision 20, Section 14.3.3.4, Effects of Loss-of-Coolant and Safety Injection on the Reactor Vessel

- BVPS Unit 2 UFSAR, Revision 12, Section 5.3.3.1 - Reactor Vessel Integrity – Design
- BVPS Unit 2 UFSAR, Revision 12, Section 5.3.1, Reactor Vessel Materials
- BVPS Unit 2 UFSAR, Revision 12, Section 5.4.14.2.1, Reactor Vessel Structural Support

License Renewal Drawings

The RV aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-406-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Reactor Coolant System

Unit 2:

- 10080-RM-406-1, Sheet 1, Revision 17, Valve Operating No. Diagram - Reactor Coolant System

Components Subject to AMR

The RV component types subject to aging management review and their intended functions are shown in Table 2.3.1.3-1 below. The aging management review results for these components are provided in Table 3.1.2-3, Reactor Coolant Systems – Reactor Vessel – Summary of Aging Management Evaluation.

**Table 2.3.1.3-1**
**Reactor Vessel**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Control Rod Drive Assembly | Pressure Boundary<br>Structural/Functional Support |
| Neutron Shield Tank | Pressure Boundary<br>Radiation Shielding<br>Structural/Functional Support |
| Vessel-Bottom Head | Pressure Boundary<br>Structural/Functional Support |
| Vessel-Bottom Head Instrument Tubes | Pressure Boundary<br>Structural/Functional Support |
| Vessel-Closure Head (External Surface) | Pressure Boundary<br>Structural/Functional Support |
| Vessel-Closure Head Dome | Pressure Boundary<br>Structural/Functional Support |
| Vessel-Closure Head Flange | Pressure Boundary<br>Structural/Functional Support |
| Vessel-Closure Head Vent Pipe | Pressure Boundary |
| Vessel-Closure Stud Assembly | Pressure Boundary |
| Vessel-Core Support Lugs | Structural/Functional Support |
| Vessel-CRDM Housings-Tube | Pressure Boundary<br>Structural/Functional Support |
| Vessel-External Surface | Pressure Boundary |
| Vessel-Inlet and Outlet Nozzles | Pressure Boundary<br>Structural/Functional Support |
| Vessel-Inlet and Outlet Nozzle Safe Ends | Pressure Boundary |
| Vessel-Inlet and Outlet Nozzle Welds | Pressure Boundary |
| Vessel-Instrumentation Port | Pressure Boundary<br>Structural/Functional Support |
| Vessel-Latch Housing | Pressure Boundary |
| Vessel-Lower, Intermediate, and Upper (nozzle) Shells | Pressure Boundary<br>Structural/Functional Support |
| Vessel-Partial Length CRDM-Motor Tube | Pressure Boundary |
| Vessel-Refueling Seal Ledge | Structural/Functional Support |
| Vessel-Vessel Flange | Pressure Boundary<br>Structural/Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.1.4 Reactor Vessel Internals

System Description

The reactor vessel internals (RVI) function to support the reactor core, maintain fuel alignment, direct the reactor coolant flow within the reactor vessel, provide shielding, provide for pressure boundary and provide guides for in-core instrumentation. The RVI are divided into three major assemblies: the lower core support structure, the upper core support structure, and the in-core instrumentation support structure.

The lower core support structure consists of the following components:

- Core baffle and formers
- Core barrel (upper and lower)
- Core support column
- Core support forging
- Diffuser plate (Unit 1 only)
- Lower core plate
- Lower support columns
- Secondary support assembly
- Thermal shield

The upper core support structure consists of the following components:

- Control rod guide tubes
- Hold down spring
- Upper core plate
- Upper support assembly
- Upper support columns

The in-core instrumentation support structure consists of an upper system to convey and support thermocouples penetrating the vessel through the head and a lower system to convey and support flux thimbles penetrating the vessel through the bottom.

Thimbles, thimble tubes, the seal table, and fittings are also covered in this section.

The Reactor Vessel Internals meet 10 CFR 54.4(a)(1) because they direct the main flow of coolant through the core and provide for secondary flows for cooling of the upper head area, thermal shield, lower vessel wall, and the lower core barrel; they maintain fuel alignment and limit fuel assembly movement; they provide gamma and neutron shielding; they provide guides for the in-core instrumentation; they support the reactor core; and they absorb control rod dynamic loads and transmit these and other loads to the reactor vessel flange.

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 3.2.2.2 - Reactor Vessel Internals - Description and Drawings
- BVPS Unit 1 UFSAR, Revision 20, Section B.3.4.2, Analysis of Reactor Vessel Internals
- BVPS Unit 2 UFSAR, Revision 12, Section 3.9N.5 - Reactor Vessel Internals

License Renewal Drawings

The RVI aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-406-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Reactor Coolant System

Unit 2:

- 10080-RM-406-1, Sheet 1, Revision 17, Valve Operating No. Diagram - Reactor Coolant System

Components Subject to AMR

The RVI component types subject to aging management review and their intended functions are shown in Table 2.3.1.4-1 below. The aging management review results for these components are provided in Table 3.1.2-4, Reactor Coolant Systems – Reactor Vessel Internals – Summary of Aging Management Evaluation.

**Table 2.3.1.4-1**
**Reactor Vessel Internals**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Internals-Baffle Bolts | Structural/Functional Support |
| Internals-Clevis Insert | Structural/Functional Support |
| Internals-Clevis Insert Bolt | Structural/Functional Support |
| Internals-Control Rod Guide Tube | Structural/Functional Support |
| Internals-Control Rod Guide Tube Bolts | Structural/Functional Support |
| Internals-Control Rod Guide Tube Support Pins | Structural/Functional Support |
| Internals-Core Baffle and Core Former | Flow Control<br>Radiation Shielding<br>Structural/Functional Support |

| Component Type | Intended Functions* |
|---|---|
| Internals-Core Barrel | Flow Control<br>Structural/Functional Support |
| Internals-Core Support Forging | Flow Control<br>Structural/Functional Support |
| Internals-Diffuser Plate (Unit 1 only) | Flow Control<br>Structural/Functional Support |
| Internals-Fuel Alignment Pin (lower assembly) | Structural/Functional Support |
| Internals-Fuel Alignment Pin (upper assembly) | Structural/Functional Support |
| Internals-Hold Down Spring and Upper Support Assembly | Structural/Functional Support |
| Internals-Instrumentation Guide Tubes | Structural/Functional Support |
| Internals-Lower Core Plate | Flow Control<br>Structural/Functional Support |
| Internals-Lower Support Column | Structural/Functional Support |
| Internals-Lower Support Column Bolts | Structural/Functional Support |
| Internals-Lower Support Column-Base | Structural/Functional Support |
| Internals-Radial Support | Structural/Functional Support |
| Internals-Seal Table | Pressure Boundary<br>Structural/Functional Support |
| Internals-Seal Table Fitting | Pressure Boundary<br>Structural/Functional Support |
| Internals-Secondary Support Assembly | Flow Control<br>Structural/Functional Support |
| Internals-Thermal Shield | Radiation Shielding |
| Internals-Thimble Guide Tube | Pressure Boundary<br>Structural/Functional Support |
| Internals-Upper Core Plate | Flow Control<br>Structural/Functional Support |
| Internals-Upper Core Plate Alignment Pins | Structural/Functional Support |
| Internals-Upper Core Plate-Flow Mixer | Flow Control<br>Structural/Functional Support |
| Internals-Upper Support Column | Structural/Functional Support |
| Internals-Upper Support Column Bolts | Structural/Functional Support |
| Internals-Upper Support Column-Base | Structural/Functional Support |
| Thimbles | Pressure Boundary |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.2 Engineered Safety Features Systems

Engineered Safety Features Systems consist of systems and components designed to remove heat from the reactor core during normal and accident conditions, and to cool and depressurize containment following a loss of coolant or steam break accident inside containment. The following systems are included in this subsection:

- Containment Depressurization System (2.3.2.1)
- Residual Heat Removal System (2.3.2.2)
- Safety Injection System (2.3.2.3)

#### 2.3.2.1 Containment Depressurization System

System Description

The Containment Depressurization System is designed to cool and depressurize the containment following a design basis accident. Containment depressurization is required to minimize leakage out of containment and to ensure containment integrity. The system is then required to remove heat from containment for an extended period of time. A second function is to remove fission products from the containment environment following a postulated primary system break.

The Containment Depressurization System is composed of two subsystems, the Quench Spray System and the Recirculation Spray System.

The Quench Spray System is designed to provide cold water from the Refueling Water Storage Tank (RWST), chemically treat the water and spray the containment. The RWST is equipped with a cooling system to maintain RWST temperature within technical specification limits. The Quench Spray System is made up of two separate parallel trains, each consisting of a quench spray pump discharging to spray headers located near the top of the reactor containment. Each train draws water independently from the RWST. Each train operating alone is capable of delivering 100 percent of the required quench spray to containment.

Sodium hydroxide (NaOH) solution is added to the quench spray from the chemical addition tank to improve removal of radioactive iodine from the containment atmosphere and to control containment sump pH. Redundant trains of rotary positive displacement chemical injection pumps and discharge valves are provided to meter the NaOH into the quench spray pump suctions.

Initially, the Quench Spray System runs alone. The RWST water is sprayed inside containment to remove heat and then accumulates in the containment sump. After a period of time when adequate recirculation spray pump net positive suction head is available from the sump, the Recirculation Spray System is started and the Quench Spray and Recirculation Spray Systems run concurrently until the RWST reaches a certain low level.

The Recirculation Spray System provides a means for long-term cooling utilizing the River Water System for Unit 1 (Service Water System for Unit 2) as the ultimate heat sink. The

Recirculation Spray System is designed to recirculate water from the containment sump through coolers to spray containment. The Recirculation Spray System is made up of four system headers, each with an associated recirculation spray pump and recirculation spray cooler. Each header feeds a spray header located beneath the top of the reactor containment.

The Containment Depressurization System meets 10 CFR 54.4(a)(1) because the system provides necessary cooling and depressurization of containment after a loss of coolant, it provides input signals used in causing the Safety Injection System to change modes, it contains safety related components that provide the means for assessing plant conditions during and following an accident, it provides a containment isolation function, it has features that ensure system leakage from recirculation spray pump seals (some pumps are outside of containment) is maintained as low as practical to minimize potential offsite releases, it provides the required supply of cold water from the RWST to the quench spray, low head safety injection and high head safety injection trains, it is designed to remove radioactive iodine from the containment atmosphere and to control the containment sump pH level, it ensures adequate net positive suction head to the recirculation spray pumps, and it provides flow paths to supply containment sump water to the Unit 2 HHSI pump suctions and it can provide a backup supply to the Unit 1 HHSI pumps (in case the Unite 1 LHSI pumps fail to operate). It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), Station Blackout (10 CFR 50.63), and Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 6.4, Containment Depressurization System
- BVPS Unit 2 UFSAR, Revision 12, Section 6.2, Containment Systems

License Renewal Drawings

The Containment Depressurization System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-411-1, Sheet 1, Revision 13, Valve Operating No. Diagram - Safety Injection System
- 8700-RM-413-1, Sheet 1, Revision 13, Valve Operating No. Diagram - Containment Depressurization System
- 8700-RM-413-2, Sheet 2, Revision 8, Valve Operating No. Diagram - Containment Depressurization System

Unit 2:

- 10080-RM-411-1, Sheet 1, Revision 10, Valve Operating No. Diagram - Low/High Head Safety Injection
- 10080-RM-413-1, Sheet 1, Revision 7, Valve Operating No. Diagram - Recirculation Spray System
- 10080-RM-413-2, Sheet 2, Revision 9, Valve Operating No. Diagram - Quench Spray System
- 10080-RM-414C-1, Sheet 1, Revision 6, Valve Operating No. Diagram - PAS System-Liquid Samples

Components Subject to AMR

The Containment Depressurization System component types subject to aging management review and their intended functions are shown in Table 2.3.2.1-1 below. The aging management review results for these components are provided in Table 3.2.2-1, Engineered Safety Features – Containment Depressurization System – Summary of Aging Management Evaluation.

**Table 2.3.2.1-1**
**Containment Depressurization System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| Element | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Heat Exchanger | Heat Transfer<br>Pressure Boundary |
| Orifice | Flow Restriction<br>Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Seal | Pressure Boundary |
| Strainer | Pressure Boundary |
| Tank | Pressure Boundary |
| Valve | Pressure Boundary |

| Component Type | Intended Functions* |
|---|---|
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Chemical Addition Building<br>Unit 1 Reactor Containment Building<br>Unit 1 Refueling Water Storage Tank Foundation Mat and Shield Wall<br>Unit 1 Safeguards Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Pipe Tunnels<br>Unit 2 Reactor Containment Building<br>Unit 2 Refueling Water Storage Tank and Chemical Addition Tank Shield Wall<br>Unit 2 Safeguards Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.2.2 Residual Heat Removal System

System Description

The Residual Heat Removal (RHR) System transfers heat from the RCS (Section 2.3.1.1) to the Primary Component and Neutron Shield Tank Cooling Water System (Section 2.3.3.24) to reduce the temperature of the reactor coolant to cold shutdown temperature at a controlled rate during the second part of normal plant cooldown, and maintains this temperature until the plant is started up.

The RHR System consists of two independent redundant trains. Each train consists of one residual heat removal pump, one residual heat removal exchanger and the required piping, instrumentation and valves for operational control. During RHR System operation, reactor coolant is pumped by the residual heat removal pumps from one reactor hot leg connection through the tube side of the residual heat removal heat exchangers, where it is cooled by primary component cooling water on the shell side. It is then returned to two reactor coolant cold leg connections, via the Safety Injection System (Section 2.3.2.3) accumulator discharge piping.

The Residual Heat Removal System meets 10 CFR 54.4(a)(1) because a portion of the system forms a part of the reactor coolant pressure boundary, system safety related components provide the means for assessing plant conditions during and following an accident, the system provides a containment isolation function, the system provides for reactor coolant pressure relief, and the system provides the means to remove reactor core decay heat and sensible heat. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.3, Residual Heat Removal System
- BVPS Unit 2 UFSAR, Revision 12, Section 5.4.7, Residual Heat Removal System

License Renewal Drawings

The RHR System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-406-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Reactor Coolant System
- 8700-RM-407-1, Sheet 1, Revision 18, Valve Operating No. Diagram - Chemical and Volume Control System
- 8700-RM-410-1, Sheet 1, Revision 9, Piping and Instrumentation Diagram - Residual Heat Removal System
- 8700-RM-411-2, Sheet 2, Revision 8, Valve Operating No. Diagram - Safety Injection System

Unit 2:

- 10080-RM-407-1A, Sheet 1, Revision 10, Valve Operating No. Diagram - Chemical and Volume Control
- 10080-RM-406-1, Sheet 1, Revision 17, Valve Operating No. Diagram - Reactor Coolant System
- 10080-RM-410-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Residual Heat Removal Piping
- 10080-RM-414A-2, Sheet 2, Revision 10, Valve Operating No. Diagram - Reactor Plant Sample - Hood 2

Components Subject to AMR

The RHR System component types subject to aging management review and their intended functions are shown in Table 2.3.2.2-1 below. The aging management review results for these components are provided in Table 3.2.2-2, Engineered Safety Features – Residual Heat Removal System – Summary of Aging Management Evaluation.

**Table 2.3.2.2-1**
**Residual Heat Removal System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| Element | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Heat Exchanger | Heat Transfer<br>Pressure Boundary |
| Orifice | Flow Restriction<br>Pressure Boundary |
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Reactor Containment Building<br>Unit 1 Safeguards Building<br>Unit 2 Reactor Containment Building<br>Unit 2 Safeguards Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.2.3 Safety Injection System

System Description

The Safety Injection System is described in two modes or phases; the Injection Phase and the Recirculation Phase. The Injection Phase provides emergency core cooling and additional negative reactivity immediately following an accident, by prompt delivery of borated water to the reactor vessel. The Recirculation Phase provides long-term post-accident cooling by recirculating water from the containment sump.

Injection Phase – The principal components used during the Injection Phase are accumulators, the Charging/High Head Safety Injection (HHSI) pumps and the Low Head Safety Injection (LHSI) pumps.

Each of three accumulators discharges to one of the reactor coolant cold legs when RCS pressure drops below accumulator pressure, thus assuring rapid core flooding for large breaks. Accumulator pressure is provided by nitrogen gas overpressure. The accumulators are located inside the containment.

The HHSI pumps perform charging functions during normal plant operations (These pumps are discussed here, but are not covered as components in Table 2.3.2.3-1 below. They are covered as components in Table 2.3.3.10-1 of LRA Section 2.3.3.10, Chemical and Volume Control System). On a Safety Injection signal, these pumps provide for high pressure makeup to replace the coolant and add negative reactivity to the core. Suction valves reposition to isolate the pumps from the Volume Control Tank and align them to the RWST. For Unit 1, the inlet and outlet valves of the Boron Injection Tank (BIT), which normally isolate the BIT from the HHSI pumps and the RCS, open. The discharge of the HHSI pumps is through the BIT. For Unit 2, a BIT and boron injection surge tank are installed but are not connected to the system and are not in scope for License Renewal.

The LHSI pumps are in standby during normal plant operation, aligned to take suction from the RWST in the event of an accident. The LHSI pumps provide a high volume of water at low pressures. On a Safety Injection signal, the LHSI pumps start. If the break is small, the pumps will run at minimum flow during the Injection Phase, recirculating to the RWST. For large breaks, the RCS is depressurized and voided of coolant rapidly. In this situation, the LHSI pumps and the accumulators provide the high flow rate that is required to quickly re-cover the exposed fuel and limit possible core damage.

Recirculation Phase - As the reactor coolant that leaks out of the break and the water sprayed into the containment by the Containment Depressurization System (LRA Section 2.3.2.1) collects in the containment sump, the water level in the RWST decreases and eventually low-level conditions cause the system to transfer to the recirculation phase.

With the transfer to the recirculation phase, the suction source for the HHSI pumps shifts from the RWST to the containment sump. At Unit 1, the LHSI pump suction valves from the containment sump open and the LHSI pump miniflow isolation valves to the RWST close. The suction of the HHSI pumps is automatically shifted from the RWST to the discharge header of the LHSI pumps. The suction valves of the LHSI pumps and HHSI pumps from the RWST close. Water from the containment sump is now being recirculated into the RCS. At Unit 2, initiation of transfer to recirculation mode causes the discharge of two (of four) Recirculation Spray pumps to re-align to the LHSI discharge header, and valves from the LHSI discharge header open to supply the HHSI pump suctions. The HHSI suction valves from the RWST close and the LHSI pumps stop.

The Safety Injection System meets 10 CFR 54.4(a)(1) because a portion of the system forms a part of the reactor coolant pressure boundary, the system provides isolation against the potential for radioactive leakage into the RWST, system safety related components provide the means for assessing plant conditions during and following an accident, accumulator tanks are provided for passive injection of borated water into the RCS, it provides protection against the overpressurization and rupture of the ECCS low pressure piping, it provides a containment isolation function, it provides a source of emergency core cooling, it provides a supply of gaseous nitrogen and instrument air to support RCS pressure relief and feed and bleed, and it provides components which support feed and bleed cooling if no other source for a secondary heat sink is available. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining

system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), and Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 6.3, Emergency Core Cooling System
- BVPS Unit 2 UFSAR, Revision 12, Section 6.3, Emergency Core Cooling System

License Renewal Drawings

The Safety Injection System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-406-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Reactor Coolant System
- 8700-RM-406-2, Sheet 2, Revision 15, Valve Operating No. Diagram - Reactor Coolant System
- 8700-RM-407-1, Sheet 1, Revision 18, Valve Operating No. Diagram - Chemical and Volume Control System
- 8700-RM-411-1, Sheet 1, Revision 13, Valve Operating No. Diagram - Safety Injection System
- 8700-RM-411-2, Sheet 2, Revision 8, Valve Operating No. Diagram - Safety Injection System
- 8700-RM-413-1, Sheet 1, Revision 13, Valve Operating No. Diagram - Containment Depressurization System

Unit 2:

- 10080-RM-406-1, Sheet 1, Revision 17, Valve Operating No. Diagram - Reactor Coolant System
- 10080-RM-407-1A, Sheet 1, Revision 10, Valve Operating No. Diagram - Chemical and Volume Control
- 10080-RM-411-1, Sheet 1, Revision 10, Valve Operating No. Diagram - Low/High Head Safety Injection
- 10080-RM-411-2, Sheet 2, Revision 10, Valve Operating No. Diagram - SI Accumulators/Nitrogen
- 10080-RM-413-2, Sheet 2, Revision 9, Valve Operating No. Diagram - Quench Spray System

- 10080-RM-414A-1, Sheet 1, Revision 13, Valve Operating No. Diagram - Reactor Plant Sample - Hood 1

Components Subject to AMR

The Safety Injection System component types subject to aging management review and their intended functions are shown in Table 2.3.2.3-1 below. The aging management review results for these components are provided in Table 3.2.2-3, Engineered Safety Features – Safety Injection System – Summary of Aging Management Evaluation.

**Table 2.3.2.3-1**
**Safety Injection System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Accumulator | Pressure Boundary |
| Bolting | Pressure Boundary |
| Element | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Heat Exchanger | Heat Transfer<br>Pressure Boundary |
| Orifice | Flow Restriction<br>Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Seal | Pressure Boundary |
| Tank | Pressure Boundary |
| Valve | Flow Control<br>Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Reactor Containment Building<br>Unit 1 Safeguards Building<br>Unit 2 Auxiliary Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Reactor Containment Building<br>Unit 2 Safeguards Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3 Auxiliary Systems

Auxiliary Systems are those systems used to support normal and emergency plant operations. The systems provide cooling, ventilation, sampling, and other required functions. The following systems are included in this subsection.

- Area Ventilating Systems - Air Conditioning (2.3.3.1)
- Area Ventilation Systems - Auxiliary Building (2.3.3.2)
- Area Ventilation Systems - Control Area (2.3.3.3)
- Area Ventilation Systems - Cooling (2.3.3.4)
- Area Ventilation Systems - Miscellaneous (2.3.3.5)
- Area Ventilation Systems - Reactor Containment Building (2.3.3.6)
- Boron Recovery and Primary Grade Water System (2.3.3.7)
- Building and Yard Drains System (2.3.3.8)
- Building Services Hot Water Heater System (2.3.3.9)
- Chemical and Volume Control System (2.3.3.10)
- Chilled Water System (2.3.3.11)
- Compressed Air System (2.3.3.12)
- Containment System (2.3.3.13)
- Containment Vacuum and Leakage Monitoring System (2.3.3.14)
- Domestic Water System (2.3.3.15)
- Emergency Diesel Generators and Support Systems (2.3.3.16)
- ERF Substation System (2.3.3.17)
- Fire Protection System (2.3.3.18)
- Fuel Pool Cooling and Purification System (2.3.3.19)
- Glycol Heating System (2.3.3.20)
- Liquid Waste Disposal System (2.3.3.21)
- Post Accident Sample System (2.3.3.22)
- Post-DBA Hydrogen Control System (2.3.3.23)
- Primary Component and Neutron Shield Tank Cooling Water System (2.3.3.24)
- Radiation Monitoring System (2.3.3.25)
- Reactor Plant Sample System (2.3.3.26)
- River Water System (2.3.3.27)
- Security (2.3.3.28)
- Service Water System (2.3.3.29)
- Solid Waste Disposal System (2.3.3.30)
- Supplementary Leak Collection and Release System (2.3.3.31)
- Water Treating System (2.3.3.32)

### 2.3.3.1 Area Ventilating Systems - Air Conditioning

System Description

At BVPS this system is a designated Unit 1 system, but consists of many ventilation systems involving air conditioning servicing several site shops, offices, workrooms, storage rooms, and locker rooms. Among these, the only areas associated with intended functions are the switchgear areas, and the Normal Switchgear Ventilation System, described below.

Air exhausted from switchgear areas by the normal switchgear exhaust fan is ducted through an air filter then a bank of six chilled-water cooling coils. Only the ventilation flow path to supply outside air and to exhaust the area to the outside is in scope for License Renewal. The cooling coils are not required for any intended function. The conditioned air is then ducted through a roll filter, then to the suction side of the normal switchgear supply fan, where it is distributed to switchgear, the rod control room, the cable tray mezzanine, and the battery rooms.

The Area Ventilating Systems - Air Conditioning meets 10 CFR 54.4(a)(2) because normal switchgear ventilation supply-dampers provide a means for supplying outside air after a loss of HVAC (chilled-water cooling) and because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48).

License Renewal Drawings

The Area Ventilating Systems - Air Conditioning aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-444E-3, Sheet 3, Revision 2, Valve Operating No. Diagram - Switchgear Ventilation

Unit 2:

- None. This system is a designated Unit 1 system.

Components Subject to AMR

The Area Ventilating Systems - Air Conditioning component types subject to aging management review and their intended functions are shown in Table 2.3.3.1-1 below. The aging management review results for these components are provided in Table 3.3.2-1, Auxiliary Systems - Area Ventilating Systems - Air Conditioning - Summary of Aging Management Evaluation.

**Table 2.3.3.1-1**
**Area Ventilating Systems - Air Conditioning**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| Collar | Pressure Boundary |
| Damper Housing | Fire Barrier<br>Pressure Boundary |
| Duct | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Fan | Pressure Boundary |
| Filter | Pressure Boundary |
| Heat Exchanger | Pressure Boundary |
| Seal | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Service Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.2 Area Ventilation Systems - Auxiliary Building

System Description

This system is only in scope for Unit 2. It consists of two subsystems. The functions of the subsystems are briefly described below.

Unit 2 Auxiliary Building Ventilation System

The air supply portion of the Unit 2 Auxiliary Building Ventilation System includes two air-handling units. The air supply and conditioning portion of this system does not provide any intended functions for License Renewal. Fire dampers within this system are in scope for License Renewal.

The two filter exhaust fans of the Supplementary Leak Collection and Release System (Section 2.3.3.31) are used to exhaust the air. Air is exhausted at a rate higher than the supply to maintain the buildings under a negative pressure.

When clean areas are adjacent to potentially contaminated areas, air is supplied to the clean areas and exhausted from the potentially contaminated areas to decrease the possibility of any spread of contamination.

Unit 2 Emergency Exhaust Fan System

The Emergency Exhaust Fan System consisting of two axial flow exhaust fans, ducting, and dampers, provides ventilation for the charging pump cubicles and component cooling water pumps general area in the event of a failure of normal ventilation.

Other Unit 2 Auxiliary Building ventilation subsystems also provide cooling and ventilation to various components and areas including the air ejector charcoal delay beds, the waste gas charcoal delay beds, the post accident sampling cubicle, the Aux Building elevator machinery room and the Waste Handling Building. Fire dampers in these flow paths are in scope for License Renewal, but cooling and ventilation of these areas are not intended functions for License Renewal.

The Area Ventilation Systems - Auxiliary Building meets 10 CFR 54.4(a)(1) because system safety related components provide the means for assessing plant conditions during and following an accident, and when the Supplemental Leak Collection and Release System is unavailable, the Auxiliary Building Emergency Exhaust System will be used to evacuate the Component Cooling and Charging Pump Areas and the Post Accident Sampling System. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.3.24, Fire Area PA-4 - Primary Auxiliary Building EL 755 FT. - 6 IN.
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.3.23, Fire Area PA-3 - Auxiliary Building General Area
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.3.25, Fire Area PA-5 - Primary Auxiliary Building El. 773' 6"
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5.1.6.6, Ventilation
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.2.3.1.11, Heating, Ventilating, Air-Conditioning Systems (HVAC)
- BVPS Unit 2 UFSAR, Revision 12, Table 7.5-1, Safety Related Display Instrumentation

License Renewal Drawings

The Area Ventilation Systems - Auxiliary Building aging management review boundaries are highlighted on the following drawings:

Unit 1:

- None. Unit 1 is not in scope.

Unit 2:

- 10080-RM-444D-1, Sheet 1, Revision 7, Valve Operating No. Diagram - Aux Bldg Ventilation System
- 10080-RM-444D-2, Sheet 2, Revision 8, Valve Operating No. Diagram - Aux Bldg Ventilation System

Components Subject to AMR

The Area Ventilation Systems - Auxiliary Building component types subject to aging management review and their intended functions are shown in Table 2.3.3.2-1 below. The aging management review results for these components are provided in Table 3.3.2-2, Auxiliary Systems – Area Ventilation Systems - Auxiliary Building – Summary of Aging Management Evaluation.

**Table 2.3.3.2-1**
**Area Ventilation Systems - Auxiliary Building**
**Component Types Subject to Aging Management Review**

| Component Type (Unit 2 only) | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| Collar | Pressure Boundary |
| Damper Housing | Fire Barrier<br>Pressure Boundary |
| Duct | Pressure Boundary |
| Element | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Fan | Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | Pressure Boundary |
| Valve | Pressure Boundary |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.3 Area Ventilation Systems - Control Area

System Description

The Unit 1 portion of the combined control room is within the Unit 1 Service Building, while the Unit 2 portion of the combined control room is within the Unit 2 Control Building. The area ventilation systems addressed in this section are the Unit 1 Control Room Air Conditioning System and the Unit 2 Control Building Ventilation System. The functions of each system are to provide cooling, heating, ventilation, isolation of the control room from outside air, control room pressurization, and smoke removal for the several areas supplied.

Two ventilation subsystems service the Unit 2 Control Building areas: the control room air-conditioning subsystem and the control building air-conditioning subsystem. The control room air-conditioning subsystem ventilates the main control room and two adjoining areas: the computer room and the HVAC equipment room. The control building air-conditioning subsystem ventilates the remainder of the Control Building.

Each Unit has a Control Room Air Conditioning System consisting of two 100% capacity air-conditioning units (ACU). One of the two ACUs supplies a mixture of outside and return air to the control room during normal operation. In the event of a CIB signal or a high area radiation signal in either plant, redundant motorized dampers in both units' outdoor air intake and exhaust ductwork will close fully and the air-conditioning systems will continue to run on recirculation air. When a CIB or a high area radiation signal occurs, redundant parallel motorized dampers will open at Unit 2 and the selected Unit 2 control room emergency supply fan will automatically start, maintaining the positive pressure in both Units' control room area. Air is drawn through one of two redundant emergency supply filtration units, each unit consisting of a moisture separator, an electric heating coil, a high efficiency particulate air filter (HEPA), a charcoal bank filter, and a second HEPA. A loss of static pressure across the emergency supply fan will cause the redundant fan to be energized. Unit 1 also has a filtration and pressurization system that is available for manual alignment and operation in the unlikely event that both Unit 2 pressurization systems become unavailable during an accident.

The Smoke Detection System located within the control room area alarms locally and annunciates in the control room. Purging of smoke from the control room area is accomplished by manually positioning the outdoor, recirculation, and exhaust air dampers and running the system on a 100% outdoor air supply and 100% exhaust mode. Ventilation to the Unit 2 computer room is isolated upon initiation of the halon fire suppression system.

The Area Ventilation Systems - Control Area System meets 10 CFR 54.4(a)(1) because the Unit 2 Control Building Ventilation System ensures sufficient ventilation and heat removal capability for the entire building, miscellaneous Unit 2 QA Category 1 backdraft dampers provide protection against CO2 overpressurization, an independent Unit 1 control air system supplies control air to the Unit 1 control area ventilation system through the use of two control air compressors, two air dryers, and a "ring-formed" distribution header, miscellaneous QA Category 1 volume dampers provide a means for adjusting the air flow to each zone in the control area, system safety related components provide the means for assessing plant conditions during and following an accident in support of NRC Regulatory Guide 1.97, the control room air handling unit fans and dampers provide essential support in the distribution of air from the emergency outdoor air pressurization fans and filters, the Unit 1 Control Room ventilation air compressors supply accumulators for inflation of bladders on the outside air isolation dampers, two river water or service water cooling coils in the air handling units at each Unit provide for control room cooling under DBA conditions, and when initiated due to a CIB signal or a high radiation level measured in the control room, redundant emergency outdoor air pressurization fans supply filtered air to maintain indefinitely the pressurized condition in the main control area. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant

evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 22, Section 9.13.4, Main Control Area
- BVPS Unit 2 UFSAR, Revision 15, Section 9.4.1, Control Building Ventilation System

License Renewal Drawings

The Area Ventilation Systems - Control Area aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-430-2, Sheet 2, Revision 15, Piping and Instrumentation Diagram - River Water System
- 8700-RM-444A-1, Sheet 1, Revision 4, Valve Operating No. Diagram – Control Room Emergency Pressurization Air System
- 8700-RM-444A-2, Sheet 2, Revision 12, Valve Operating No. Diagram - Control Room Air Conditioning System
- 8700-RM-444A-4, Sheet 4, Revision 9, Valve Operating No. Diagram - Control Room Area-Air Conditioning

Unit 2:

- 10080-RM-444A-1, Sheet 1, Revision 7, Valve Operating No. Diagram - Control Bldg Ventilation System
- 10080-RM-444A-2, Sheet 2, Revision 12, Valve Operating No. Diagram - Computer and Control Room Air Conditioning

Components Subject to AMR

The Area Ventilation Systems - Control Area component types subject to aging management review and their intended functions are shown in Table 2.3.3.3-1 below. The aging management review results for these components are provided in Table 3.3.2-3, Auxiliary Systems – Area Ventilation Systems - Control Area - Summary of Aging Management Evaluation.

**Table 2.3.3.3-1**
**Area Ventilation Systems - Control Area**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Air Dryer | Pressure Boundary |
| Collar | Pressure Boundary |
| Conditioner | Pressure Boundary |
| Damper Housing | Fire Barrier<br>Pressure Boundary |
| Duct | Pressure Boundary |
| Element | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Fan | Pressure Boundary |
| Filter | Filtration<br>Pressure Boundary |
| Heat Exchanger | Heat Transfer<br>Pressure Boundary |
| Heater | Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | Pressure Boundary |
| Seal | Pressure Boundary |
| Separator | Pressure Boundary |
| Tank | Pressure Boundary |
| Valve | Pressure Boundary |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.4 Area Ventilation Systems - Cooling

System Description

The Unit 1 and 2 area ventilation systems addressed here involve several systems. Each is listed below and briefly described.

Unit 1 Main Steam Valve Area Cooling System

Cooling and ventilation provided by this system does not perform an intended function. The system contains fire dampers that perform intended functions.

Unit 2 Main Steam Valve Area Supply and Recirculation

Two ventilation systems are provided in the Main Steam and Feedwater Valve Area. Air is drawn into the Main Steam and Feedwater Valve Area then discharged through a motor-operated

damper and various distribution ductwork into the Main Steam and Feedwater Valve Area. The system performs intended functions.

Unit 1 Safeguards Area Cooling System

Cooling and ventilation provided by this system does not perform an intended function. The valve pit area supply ductwork is provided with two series motor-operated isolation dampers which close under a containment isolation signal. The system also contains fire dampers that perform intended functions.

Unit 2 North Safeguards Area Supply and Recirculation

The system consists of an air-conditioning unit with electric unit heaters. During the cooling mode of the system, the thermostat controls the operation of the fan, which draws air over the cooling coils and recirculates air in the area. Service water flows through the cooling coils at all times. During the heating mode of the system, the thermostat controls the electric unit heaters and maintains area temperature above 55 deg F. The system performs intended functions.

Unit 2 South Safeguards Area Supply and Recirculation

The system consists of an air-conditioning unit with electric unit heaters. During the cooling mode of the system, the thermostat controls the operation of the fan, which draws air over the cooling coils and recirculates air in the area. Service water flows through the cooling coils at all times. During the heating mode of the system, the thermostat controls the electric unit heaters and maintains area temperature above 55 deg F. The system performs intended functions

Unit 1 Cable Vault Area Cooling System

Cooling and ventilation provided by this system does not perform an intended function. The system contains fire dampers that perform intended functions.

Unit 2 Cable Vault and Rod Control Area Supply and Recirculation

The system consists of two air-conditioning units (primary system), two unit coolers (secondary system), volume control dampers, supply and return air grills, and related ductwork.

The primary system operates on 100% recirculation mode. During normal operation, the chilled water cooling coil is used to cool the recirculated area. During emergency conditions, when chilled water may not be available, the Supplementary Leak Collection and Release System (Section 2.3.3.31) performs the cooling function. Water flows to the heating and chilled water cooling coils are modulated by return air thermostat. Heating and Chilled Water cooling are not intended functions. Service Water cooling coils provide a safety-related cooling water source, but are normally isolated to conserve service water system flow margin.

The secondary ventilation system consists of two unit coolers, one located in the cable vault and the other in the cable tunnel area. Each cooler operates continuously during normal plant operation with 100% recirculation using chilled water as a cooling medium. This subsystem does not perform any intended functions.

Unit 1 Pipe Tunnels Area Cooling System

Cooling and ventilation provided by this system does not perform an intended function. The system contains fire dampers that perform intended functions.

Unit 2 Pipe Tunnels Area Supply and Recirculation

Cooling and ventilation provided by this system does not perform an intended function.

Unit 1 Fuel Building Cooling System

Cooling and ventilation provided by this system does not perform an intended function. The system contains fire dampers that perform intended functions.

Unit 2 Fuel Building Supply and Recirculation

Cooling and ventilation provided by this system does not perform an intended function.

Unit 1 Decontamination Building Filtration and Exhaust System

The ventilation system consists of two subsystems: the normal roof exhaust ventilation subsystem and the filtration and exhaust subsystem. The filtration and exhaust subsystem was retired in-place.

The normal roof exhaust subsystem ventilates the decontamination building under normal operating conditions. This subsystem consists of two powered roof ventilator exhaust fans, and a motorized damper at the west wall fresh air intake. This portion of the system is in the process of being retired and does not perform any intended functions.

Unit 2 Decontamination Building Filtration and Exhaust System

The ventilation system consists of two subsystems: the normal roof exhaust ventilation system and the filtration and exhaust subsystem.

The normal roof exhaust subsystem does not perform any intended functions.
The filtration and exhaust subsystem ventilates the gaseous waste storage tank (GWST) area and the cask washdown area. Cooling and ventilation provided by this system does not perform an intended function. The system contains fire dampers that perform intended functions.

Unit 2 MCC-2-E03 and MCC-2-E04 Recirculation System

The MCC-2-E03 and MCC-2-E04 Recirculation System consists of recirculation fans and service water cooling coils for each of the two redundant MCCs located in the enclosure in the Auxiliary Building. The system performs intended functions.

Unit 2 Alternate Shutdown Panel Cubicle Air Conditioning

The system consists of one self-contained air-conditioning unit, a motor-operated water-regulating valve, an electric duct heater, a motor-operated damper, volume control dampers, fire dampers, supply air diffuser, return air grille, and related ductwork.

The Area Ventilation Systems - Cooling System meets 10 CFR 54.4(a)(1) because: dampers in the Safeguards Area Cooling Subsystem provide for the automatic termination of air flow upon receiving a CIB signal; the Alternate Shutdown Panel Room Ventilation Subsystem provides the standby function for heat removal from the area, as well as maintaining pressurization of the area during a fire in the control building or cable tunnel area northwest of the auxiliary building; and the system provides heat removal from other areas containing safety related equipment. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.13.3, Ventilation Systems-Fuel Building
- BVPS Unit 1 UFSAR, Revision 20, Section 9.15.2, Decontamination Facility-Description

- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.3.10, Fire Area CV-1 - Cable Vault and Rod Control Area
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.3.11, Fire Area CV-2 - Cable Vault and Rod Control Area
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.3.12, Fire Area CV-3 - Cable Vault and Rod Control Area Cable Tunnel
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5.1.6.6, Ventilation
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.2.3.1.11, Heating, Ventilating, Air-Conditioning Systems (HVAC)
- BVPS Unit 2 UFSAR, Revision 12, Section 9.4.9 Main Steam and Feedwater Valve Area Ventilation System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.4.11 Safeguards Area Ventilation System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.4.12 Cable Vault and Rod Control Area Ventilation System and Alternate Shutdown Panel Room Ventilation System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.3.1, Fire Area ASP - Alternate Shutdown Panel Room

- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.3.13, Fire Area CV-4 - Cable Vault and Rod Control Area
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.3.14, Fire Area CV-5 - Cable Vault and Rod Control

License Renewal Drawings

The Area Ventilation Systems - Cooling aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-444B-1, Sheet 1, Revision 4, Valve Operating No. Diagram - Area Vent and Cooling

Unit 2:

- 10080-RM-444B-1, Sheet 1, Revision 10, Valve Operating No. Diagram - Main Steam, Safeguards and Pipe Tunnels Ventilation and Air Conditioning System
- 10080-RM-444B-2, Sheet 2, Revision 8, Valve Operating No. Diagram - Area Ventilation System-Cooling Fueling and Decontamination Building
- 10080-RM-444B-3, Sheet 3, Revision 8, Valve Operating No. Diagram - Cable Vault and Rod Control Area A/C and Ventilation System

Components Subject to AMR

The Area Ventilation Systems - Cooling component types subject to aging management review and their intended functions are shown in Table 2.3.3.4-1 below. The aging management review results for these components are provided in Table 3.3.2-4, Auxiliary Systems – Area Ventilation Systems - Cooling – Summary of Aging Management Evaluation.

**Table 2.3.3.4-1**
**Area Ventilation Systems - Cooling**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| Collar | Pressure Boundary |
| Damper Housing | Fire Barrier<br>Pressure Boundary |
| Duct | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Fan | Pressure Boundary |
| Filter | Filtration<br>Pressure Boundary |

| Component Type | Intended Functions* |
|---|---|
| Heat Exchanger | Heat Transfer<br>Pressure Boundary |
| Piping | Pressure Boundary |
| Seal | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Safeguards Building<br>Unit 2 Fuel Building<br>Unit 2 Main Steam Valve and Cable Vault Area | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.5 Area Ventilation Systems - Miscellaneous

System Description

The Unit 1 and 2 area ventilation systems addressed here involve several systems. Relevant descriptions are provided below:

Unit 1 Service Building

In addition to the Switchgear Cooling System, heated air in emergency switchgear is removed by one of two redundant continuously running emergency switchgear and battery room exhaust fans.

Common Intake Structure

Each pump cubicle containing a Unit 1 River Water pump is supplied by an axial flow fan powered from Unit 1. An additional fan is provided in the cubicle containing the motor driven fire pump. Each pump cubicle containing a Unit 2 Service Water pump is supplied by a Unit 2 powered ventilation fan which supplies a mixture of outdoor air and recirculated air to the cubicle. Outdoor air supplied to the three cubicles is exhausted through roof relief hoods with self-acting back draft dampers.

Unit 1 Diesel Generator Building

Each of the two diesel generator rooms contain a ceiling-mounted propeller exhaust fan, which discharges room air outdoors to dissipate excess equipment heat. Operation of either fan automatically opens its respective discharge damper, and the outdoor air intake double damper in that particular diesel generator room. Starting of either diesel generator engine will also cause its

respective outdoor air intake double damper to open regardless of exhaust fan operation. This provides combustion air for the diesel.

Unit 2 Diesel Generator Building

Each of the two diesel generator rooms contain an independent ventilation system, consisting of a normal exhaust fan, a primary supply fan, and a secondary supply fan. The fans dissipate excess equipment heat.

Additionally, miscellaneous ventilation is provided by this system in the following areas: Unit 1 PCA shop area, Unit 1 Cooling Tower Pump House, Unit 1 Chlorine Storage Building, Unit 1 Chlorine Equipment Building, Unit 1 Turbine Building, Unit 1 Sewage Treatment Plant Control House, Unit 1 Foam House, Unit 1 CO2 Storage Building, Unit 1 Warehouse, Unit 1 Chemical Addition Building, Unit 2 Service Building, Unit 2 Cooling Tower Pump House, Alternate Intake Structure, Unit 2 Auxiliary Boiler Building, Unit 2 Turbine Building, Unit 2 Elevator Machinery Room, Unit 2 Condensate Pumps Motors, Unit 2 Turbine Building Battery Room, Unit 2 Turbine, Service and Auxiliary Building Enclosed Walkway. Ventilation in these areas is not needed for support of any License Renewal intended functions, but some systems contain fire dampers.

The Area Ventilation Systems - Miscellaneous System meets 10 CFR 54.4(a)(1) because:

- The Diesel Generator Buildings Ventilation System provides outdoor supply air to the diesel generator rooms (including smoke removal) and discharges room air outdoors to dissipate excess equipment heat.

- The Intake Structure Ventilation System supplies a mixture of outdoor air and recirculated air to the river water and service water pump cubicles to dissipate excess equipment heat.

- The Service Building Emergency Switchgear Ventilation System supplies a temperature controlled mixture of outdoor air and exhaust air to dissipate excess equipment heat.

The Area Ventilation Systems - Miscellaneous System also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions.

The Area Ventilation Systems - Miscellaneous System also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 8.5.2.4, Diesel Generator Building

- BVPS Unit 1 UFSAR, Revision 20, Section 8.5.3 125 Volt DC Power System

- BVPS Unit 2 UFSAR, Revision 12, Section 9.4.4, Turbine Building Area Ventilation System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.4.6, Emergency Diesel Generator Building Ventilation System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.4.8, Intake Structure Ventilation System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.4.8.2, Alternate Intake Structure Ventilation System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.4.10, Service Building Ventilation System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.4.10.3, Emergency Switchgear Room Ventilation System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.4.14, Cooling Tower Pumphouse Ventilation System

License Renewal Drawings

The Area Ventilation Systems - Miscellaneous aging management review boundaries are highlighted on the following drawings:

Unit 1:

- None.

Unit 2:

- 10080-RM-444F-1, Sheet 1, Revision 2, Valve Operating No. Diagram - Main and Alternate Intake Structure and Cooling Tower Pump House Ventilation System
- 10080-RM-444F-3, Sheet 3, Revision 2, Valve Operating No. Diagram - Area Ventilation System Miscellaneous Orange and Purple Switchgear Rooms
- 10080-RM-444F-4, Sheet 4, Revision 3, Valve Operating No. Diagram - Diesel Generator Room and Aux Boiler Room
- 10080-RM-444F-5, Sheet 5, Revision 4, Valve Operating No. Diagram - Normal Switchgear and Turbine Bldg Ventilation System

Components Subject to AMR

The Area Ventilation Systems - Miscellaneous component types subject to aging management review and their intended functions are shown in Table 2.3.3.5-1 below. The aging management review results for these components are provided in Table 3.3.2-5, Auxiliary Systems – Area Ventilation Systems - Miscellaneous – Summary of Aging Management Evaluation.

**Table 2.3.3.5-1**
**Area Ventilation Systems - Miscellaneous**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| Collar | Pressure Boundary |
| Damper Housing | Fire Barrier<br>Pressure Boundary |
| Duct | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Fan | Pressure Boundary |
| Filter | Pressure Boundary |
| Seal | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Service Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.6 Area Ventilation Systems - Reactor Containment Building

System Description

The area ventilation systems of the Unit 1 and 2 Reactor Containment Buildings involve several subsystems. Each is listed below and briefly described.

Unit 1 Containment Air Recirculation Cooling System

Bulk air cooling of the containment is achieved by three emergency powered air recirculation cooling systems with the recirculated air being cooled on passing through chilled water or river water coil banks. Chilled Water supply is not required to support any intended functions.

Unit 2 Containment Atmosphere Recirculation System

The Containment Atmosphere Recirculation System consists of three 50% capacity atmosphere recirculation unit coolers with air distribution ductwork. Two of the three atmosphere recirculation unit coolers function during normal operation. Air is drawn by the fan over the respective unit's cooling coils and then is discharged into, and distributed through, ductwork to the containment levels. Chilled Water supply is not required to support any intended functions.

Iodine Filtration System

Each unit was originally supplied with Containment Iodine Filtration systems consisting of two fans and filter units. Neither system supports any intended functions, and the Unit 1 system has been retired.

Unit 1 Containment Purge Exhaust and Supply System

During shutdown periods, containment purging ventilation is provided by an exhaust system and supply system designed to maintain a slightly negative containment pressure, with provisions to handle variable flow rates. This system also functions as a heating and ventilation system during periods of maintenance. In normal unit operation, the purge exhaust and purge supply circuits are inoperative. This system provides a containment isolation function and includes fire dampers.

Unit 2 Containment Purge Air System

The Containment Purge Air System consists of supply and exhaust air subsystems. An outdoor air pressure-equalizing line with a manually-operated valve is provided between the isolation valve outside the containment on the purge supply line and its containment penetration. This line is used to bring the containment to atmospheric pressure prior to purging. Supply and exhaust ductwork are provided with containment butterfly isolation valves. During normal operation of the plant, the purge supply circuit is inoperative and the isolation valves are closed. This system provides a containment isolation function and includes fire dampers.

Unit 1 Control Rod Drive Mechanism Shroud Cooling System

Cooling of the control rod drive mechanism shroud is provided by three ventilation systems drawing containment ambient air through the shroud and detachable ductwork. The fans discharge through component cooling water coil banks before returning the air to containment ambient. Ventilation flow and cooling is not required to support any intended functions.

Unit 2 Control Rod Drive Mechanism Ventilation System

Cooling is provided by three ventilation subsystems. The Control Rod Drive Mechanism Ventilation System fans draw containment ambient air through the control rod drive mechanism shroud and detachable ductwork. The fans discharge the air that is drawn from the control rod drive mechanism shroud, through coils that are cooled by the primary component cooling water system before discharging to the containment atmosphere. Ventilation flow and cooling are not required to support any intended functions.

The Area Ventilation Systems - Reactor Containment Building meets 10 CFR 54.4(a)(1) because system safety related components provide the means for assessing plant conditions during and following an accident and the Containment Atmosphere Recirculation System provides the means to maintain the bulk air temperature in containment suitable for personnel and equipment operation during normal operation and a loss of offsite power. It also meets 10 CFR 54.4(a)(2)

because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), Environmental Qualification (10 CFR 50.49), and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Figure 5.1-5, Reactor Containment Sections 1-1, 6-6, 22-22 and 24-24
- BVPS Unit 1 UFSAR, Revision 20, Section 5.4.1, Internal Containment Systems - Ventilation Systems
- BVPS Unit 2 UFSAR, Revision 12, Section 9.4.7, Containment Ventilation System

License Renewal Drawings

The Area Ventilation Systems - Reactor Containment Building aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-416-1, Sheet 1, Revision 12, Piping and Instrumentation Diagram - Vent and Air Cond Primary Plant

Unit 2:

- 10080-RM-412-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Containment Vacuum System
- 10080-RM-444C-1, Sheet 1, Revision 2, Valve Operating No. Diagram - Containment Area Ventilation System
- 10080-RM-444C-2, Sheet 2, Revision 4, Valve Operating No. Diagram - Containment Area Ventilation System

Components Subject to AMR

The Area Ventilation Systems - Reactor Containment Building component types subject to aging management review and their intended functions are shown in Table 2.3.3.6-1 below. The aging management review results for these components are provided in Table 3.3.2-6, Auxiliary Systems – Area Ventilation Systems - Reactor Containment Building – Summary of Aging Management Evaluation.

**Table 2.3.3.6-1**
**Area Ventilation Systems - Reactor Containment Building**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| Collar | Pressure Boundary |
| Damper Housing | Fire Barrier<br>Pressure Boundary |
| Duct | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Fan | Pressure Boundary |
| Heat Exchanger | Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Reactor Containment Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.7 Boron Recovery and Primary Grade Water System

System Description

The overall function of the Boron Recovery and Primary Grade Water System is to contain and process the RCS letdown flow which is required to maintain the correct boron concentration in the RCS and to accommodate fluctuations in RCS volume due to changes in plant loads. The system processes letdown that is diverted to the degassifiers and liquids that have been collected in the Primary Drain Transfer Tanks (PDTT). These radioactive liquids are stripped to remove the dissolved and entrained gases. The separated gases are discharged to the Gaseous Waste System where they are processed and stored before they are recycled or discharged to the atmosphere. The stripped liquids are sent to either the Chemical and Volume Control System, the Unit 1 Coolant Recovery Tanks or the Unit 2 steam generator blowdown tanks. Unit 2 normally sends excess fluid to the Unit 1 Coolant Recovery Tanks. The stripped liquid that is sent to the Unit 1 Coolant Recovery Tanks is evaporated to reclaim boric acid and primary grade water for future use or disposal.

The Boron Recovery and Primary Grade Water System meets 10 CFR 54.4(a)(1) because the safety related portion of the Unit 2 Boron Recovery System serves as a pressure boundary for containing the RCS letdown flow from the CVCS. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because

it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.2, Boron Recovery System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.3.4.6, Boron Recovery System

License Renewal Drawings

The Boron Recovery and Primary Grade Water System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- Unit 1 components subject to aging management review are in scope for 10 CFR 54.4(a)(2) only, as a result of the additional review discussed in Section 2.1.1.3. They are not highlighted on any drawing.

Unit 2:

- 10080-RM-408-1, Sheet 1, Revision 7, Valve Operating No. Diagram - Boron Recovery

Components Subject to AMR

The Boron Recovery and Primary Grade Water System component types subject to aging management review and their intended functions are shown in Table 2.3.3.7-1 below. The aging management review results for these components are provided in Table 3.3.2-7, Auxiliary Systems – Boron Recovery and Primary Grade Water System – Summary of Aging Management Evaluation.

**Table 2.3.3.7-1**
**Boron Recovery and Primary Grade Water System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Heat Exchanger | Pressure Boundary |
| Orifice | Pressure Boundary |
| Piping | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Fuel Building<br>Unit 1 PWST<br>Unit 1 Safeguards Building<br>Unit 2 Auxiliary Building<br>Unit 2 Fuel Building<br>Unit 2 Main Steam Valve and Cable Vault Area | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.8 Building and Yard Drains System

System Description

The Unit 1 Building and Yard Drains System is divided into four subsystems – floor drains, roof and yard drains, oily drains and sanitary drains. Unit 2 has these same four subsystems, plus a fifth, the recirculating spray pump casing drains. After the oil has been separated from the oil drains and the sanitary drains have undergone treatment, they combine with the roof and floor drains and enter the river through the storm sewer. The system is made up of piping, valves, tanks, pumps, accumulators, separators, indicators, elements, and switches.

The Building and Yard Drains System meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions.

Additional information can be found in the following UFSAR sections:

- None

License Renewal Drawings

- Unit 1 and 2 components subject to aging management review are in scope for 10 CFR 54.4(a)(2) only, as a result of the additional review discussed in Section 2.1.1.3. They are not highlighted on any drawing.

Components Subject to AMR

The Building and Yard Drains System component types subject to aging management review and their intended functions are shown in Table 2.3.3.8-1 below. The aging management review results for these components are provided in Table 3.3.2-8, Auxiliary Systems - Building and Yard Drains System - Summary of Aging Management Evaluation.

**Table 2.3.3.8-1**
**Building and Yard Drains System**
**Component Types Subject to Aging Management Review (AMR)**

| Component Types | Intended Function* |
|---|---|
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Intake Structure<br>Unit 1 Safeguards Building<br>Unit 1 Service Building<br>Unit 2 Auxiliary Building<br>Unit 2 Control Building<br>Unit 2 Cable Tunnel<br>Unit 2 Diesel Generator Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Pipe Tunnels<br>Unit 2 Service Building<br>Unit 2 Service Water Valve Pits | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.9 Building Services Hot Water Heater System

System Description

The Unit 1 Building Services Hot Water Heater System consists of four main circuits, or loops: Loop No. 1 – Turbine Building; Loop No. 2 – Service Building, including the Safeguards Area and Main Steam Valve Area; Loop No. 3 – Auxiliary Building, including the Pipe Tunnels area; Loop No. 4 – Fuel and Decontamination Building, including the Diesel Generator Building. Unit 2 is very similar, but Loop No. 3 consists of Unit 1 Loop No. 3 and 4 areas, with Unit 2 Loop 4 containing the Waste Handling Building and the Condensate Polishing Building. Water is circulated throughout the Unit 1 and Unit 2 systems by pumps, through heat exchangers, where it is heated by steam supplied to the heat exchangers from the associated auxiliary steam

system. The systems consist of piping, tanks, pumps, valves, dampers, orifices, traps, strainers, heaters, controllers, indicators, and switches.

The Building Services Hot Water Heater System meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions.

Additional information can be found in the following UFSAR sections:

- None

License Renewal Drawings

- Components subject to aging management review are in scope for 10 CFR 54.4(a)(2) only, as a result of the additional review discussed in Section 2.1.1.3. They are not highlighted on any drawing.

Components Subject to AMR

The Building Services Hot Water Heater System component types subject to aging management review and their intended functions are shown in Table 2.3.3.9-1 below. The aging management review results for these components are provided in Table 3.3.2-9, Auxiliary Systems - Building Services Hot Water Heater System - Summary of Aging Management Evaluation.

**Table 2.3.3.9-1**
**Building Services Hot Water Heater System**
**Component Types Subject to Aging Management Review (AMR)**

| Component Types | Intended Function* |
|---|---|
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Fuel Building<br>Unit 1 Pipe Tunnels<br>Unit 1 Safeguards Building<br>Unit 1 Service Building<br>Unit 2 Auxiliary Building<br>Unit 2 Control Building<br>Unit 2 Decontamination Building<br>Unit 2 Fuel Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Service Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.10 Chemical and Volume Control System

System Description

The Chemical and Volume Control System is the primary support system for the Reactor Coolant System during all normal modes of plant operations. The charging and letdown functions of the system are employed to maintain a programmed water level in the reactor coolant system pressurizer during all phases of plant operation. This is achieved by means of a continuous feed (charging) and bleed (letdown) process.

Reactor coolant is letdown to the Charging System from an RCS cold leg. It then flows through the shell side of the regenerative heat exchanger where its temperature is reduced. The coolant letdown pressure is then reduced by passing through a restricting orifice. After passing through the non-regenerative heat exchanger letdown inlet valve the reactor coolant letdown flows through the tube side of the non-regenerative heat exchanger where its temperature is further reduced. Downstream of the non-regenerative heat exchanger, a second pressure reduction occurs at the non-regenerative heat exchanger discharge pressure control valve.

The letdown coolant flow path then leads to the purification system demineralizers, the reactor coolant filter, and into the volume control tank through a spray nozzle. The charging pumps normally take a suction from the volume control tank and return the cooled, purified reactor coolant to an RCS loop cold leg.

The Chemical and Volume Control System meets 10 CFR 54.4(a)(1) because portions of the system form a part of the reactor coolant pressure boundary, the system provides isolation against the potential for radioactive leakage into the RWST, it provides a containment isolation function, it provides a means for assessing plant conditions during and following an accident, the charging pumps supply high head injection flow to the Safety Injection System, the system provides a continuous supply of filtered borated water for RCP seal injection and leakoff, it provides auxiliary spray to the pressurizer, it provides reactor makeup/reactivity control and is capable of borating the RCS to cold shutdown, and the system provides the capability for removing fission, activation and corrosion product to control radiation levels and to minimize radioactive releases due to leaks. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), Environmental Qualification (10 CFR 50.49), and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.1, Chemical and Volume Control System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.3.4, Chemical and Volume Control System

License Renewal Drawings

The Chemical and Volume Control System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-406-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Reactor Coolant System
- 8700-RM-406-2, Sheet 2, Revision 15, Valve Operating No. Diagram - Reactor Coolant System
- 8700-RM-407-1, Sheet 1, Revision 18, Valve Operating No. Diagram - Chemical and Volume Control System
- 8700-RM-407-2, Sheet 2, Revision 2, Valve Operating No. Diagram - Chemical and Volume Control System
- 8700-RM-407-3, Sheet 3, Revision 12, Valve Operating No. Diagram - Chemical and Volume Control System
- 8700-RM-407-4, Sheet 4, Revision 13, Valve Operating No. Diagram - Chemical and Volume Control System
- 8700-RM-407-5, Sheet 5, Revision 6, Valve Operating No. Diagram - CH-P-1A, 1B and 1C Lube Oil System
- 8700-RM-408-1, Sheet 1, Revision 3, Valve Operating No. Diagram - Boron Recovery Degassifiers
- 8700-RM-408-6, Sheet 6, Revision 9, Valve Operating No. Diagram - Boron Recovery PG Wtr Distribution
- 8700-RM-414A-2, Sheet 2, Revision 4, Valve Operating No. Diagram - Sample System
- 8700-RM-419-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Gaseous Waste Disposal System

Unit 2:

- 10080-RM-406-1, Sheet 1, Revision 17, Valve Operating No. Diagram - Reactor Coolant System
- 10080-RM-407-1A, Sheet 1, Revision 10, Valve Operating No. Diagram - Chemical and Volume Control
- 10080-RM-407-1B, Sheet 2, Revision 6, Valve Operating No. Diagram - Chemical and Volume Control
- 10080-RM-407-2, Sheet 2, Revision 13, Valve Operating No. Diagram - Charging System VCT and Make-Up
- 10080-RM-407-3, Sheet 3, Revision 9, Valve Operating No. Diagram - RCP Seal Water/Excess Letdown
- 10080-RM-407-5, Sheet 5, Revision 4, Valve Operating No. Diagram - 2CHS-P21A, 21B, 21C Lube Oil System
- 10080-RM-408-1, Sheet 1, Revision 7, Valve Operating No. Diagram - Boron Recovery

- 10080-RM-409-1, Sheet 1, Revision 8, BVPS Unit 2 Valve Operating No. Diagram - Reactor Plant Drains System
- 10080-RM-414A-2, Sheet 2, Revision 10, Valve Operating No. Diagram - Reactor Plant Sample - Hood 2
- 10080-RM-414C-1, Sheet 1, Revision 6, Valve Operating No. Diagram - PAS System-Liquid Samples
- 10080-RM-418-1, Sheet 1, Revision 7, Valve Operating No. Diagram - Solid Waste Disposal Piping

Components Subject to AMR

The Chemical and Volume Control System component types subject to aging management review and their intended functions are shown in Table 2.3.3.10-1 below. The aging management review results for these components are provided in Table 3.3.2-10, Auxiliary Systems – Chemical and Volume Control System – Summary of Aging Management Evaluation.

**Table 2.3.3.10-1**
**Chemical and Volume Control System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| Demineralizer | Pressure Boundary |
| Element | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Filter | Filtration<br>Pressure Boundary |
| Heat Exchanger | Heat Transfer<br>Pressure Boundary |
| Indicator | Pressure Boundary |
| Miscellaneous Mechanical Equipment | Pressure Boundary |
| Orifice | Flow Restriction<br>Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Tank | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Reactor Containment Building | NSR Functional Support |

| Component Type | Intended Functions* |
|---|---|
| Unit 2 Auxiliary Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Reactor Containment Building<br>Unit 2 Refueling Water Storage Tank<br>Unit 2 Pipe Tunnel | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.11 Chilled Water System

System Description

The Chilled Water System consists of three chillers rated at 450 tons (650 tons for Unit 2) of refrigeration capacity each. Chilled water is circulated through the chillers and the various cooling loads by chilled water circulation pumps. Each chiller has its own circulation pump. The system is designed to deliver water at 45 deg F to numerous loads. Heat removal by the system is not required to support any intended functions.

The Chilled Water System meets 10 CFR 54.4(a)(1) because system safety related components provide the means for assessing plant conditions during and following an accident and the system provides a containment isolation function. It also meets 10 CFR 54.4(a)(2) because it provides cooling water to various safety related components and because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.4.3.2, Chilled Water Subsystem
- BVPS Unit 2 UFSAR, Revision 12, Section 9.2.2.2, Chilled Water System

License Renewal Drawings

The Chilled Water System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-429-2, Sheet 2, Revision 6, Valve Operating No. Diagram - Component Cooling Water

Unit 2:

- 10080-RM-429-4, Sheet 4, Revision 8, Valve Operating No. Diagram - Chilled Water - Containment

Components Subject to AMR

The Chilled Water System component types subject to aging management review and their intended functions are shown in Table 2.3.3.11-1 below. The aging management review results for these components are provided in Table 3.3.2-11, Auxiliary Systems – Chilled Water System – Summary of Aging Management Evaluation.

**Table 2.3.3.11-1**
**Chilled Water System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| External Surfaces | Pressure Boundary |
| Piping | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Pipe Tunnels<br>Unit 1 Reactor Containment Building<br>Unit 1 Service Building<br>Unit 1 Safeguards Building<br>Unit 2 Auxiliary Building<br>Unit 2 Fuel Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Pipe Tunnels<br>Unit 2 Reactor Containment Building<br>Unit 2 Safeguards Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.12 Compressed Air System

System Description

The Compressed Air Systems for Units 1 and 2 are made up of the following subsystems:

- Station Air System (Station Service Air in Unit 2)
- Instrument Air System

- Containment Instrument Air System
- Others

Station Air System

The Station Air System consists of two air compressors, two station air receiver tanks, and the necessary pipes and valves to deliver the air to numerous plant locations for maintenance personnel use. This system also supplies raw air to the instrument air system.

Instrument Air System

The Instrument Air System is supplied from station air, using air dryers, prefilters, after filters; and a receiver tank. The system has the necessary pipes and valves to deliver air to numerous air loads. The function of this system is to provide clean, dry air to the station's air operated components. This system also supplies the compressed air to the containment instrument air system at Unit 1. The Unit 2 Instrument Air system acts as a backup to the Unit 2 containment instrument air system. The system provides a containment isolation function at both units. Inflatable bladders with air accumulators support sealing flood doors and some dampers. The supply of compressed air does not support any other intended function at Unit 1. Compressed air at Unit 2 is needed to support operation of selected valves for fire protection/safe shutdown only.

Containment Instrument Air System

Unit 1 Containment Instrument Air System is supplied by the Station Instrument Air System. The Unit 2 Containment Instrument Air System consists of two air compressors. The function of this system at both units is to provide clean, dry air to the air operated components in the containment. A Unit 2 backup air supply is available from the Instrument Air System.

Others

In Unit 1, in the event of a loss of both station air compressors, a diesel-driven air compressor is available to supply air to the instrument air lines. The Intake Structure and the Unit 1 Cooling Tower Pump House each contain an independent compressed air system to supply the loads in those buildings. These subsystems do not support any intended functions.

In Unit 2, the Condensate Polishing Air System consists of one compressor; a receiver tank, and the necessary pipes and valves. The function of this system is to supply raw compressed air to the Unit 2 Condensate Polishing System and to provide a backup air supply to the Unit 2 Station Service Air System. This subsystem does not support any intended functions.

The Compressed Air System meets 10 CFR 54.4(a)(1) because system safety related components provide the means for assessing plant conditions during and following an accident and the system provides a containment isolation function. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that

demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.8, Compressed Air Systems

- BVPS Unit 2 UFSAR, Revision 12, Section 9.3.1, Compressed Air Systems
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.2.3.1.12 Station Service Air System

License Renewal Drawings

The Compressed Air System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-434-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Station Compressed Air
- 8700-RM-434-2, Sheet 2, Revision 15, Valve Operating No. Diagram - Instrument Air and Containment Instrument Air
- 8700-RM-434-8, Sheet 8, Revision 4, Valve Operating No. Diagram - Air System Intake Structure Watertight Doors

Unit 2:

- 10080-RM-433-1C, Sheet 1C, Revision 12, Valve Operating No. Diagram - Fire Protection Water - Auxiliary Building
- 10080-RM-434-1B, Sheet 1B, Revision 3, Valve Operating No. Diagram - Service Air System-Distribution
- 10080-RM-434-1A, Sheet 1A, Revision 5, Valve Operating No. Diagram - Station Service Air Plant/Distribution
- 10080-RM-434-2, Sheet 2, Revision 14, Valve Operating No. Diagram - Station Instrument Air
- 10080-RM-434-3, Sheet 3, Revision 8, Valve Operating No. Diagram - Containment Instrument Air
- 10080-RM-434-10, Sheet 10, Revision 1, Valve Operating No. Diagram – Containment Instrument Air

Components Subject to AMR

The Compressed Air System component types subject to aging management review and their intended functions are shown in Table 2.3.3.12-1 below. The aging management review results for these components are provided in Table 3.3.2-12, Auxiliary Systems – Compressed Air System – Summary of Aging Management Evaluation.

**Table 2.3.3.12-1**
**Compressed Air System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Air Dryer | NSR Functional Support |
| External Surfaces | Pressure Boundary |
| Filter | NSR Functional Support |
| Pipe Fitting | Pressure Boundary |
| Piping | NSR Functional Support<br>Pressure Boundary |
| Tank | NSR Functional Support<br>Pressure Boundary |
| Valve | NSR Functional Support<br>Pressure Boundary |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.13 Containment System

System Description

Note: The Containment System contains components subject to aging management review that are mechanical, structural, or electrical in nature. The mechanical items are accounted for here (Section 2.3.3.13), the structural components are accounted for in Section 2.4.2.4 (Containment System), and the electrical components are accounted for in Section 2.5.7 (Containment Electrical Penetrations).

The Containment System comprises the components that provide services and communications through the exterior reactor containment wall. These services and communications are performed through leak tight penetrations. These penetrations are classified as follows:

- Piping penetrations, thermally hot and/or cold,
- Electrical penetrations,
- Personnel air lock,
- Equipment access hatch,
- Emergency airlock, and
- Fuel transfer tube.

The piping penetrations through the containment wall are provided with isolation valves. The isolation valves provide inside and outside containment isolation in the event of a Design Basis Accident (DBA).

The personnel airlock is a primary means by which plant personnel can enter or leave the containment. The personnel airlock is a double closure penetration. The airlock is designed such that, under normal operating and accident conditions, it will be impossible to have both doors unsealed at the same time.

The removable equipment hatch is a single closure penetration which is bolted to the inside of the containment wall. The 14' 6" opening is sealed with double "O" rings. Prior to bringing any major mechanical equipment into the Reactor Containment Building, the 14' 6" diameter hatch head must be unbolted from the shell head flange.

The emergency airlock located in the equipment hatch provides a second entrance/exit for the containment. It is not used for personnel entrance or exit under normal conditions. The removable emergency airlock is a double closure penetration which is bolted to the equipment hatch. The 30 inch doors are sealed with double "O" rings.

The fuel transfer tube is part of the fuel handling system. The fuel transfer canal and the spent fuel pool are connected by the fuel transfer tube.

The Containment System meets 10 CFR 54.4(a)(1) because it provides a pressure boundary or essentially leak tight barrier to protect the public health and safety in the event of any postulated design basis events. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 5, Containment Systems
- BVPS Unit 2 UFSAR, Revision 12, Section 6.2, Containment Systems

License Renewal Drawings

The Containment System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-447-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Containment Systems

Unit 2:

- 10080-RM-447-1, Sheet 1, Revision 7, Valve Operating No. Diagram - Containment Air Locks and Fuel Transfer Tube

Components Subject to AMR

The Containment System component types subject to aging management review and their intended functions are shown in Table 2.3.3.13-1 below. The aging management review results for these components are provided in Table 3.3.2-13, Auxiliary Systems - Containment System - Summary of Aging Management Evaluation.

**Table 2.3.3.13-1**
**Containment System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| External Surfaces | Pressure Boundary |
| Piping | Pressure Boundary |
| Valve | Pressure Boundary |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.14 Containment Vacuum and Leakage Monitoring System

System Description

The Containment Vacuum System (CVS) consists of a containment vacuum ejector, two containment vacuum pumps, piping, valves and instrumentation. The containment vacuum ejector removes air from the containment structure to create a sub atmospheric pressure prior to initial plant operation and after subsequent refueling operations. Once the sub atmospheric condition is achieved, it is maintained by the two containment vacuum pumps. Each pump draws a separate suction from the containment dome. The discharge of the containment vacuum pumps flows to the gaseous waste disposal system.

The Leakage Monitoring System provides for monitoring containment pressure and air inleakage.

Four containment penetrations are used for all the pressure indication, computer inputs and pressure recordings required by the CVS and LMS Systems.

The Containment Vacuum and Leakage Monitoring System meets 10 CFR 54.4(a)(1) because the system provides a containment isolation function, it provides a means for assessing plant conditions during and following an accident, the containment pressure instrumentation generates signals for safety functions, and a flow path is provided for sampling the containment environment. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system

components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 5.4.2, Containment Vacuum and Leakage Monitoring System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5.10, Containment Vacuum System

License Renewal Drawings

The Containment Vacuum and Leakage Monitoring System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-412-1, Sheet 1, Revision 8, Piping and Instrumentation Diagram - Containment Vacuum and Leakage Monitoring
- 8700-RM-446-1, Sheet 1, Revision 4, Valve Operating No. Diagram - Post DBA Hydrogen Control System

Unit 2:

- 10080-RM-412-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Containment Vacuum System
- 10080-RM-412-2, Sheet 2, Revision 4, Valve Operating No. Diagram - Leakage Monitoring
- 10080-RM-414C-2, Sheet 2, Revision 6, Valve Operating No. Diagram - Post Accident Sample System Gaseous Samples

Components Subject to AMR

The Containment Vacuum and Leakage Monitoring System component types subject to aging management review and their intended functions are shown in Table 2.3.3.14-1 below. The aging management review results for these components are provided in Table 3.3.2-14, Auxiliary Systems – Containment Vacuum and Leakage Monitoring System – Summary of Aging Management Evaluation.

**Table 2.3.3.14-1**
**Containment Vacuum and Leakage Monitoring System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| External Surfaces | Pressure Boundary |
| Orifice | Flow Restriction<br>Pressure Boundary |
| Piping | Pressure Boundary |
| Separator | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Safeguards Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Pipe Tunnels | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.15 Domestic Water System

System Description

The Domestic Water System (DWS) is supplied by the Midland municipal water system. Hot and cold water are supplied to the control room, dark room, and chemical laboratories, PCA washroom and laundry, office area, washroom and first aid area, and the water treating and chemical lab area. The DWS is made up of piping, valves, tanks, pumps, heat exchangers, strainers, controllers, indicators and switches. The supply of domestic water does not support any intended functions.

The Domestic Water System meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions.

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.11, Water Supply and Treatment Systems

- BVPS Unit 2 UFSAR, Revision 12, Section 9.2.4.1, Design Bases
- BVPS Unit 2 UFSAR, Revision 12, Section 9.2.4.2, System Description

License Renewal Drawings

- Unit 1 and 2 components subject to aging management review are in scope for 10 CFR 54.4(a)(2) only, as a result of the additional review discussed in Section 2.1.1.3. They are not highlighted on any drawing.

Components Subject to AMR

The Domestic Water System component types subject to aging management review and their intended functions are shown in Table 2.3.3.15-1 below. The aging management review results for these components are provided in Table 3.3.2-15, Auxiliary Systems – Domestic Water System – Summary of Aging Management Evaluation.

**Table 2.3.3.15-1**
**Domestic Water System**
**Component Types Subject to Aging Management Review (AMR)**

| Component Types | Intended Function* |
|---|---|
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Service Building<br>Unit 2 Auxiliary Building<br>Unit 2 Control Building<br>Unit 2 Cable Tunnel<br>Unit 2 Decontamination Building<br>Unit 2 Fuel Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Service Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.16 Emergency Diesel Generators and Support Systems

System Description

The Emergency Diesel Generator (EDG) System for each unit consists of two engine/generator sets each of which is dedicated to an emergency train. Each engine/generator set includes all of the necessary controls and support equipment that is required to start, run, sequence and load the EDG in the emergency mode as required to meet the plant's operational requirements. Upon a loss of voltage to an emergency bus, the EDG will automatically start, energize the bus when at rated speed and voltage (Less Than 10 seconds) and then sequence on the emergency loads to the emergency bus per plant design. Either Unit 1 EDG will carry the load, up to its full load rating, for up to seven days with the fuel contained in both storage tanks, provided the opposite EDG is not operating. The Unit 2 fuel oil storage inventory is sufficient to operate both diesels at full load for 7 days.

Each EDG includes support equipment that can generally be grouped into, but is not limited to, the following:

- Fuel Oil
- Air Start
- EDG Cooling
- Lube Oil
- Intake Air
- Exhaust Gases
- Electrical Controls and Protection

The Emergency Diesel Generators and Support Systems meet 10 CFR 54.4(a)(1) because upon a loss of voltage on the associated emergency bus, the EDG shall start, energize, sequence and power the emergency loads (as required), up to the full load rating of the engine for up to seven days to provide for the safe shutdown of the plant, when the preferred AC power source (i.e., system station service transformer) is not available, the EDGs supply AC power to the emergency buses of the 4KV station service system, thereby ensuring required AC power for a safe shutdown of the plant, the diesel generator cooling water subsystem provides cooling water essential for the operation of the diesel engines when running and heated water when the engines are shutdown, the diesel generator engine lubricating subsystem provides lubricating oil essential for the operation of the diesel engine, the emergency diesel generator turbocharger, engine air intake and exhaust systems and engine protective devices provide needed support for the reliable operation of the engines, the safety related portion of the diesel generator air start subsystem provides stored air capable of ensuring enough air for a minimum number of starts per diesel generator unit, the safety related portion of the diesel generator fuel oil subsystem provides a supply of fuel oil to each emergency diesel generator in order to ensure that the design basis of 7 days of continuous full load operation can be met, and the system contains instrumentation channels that provide inputs to the Solid State Protection System. It also meets 10 CFR 54.4(a)(3) because they contain SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Station Blackout (10 CFR 50.63) (including Station Blackout recovery).

<u>Additional information can be found in the following UFSAR sections:</u>

- BVPS Unit 1 UFSAR, Revision 20, Section 8.5.2.1, Emergency Diesel Generators
- BVPS Unit 1 UFSAR, Revision 20, Section 8.5.2.3 Diesel Generator Auxiliary Systems
- BVPS Unit 1 UFSAR, Revision 20, Section 9.14.4.1, Emergency Diesel Generators

- BVPS Unit 2 UFSAR, Revision 12, Section 8.3.1.1.15, Onsite Emergency Power Supply

License Renewal Drawings

The Emergency Diesel Generators and Support Systems aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-436-1, Sheet 1, Revision 5, Valve Operating No. Diagram - Emergency Diesel Generator Air Start System
- 8700-RM-436-2, Sheet 2, Revision 8, Valve Operating No. Diagram - Emergency Diesel Generator Fuel Oil System
- 8700-RM-436-4, Sheet 4, Revision 4, Valve Operating No. Diagram - EE-EG-1,2 Water Cooling System

Unit 2:

- 10080-RM-436-1, Sheet 1, Revision 4, Valve Operating No. Diagram - Diesel Fuel Oil
- 10080-RM-436-2, Sheet 2, Revision 3, Valve Operating No. Diagram - Diesel Air Intake, Exhaust and Vacuum
- 10080-RM-436-3, Sheet 3, Revision 10, Valve operating No. Diagram - Diesel Starting Air
- 10080-RM-436-4A, Sheet 4A, Revision 7, Valve Operating No. Diagram - Diesel Cooling Water
- 10080-RM-436-4B, Sheet 4B, Revision 8, Valve Operating No. Diagram - Diesel Cooling Water

Components Subject to AMR

The Emergency Diesel Generators and Support Systems component types subject to aging management review and their intended functions are shown in Table 2.3.3.16-1 below. The aging management review results for these components are provided in Table 3.3.2-16, Auxiliary Systems – Emergency Diesel Generators and Support Systems – Summary of Aging Management Evaluation.

**Table 2.3.3.16-1**
**Emergency Diesel Generators and Support Systems**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| External Surfaces | Pressure Boundary |
| Filter | Filtration<br>Pressure Boundary |
| Heat Exchanger | Heat Transfer<br>Pressure Boundary |

| Component Type | Intended Functions* |
|---|---|
| Heater | Pressure Boundary |
| Indicator | Pressure Boundary |
| Orifice | Flow Restriction<br>Pressure Boundary |
| Pipe Fittings | Fire Barrier<br>Pressure Boundary |
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Strainer | Filtration<br>Pressure Boundary |
| Tank | Pressure Boundary |
| Valve | Pressure Boundary |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.17 ERF Substation System

System Description

The Emergency Response Facility Substation (ERFS) is assigned to Unit 1 but is common to both Unit 1 and Unit 2. The ERFS receives standby power from a 2500 kw ERFS diesel generator. The diesel generator supplies highly reliable power to the ERFS 4,160 v switchgear for selected equipment in the ERFS, Emergency Response Facility, BVPS Units 1 and 2.

A 30,000 gallon (approx. 29,100 gallons available as configured) fuel oil storage tank is buried northwest of the switchyard relay house to provide the diesel with a 7-day fuel oil supply. Two 100% capacity fuel oil transfer pumps are installed on top of the fuel oil storage tank to transfer fuel oil to the diesel engine fuel oil day tank located in the southeast corner of the ERFS diesel building. Fuel oil is supplied from the day tank to the diesel fuel injectors by an engine mounted fuel pump and a fuel priming pump.

The Emergency Response Facility Substation meets 10 CFR 54.4(a)(1) because it provides isolation devices for all of its signal interfaces with safety systems. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Anticipated Transients Without Scram (10 CFR 50.62).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 8.4.5, Emergency Response Facility Power System

License Renewal Drawings

The ERF Substation System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-458E-1, Sheet 1, Revision 8, Valve Operating No. Diagram - RG-EG-1 Fuel Oil System
- 8700-RM-458E-2, Sheet 2, Revision 5, Valve Operating No. Diagram - RG-EG-1 Water Cooling System

Components Subject to AMR

The ERF Substation System component types subject to aging management review and their intended functions are shown in Table 2.3.3.17-1 below. The aging management review results for these components are provided in Table 3.3.2-17, Auxiliary Systems - ERF Substation System - Summary of Aging Management Evaluation.

**Table 2.3.3.17-1**
**ERF Substation System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Heat Exchanger | Heat Transfer<br>Pressure Boundary |
| Orifice | Flow Restriction<br>Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Tank | Pressure Boundary |
| Valve | Pressure Boundary |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.18 Fire Protection System

System Description

The Fire Protection System consists of a number of subsystems which provide detection, suppression, fire barrier, flammable material collection and operational aid in shutdown functions. The major subsystems are described below.

The water suppression subsystem is supplied by two vertical turbine type fire pumps (one motor driven and one diesel driven). Both pumps are located in the Intake Structure. They take suction from the Ohio River and discharge to the yard fire loop. The yard loop supplies fire hydrants, hose stations and sprinkler systems throughout the plant. The water suppression system consists of pumps, system pressure maintenance hardware, piping, hydrants, hose stations, manual valves, deluge valves and sprinkler heads.

The carbon dioxide suppression subsystem consists of refrigeration units, tanks, piping, control valves, and fire detection equipment for area and equipment enclosure protection. The Halon fire extinguishing subsystems are utilized for suppression in areas where electronic computer parts or equipment are used. The fire detection subsystem consists of smoke, ultraviolet and heat sensitive devices monitoring various areas of the plant. The fire barrier subsystems are those elements of construction that are rated in hours of fire resistance to prevent the spread of fires. They are primarily components such as penetration seals, fire doors, fire dampers, fire wrap, etc.

The Fire Protection System meets 10 CFR 54.4(a)(1) because passive structure (e.g., fire doors, penetration seals, fire dampers, etc.) are provided to prevent the spread of fire, system safety related components provide the means for assessing plant conditions during and following an accident, and the system provides a containment isolation function. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions and it meets 10 CFR 54.4(a)(2) for Unit 1 because the system provides emergency lights for Appendix R safe shutdown lighting, the system provides automatic early warning fire detection in required areas containing safety-related equipment, and because fire suppression is provided by the following subsystems: water suppression (consisting of automatic wet pipe sprinkler, deluge spray, preaction deluge and interior fire hose stations), carbon dioxide fire protection and halon fire protection. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 22, Section 9.10, Fire Protection
- BVPS Unit 1 UFSAR, Revision 22, Table 5.3-1, Containment Isolation Arrangements
- BVPS Unit 1 UFSAR, Revision 22, Section 7.8, Operating Control Stations
- BVPS Unit 1 UFSAR, Revision 22, Section 8.5.2.4, Diesel Generator Building
- BVPS Unit 1 UFSAR, Revision 22, Section 9.13.4, Main Control Area

- BVPS Unit 1 UFSAR, Revision 22, Section 9.14.4.2, Engine Driven Fire Pump

- BVPS Unit 2 UFSAR, Revision 15, Section 9.5.1, Fire Protection System
- BVPS Unit 2 UFSAR, Revision 15, Section 9.5A, Fire Protection Evaluation Report
- BVPS Unit 2 UFSAR, Revision 15, Table 6.2-60, Containment Isolation Features
- BVPS Unit 2 UFSAR, Revision 15, Table 7.5-1, Safety Related Display Instrumentation

License Renewal Drawings

The Fire Protection System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-406-3, Sheet 3, Revision 4, Valve Operating No. Diagram - Reactor Coolant System
- 8700-RM-430-1, Sheet 1, Revision 22, Piping and Instrumentation Diagram - River Water System
- 8700-RM-433-1, Sheet 1, Revision 12, Valve Operating No. Diagram - Fire Protection - Water
- 8700-RM-433-2, Sheet 2, Revision 11, Valve Operating No. Diagram - Fire Protection - Water
- 8700-RM-433-3, Sheet 3, Revision 8, Valve Operating No. Diagram - Fire Protection-CO2
- 8700-RM-433-4, Sheet 4, Revision 5, Valve Operating No. Diagram - Fire Protection - Halon and CO2
- 8700-RM-433-7, Sheet 7, Revision 11, Valve Operating No. Diagram - Fire Protection - Details
- 8700-RM-433-8, Sheet 8, Revision 8, Valve Operating No. Diagram - Fire Protection – Details

Unit 2:

- 10080-RM-406-2, Sheet 2, Revision 14, Valve Operating No. Diagram - Reactor Coolant System
- 10080-RM-416-2, Sheet 2, Revision 6, Valve Operating No. Diagram - Supplementary Leak Collection
- 10080-RM-433-1A, Sheet 1A, Revision 15, Valve Operating No. Diagram - Fire Protection Water Distribution Network
- 10080-RM-433-1B, Sheet 1B, Revision 7, Valve Operating No. Diagram - Fire Protection Water – Misc Bldgs
- 10080-RM-433-1C, Sheet 1C, Revision 12, Valve Operating No. Diagram - Fire Protection Water – Aux Bldg

- 10080-RM-433-1D, Sheet 1D, Revision 8, Valve Operating No. Diagram - Fire Protection Water - Cntmt Bldg
- 10080-RM-433-1E, Sheet 1E, Revision 6, Valve Operating No. Diagram - Fire Protection Water - Turbine Bldg
- 10080-RM-433-1F, Sheet 1F, Revision 8, Valve Operating No. Diagram - Fire Protection Water-Cond Polishing Bldg/Waste Hdlg Bldg/Yard
- 10080-RM-433-2A, Sheet 2A, Revision 14, Valve Operating No. Diagram - CO2 Fire Protection System
- 10080-RM-433-2B, Sheet 2B, Revision 2, Valve Operating No. Diagram - CO2 Fire Protection System
- 10080-RM-433-3, Sheet 3, Revision 2, Valve Operating No. Diagram - Fire Protection-Halon-Cntrl Bldg

Components Subject to AMR

The Fire Protection System component types subject to aging management review and their intended functions are shown in Table 2.3.3.18-1 below. The aging management review results for these components are provided in Table 3.3.2-18, Auxiliary Systems – Fire Protection System – Summary of Aging Management Evaluation.

**Table 2.3.3.18-1**
**Fire Protection System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| External Surfaces | NSR Functional Support<br>Pressure Boundary |
| Indicator | NSR Functional Support |
| Nozzle | Direct Flow<br>NSR Functional Support |
| Orifice | NSR Functional Support |
| Pipe Fittings | Fire Barrier<br>NSR Functional Support |
| Piping | NSR Functional Support<br>Pressure Boundary |
| Pump | NSR Functional Support |
| Strainer | NSR Functional Support |
| Tank | Fire Barrier<br>NSR Functional Support |
| Valve | Fire Barrier<br>NSR Functional Support<br>Pressure Boundary |

| Component Type | Intended Functions* |
|---|---|
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Fuel Building<br>Unit 1 Intake Structure<br>Unit 1 Pipe Tunnels<br>Unit 1 Reactor Containment Building,<br>Unit 1 Safeguards Building<br>Unit 1 Service Building<br>Unit 2 Auxiliary Building<br>Unit 2 Control Building<br>Unit 2 Cable Tunnel<br>Unit 2 Decontamination Building<br>Unit 2 Diesel Generator Building<br>Unit 2 Fuel Building<br>Unit 2 Main Steam and Cable Vault Area<br>Unit 2 Pipe Tunnels<br>Unit 2 Reactor Containment Building<br>Unit 2 Service Building<br>Unit 2 Safeguards Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.19 Fuel Pool Cooling and Purification System

System Description

The Fuel Pool Cooling and Purification System is composed of two subsystems. One subsystem is the fuel pool cooling equipment. This subsystem consists of two circulating pumps, two heat exchangers and the necessary piping and valves. This subsystem controls temperature and level of the fuel pool. The second subsystem is the fuel pool purification equipment. This subsystem consists of two circulating pumps, two filters, one ion exchanger and the necessary piping and valves. This subsystem controls the clarity and purity of the fuel pool, supports operation of the refueling cavity during refueling, provides cleanup capability for the Refueling Water Storage Tank (RWST), and provides a source of emergency makeup water to the RWST.

The Fuel Pool Cooling and Purification System meets 10 CFR 54.4(a)(1) because it provides a containment isolation function, it provides the means for removing decay and sensible heat from the spent fuel pool to control the pool water temperature to within acceptable limits, and it provides the means to control acceptable fuel pool level. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3)

because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.5, Fuel Pool Cooling and Purification System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.1.3 Spent Fuel Pool Cooling and Cleanup System

License Renewal Drawings

The Fuel Pool Cooling and Purification System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700- RM-420-1, Sheet 1, Revision 5, Piping and Instrumentation Diagram – Fuel Pool Cooling and Purification System

Unit 2:

- 10080-RM-420-1, Sheet 1, Revision 9, Valve Operating No. Diagram – Fuel Pool Cooling and Purification

Components Subject to AMR

The Fuel Pool Cooling and Purification System component types subject to aging management review and their intended functions are shown in Table 2.3.3.19-1 below. The aging management review results for these components are provided in Table 3.3.2-19, Auxiliary Systems – Fuel Pool Cooling and Purification System – Summary of Aging Management Evaluation.

**Table 2.3.3.19-1**
**Fuel Pool Cooling and Purification System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Heat Exchanger | Heat Transfer<br>Pressure Boundary |
| Orifice | Pressure Boundary |
| Pipe Fittings | Pressure Boundary |

| Component Type | Intended Functions* |
|---|---|
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Fuel Building<br>Unit 1 Reactor Containment Building<br>Unit 1 Refueling Water Storage Tank Foundation Mat and Shield Wall<br>Unit 1 Safeguards Building<br>Unit 2 Auxiliary Building<br>Unit 2 Decontamination Building<br>Unit 2 Fuel Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Pipe Tunnels<br>Unit 2 Reactor Containment Building<br>Unit 2 Refueling Water Storage Tank and Chemical Addition Tank Shield Wall | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.20 Glycol Heating System

System Description

At BVPS, the Glycol Heating System is a designated Unit 1 system. It is a closed system whose main components are two 100% capacity heat exchangers, two 100% capacity circulating pumps, glycol solution piping and heating coils. An aqueous solution of ethylene glycol is circulated through preheat coils and heating coils to prevent coil freeze-up of heating and ventilating units and air conditioning units utilizing outdoor air. The system consists of valves, piping, pumps, heat exchangers, a separator, tanks, strainers, orifices, controllers, indicators, and switches.

The Glycol Heating System meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions.

Additional information can be found in the following UFSAR sections:

- None

License Renewal Drawings

- Unit 1 components subject to aging management review are in scope for 10 CFR 54.4(a)(2) only, as a result of the additional review discussed in Section 2.1.1.3. They are not highlighted on any drawing.

Components Subject to AMR

The Glycol Heating System component types subject to aging management review and their intended functions are shown in Table 2.3.3.20-1 below. The aging management review results for these components are provided in Table 3.3.2-20, Auxiliary Systems – Glycol Heating System – Summary of Aging Management Evaluation.

**Table 2.3.3.20-1**
**Glycol Heating System**
**Component Types Subject to Aging Management Review (AMR)**

| Component Types | Intended Function* |
|---|---|
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Service Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.21 Liquid Waste Disposal System

System Description

The Liquid Waste Disposal System (LWS) consists of batch tanks, filters, pumps, heat exchangers, condensers, preheaters, evaporators, accumulators, demineralizers, associated piping, valves and instrumentation necessary for operation and control. Liquid effluents in the reactor plant resulting from operating procedures or maintenance work enter the vent and drain system. Most of the unaerated wastes are available for reuse and the remaining unaerated and all aerated wastes are routed to the LWS. After processing the liquid waste is discharged to the river.

The Liquid Waste Disposal System meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions.

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 11.2.4, Liquid Waste Disposal System

- BVPS Unit 2 UFSAR, Revision 12, Section 11.2 (Liquid Waste Management Systems)

License Renewal Drawings

- Unit 1 and 2 components subject to aging management review are in scope for 10 CFR 54.4(a)(2) only, as a result of the additional review discussed in Section 2.1.1.3. They are not highlighted on any drawing.

Components Subject to AMR

The Liquid Waste Disposal System component types subject to aging management review and their intended functions are shown in Table 2.3.3.21-1 below. The aging management review results for these components are provided in Table 3.3.2-21, Auxiliary Systems – Liquid Waste Disposal System – Summary of Aging Management Evaluation.

**Table 2.3.3.21-1**
**Liquid Waste Disposal System**
**Component Types Subject to Aging Management Review (AMR)**

| Component Types | Intended Function* |
|---|---|
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Fuel Building<br>Unit 1 Safeguards Building<br>Unit 1 Service Building<br>Unit 2 Auxiliary Building<br>Unit 2 Pipe Tunnels | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.22 Post Accident Sample System

System Description

The Post Accident Sample System consists of the PASS panel and all interconnecting piping and equipment necessary to selectively route accident-related samples to the panel for acquisition and/or on-line analysis. The system also includes the interconnecting piping and equipment necessary to return samples to various locations commensurate with sampling conditions. Post Accident Sampling Equipment is contained within a lead shielded stainless steel lined PAS box. The lead shielded PAS box is maintained at a slightly negative pressure by a blower which discharges to the primary auxiliary building (PAB) ventilation system. Major PAS valves inside the PAS box are controlled by reach rods extending through the front wall of the PAS box.

The Post Accident Sample System meets 10 CFR 54.4(a)(1) because it provides a containment isolation function. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- None

License Renewal Drawings

The Post Accident Sample System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- Unit 1 components subject to aging management review are in scope for 10 CFR 54.4(a)(2) only, as a result of the additional review discussed in Section 2.1.1.3. They are not highlighted on any drawing.

Unit 2:

- 10080-RM-414C-2, Sheet 2, Revision 6, Valve Operating No. Diagram – Post Accident Sample System Gaseous Samples

Components Subject to AMR

The Post Accident Sample System component types subject to aging management review and their intended functions are shown in Table 2.3.3.22-1 below. The aging management review results for these components are provided in Table 3.3.2-22, Auxiliary Systems – Post Accident Sample System – Summary of Aging Management Evaluation.

**Table 2.3.3.22-1**
**Post Accident Sample System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Piping | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas: | NSR Functional Support |

| Component Type | Intended Functions* |
|---|---|
| Unit 1 Auxiliary Building<br>Unit 1 Reactor Containment Building<br>Unit 1 Safeguards Building<br>Unit 2 Auxiliary Building<br>Unit 2 Reactor Containment Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.23 Post-DBA Hydrogen Control System

System Description

The intended functions associated with the Post-DBA (design basis accident) Hydrogen Control System include environmental qualification, means for assessing plant conditions during and following an accident, containment isolation, providing the means to analyze the containment atmosphere following a design basis accident for the control of hydrogen gas, and providing the means to maintain the containment atmosphere hydrogen concentration at less than four percent by volume following a design basis accident.

Two redundant hydrogen control systems are provided. Each hydrogen control system includes a hydrogen analyzer and a hydrogen recombiner unit consisting of a blower, a temperature controlled electric preheater, a thermal recombiner (reaction chamber), and an air blast heat exchanger.

The hydrogen analyzers are used to continuously monitor the hydrogen concentration inside containment. After startup of the recombiners, the analyzers also check the efficiency of the recombiner operation. The hydrogen analyzer consists of two major components, the hydrogen analyzer cabinet and the hydrogen analyzer remote control panel.

The hydrogen recombiner units are mounted on individual skids with all apparatus permanently installed. Each recombiner unit takes suction from the containment dome via connections with the Containment Vacuum System. A centrifugal fan blower provides the driving force to deliver flow to the preheater. After the recombination reaction occurs, the gas flow passes through an air blast heat exchanger. The flow then re-enters the containment through a penetration used exclusively for this system.

The Post-DBA Hydrogen Control System meets 10 CFR 54.4(a)(1) because system safety related components provide the means for assessing plant conditions during and following an accident, the system provides a containment isolation function, the system provides the means to analyze the containment atmosphere following a DBA for the control of hydrogen gas, and the system provide the means to maintain the containment atmosphere hydrogen concentration at less then 4 percent by volume following a DBA. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 6.5, Post-DBA Hydrogen Control System
- BVPS Unit 2 UFSAR, Revision 12, Section 6.2.5 (Combustible Gas Control in Containment)

License Renewal Drawings

The Post-DBA Hydrogen Control System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-446-1, Sheet 1, Revision 4, Valve Operating No. Diagram - Post DBA Hydrogen Control System
- 8700-RM-446-2, Sheet 2, Revision 5, Valve Operating No. Diagram - Post DBA Hydrogen Analyzer System

Unit 2:

- 10080-RM-446-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Post DBA Hydrogen Control System

Components Subject to AMR

The Post-DBA Hydrogen Control System component types subject to aging management review and their intended functions are shown in Table 2.3.3.23-1 below. The aging management review results for these components are provided in Table 3.3.2-23, Auxiliary Systems – Post-DBA Hydrogen Control System – Summary of Aging Management Evaluation.

**Table 2.3.3.23-1**
**Post-DBA Hydrogen Control System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Compressor | Pressure Boundary |
| Damper Housing | Pressure Boundary |
| Duct | Pressure Boundary |
| Element | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Fan | Pressure Boundary |
| Filter | Pressure Boundary |
| Heat Exchanger | Pressure Boundary |

| Component Type | Intended Functions* |
|---|---|
| Orifice | Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Recombiner | Pressure Boundary |
| Rupture Disc | Pressure Boundary |
| Valve | Pressure Boundary |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.24 Primary Component and Neutron Shield Tank Cooling Water System

System Description

The Primary Component and Neutron Shield Tank Cooling Water System provides cooling water for the removal of heat from reactor plant components during normal operations and the Residual Heat Removal System (Section 2.3.2.2) heat exchangers during cooldown. The system also supplies normal makeup to the neutron shield expansion tank. The system consists of three circulating pumps arranged in parallel, three heat exchangers in parallel and the necessary piping and valves to supply cooling water to various parallel loads.

Neutron shield tank cooling is provided by a closed loop which circulates warm water from the neutron shield tank, by natural convection flow, out to the neutron shield tank cooler. In the neutron shield tank cooler, this warm water is cooled by water from the Reactor Plant Component Cooling Water System. Cooled water from the cooler flows back to the bottom of the neutron shield tank where it is again heated to complete the cycle.

The Primary Component and Neutron Shield Tank Cooling Water System meets 10 CFR 54.4(a)(1) because it provides a containment isolation function, it provides a means for assessing plant conditions during and following an accident, it provides cooling water for heat removal from the RHR heat exchangers, it provides cooling water to the RCP thermal barriers, and it provides for containing reactor coolant water from an RCP thermal barrier rupture. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), Environmental Qualification (10 CFR 50.49), and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.4, Component Cooling Water System

- BVPS Unit 2 UFSAR, Revision 12, Section 9.2.2.1, Primary Component Cooling Water System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.2.2.3, Neutron Shield Tank Cooling Water System

License Renewal Drawings

The Primary Component and Neutron Shield Tank Cooling Water System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-406-3, Sheet 3, Revision 4, Valve Operating No. Diagram - Reactor Coolant System
- 8700-RM-407-1, Sheet 1, Revision 18, Valve Operating No. Diagram - Chemical and Volume Control System
- 8700-RM-410-1, Sheet 1, Revision 9, Piping and Instrumentation Diagram - Residual Heat Removal System
- 8700-RM-415-1, Sheet 1, Revision 13, Valve Operating No. Diagram - Component Cooling Water
- 8700-RM-415-2, Sheet 2, Revision 4, Valve Operating No. Diagram - Component Cooling Water
- 8700-RM-415-3, Sheet 3, Revision 8, Valve Operating No. Diagram - Component Cooling Water
- 8700-RM-415-4, Sheet 4, Revision 7, Valve Operating No. Diagram - Component Cooling Water
- 8700-RM-415-5, Sheet 5, Revision 10, Valve Operating No. Diagram - Component Cooling Water
- 8700-RM-420-1, Sheet 1, Revision 5, Piping and Instrumentation Diagram - Fuel Pool Cooling and Purification System

Unit 2:

- 10080-RM-406-2, Sheet 2, Revision 14, Valve Operating No. Diagram - Reactor Coolant System
- 10080-RM-415-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Primary Plant Component Cooling Water
- 10080-RM-415-2, Sheet 2, Revision 11, Valve Operating No. Diagram - Primary Plant Component Cooling Water
- 10080-RM-415-3, Sheet 3, Revision 5, Valve Operating No. Diagram - Primary Plant Component Cooling Water
- 10080-RM-415-4, Sheet 4, Revision 4, Valve Operating No. Diagram - Primary Plant Component Cooling Water

- 10080-RM-415-5, Sheet 5, Revision 5, Valve Operating No. Diagram - Primary Plant Component Cooling Water

Components Subject to AMR

The Primary Component and Neutron Shield Tank Cooling Water System component types subject to aging management review and their intended functions are shown in Table 2.3.3.24-1 below. The aging management review results for these components are provided in Table 3.3.2-24, Auxiliary Systems – Primary Component and Neutron Shield Tank Cooling Water System – Summary of Aging Management Evaluation.

**Table 2.3.3.24-1**
**Primary Component and Neutron Shield Tank Cooling Water System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Element | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Heat Exchanger | Heat Transfer<br>Pressure Boundary |
| Indicator | Pressure Boundary |
| Orifice | Flow Restriction<br>Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Tank | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Reactor Containment Building<br>Unit 1 Safeguards Building<br>Unit 2 Auxiliary Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Reactor Containment Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.25 Radiation Monitoring System

System Description

The Radiation Monitoring Systems for Unit 1 and 2 will detect, compute, indicate, annunciate and record radioactivity levels inside and outside the plant. The systems also interface with the Atmospheric Radioactive Effluent Release Assessment System (ARERAS) and the Emergency Response Facility (ERF) Computer System.

For Unit 1, the system is divided into the following subsystems:

The Unit 1 Process and Effluent Radiation Monitoring System, which (a) gives early warning of a plant malfunction, (b) warns personnel of increasing radiation activity which could result in a radiation health hazard, and (c) records and limits discharge of radioactive fluids and gases into the environment at permissible emission rates. The Process and Effluent Radiation Monitoring System consists of separate independent channels each having: (1) a radiation detector with remotely operated check source; (2) a readout device located in the control room; (3) alarms indicating equipment malfunction and high activity; and (4) associated electronic equipment and cabling. In the event of an accident, the Process and Effluent Radiation Monitoring System will provide information on the concentration and dispersion of radioactivity throughout the plant enabling operations personnel to evaluate the severity and mitigate the consequences of an accident.

The Unit 1 Area Radiation Monitoring System, which under normal conditions monitors and warns personnel of increasing radiation levels which might result in a radiation health hazard. The system also provides indication of increased radioactivity and radiation levels under accident conditions. The Area Radiation Monitoring System reads out and records the radiation levels in selected areas throughout the plant and alarms (audible and visual) if these levels exceed a preset value or if the detector malfunctions.

The Unit 1 Noble Gas Monitoring System, which provides for sampling and analysis of gaseous releases through various effluent Systems. Effluent indications can be monitored in the control room and the control terminal will calculate release magnitudes and provide memory storage and logging of all data collected.

Unit 2 utilizes the Digital Radiation Monitoring System (DRMS). The DRMS includes the following major equipment:

- Process, effluent, airborne and area monitors.
- Central Processing Units and associated cabinets in the main control room.
- Alarm and Data Display System (ADDS) for Class 1E monitors housed in panels in the main control room.
- Operator consoles.

The radiation monitors transmit information to the DRMS central processors located in the main control room. All radiation monitors interface with the two main control room operator and the health physics computer consoles which are connected to the central processors. All Category 1 seismically qualified Class 1E radiation monitors provide information via the micro processor to the operators console and also display, alarm and record information at the ADDS panel.

The Radiation Monitoring System meets 10 CFR 54.4(a)(1) because system safety related components provide the means for assessing plant conditions during and following an accident, safety related process and area radiation monitors are provided for the detection/indication of radioactivity levels inside the plant, some radiation monitors, upon the detection of high radiation levels, will cause the automatic actuation of safety related components to control or terminate a release, and safety related process radiation monitors provide the means to detect and monitor RCS leakage. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), and Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 11.3.3, Process and Effluent Radiation Monitoring System
- BVPS Unit 1 UFSAR, Revision 20, Section 11.3.4, Area Radiation Monitoring System

- BVPS Unit 2 UFSAR, Revision 12, Section 11.5.2.1, System Description – Digital Radiation Monitoring System

License Renewal Drawings

The Radiation Monitoring System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-415-1, Sheet 1, Revision 13, Valve Operating No. Diagram - Component Cooling Water
- 8700-RM-416-1, Sheet 1, Revision 12, Piping and Instrumentation Diagram - Vent and Air Cond Primary Plant
- 8700-RM-419-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Gaseous Waste Disposal System
- 8700-RM-443-1, Sheet 1, Revision 5, Valve Operating No. Diagram - Radiation Monitoring System
- 8700-RM-443-2, Sheet 2, Revision 4, Valve Operating No. Diagram - Radiation Monitoring System

- 8700-RM-443-3, Sheet 3, Revision 6, Valve Operating No. Diagram - Radiation Monitoring System
- 8700-RM-443-5, Sheet 5, Revision 4, Valve Operating No. Diagram - Radiation Monitoring System

Unit 2:

- 10080-RM-412-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Containment Vacuum System
- 10080-RM-416-1, Sheet 1, Revision 10, Valve Operating No. Diagram - Supplementary Leak Collection and Release
- 10080-RM-416-2, Sheet 2, Revision 6, Valve Operating No. Diagram - Supplementary Leak Collection
- 10080-RM-434-2, Sheet 2, Revision 14, Valve Operating No. Diagram - Station Instrument Air
- 10080-RM-443-18, Sheet 3, Revision 4, Valve Operating No. Diagram - Radiation Monitoring System
- 10080-RM-443-20, Sheet 5, Revision 3, Valve Operating No. Diagram - Radiation Monitoring System
- 10080-RM-443-21, Sheet 6, Revision 2, Valve Operating No. Diagram - Radiation Monitoring System
- 10080-RM-443-22, Sheet 7, Revision 2, Valve Operating No. Diagram - Radiation Monitoring System
- 10080-RM-444B-2, Sheet 2, Revision 8, Valve Operating No. Diagram - Area Ventilation System - Cooling Fueling and Decontamination Building

Components Subject to AMR

The Radiation Monitoring System component types subject to aging management review and their intended functions are shown in Table 2.3.3.25-1 below. The aging management review results for these components are provided in Table 3.3.2-25, Auxiliary Systems – Radiation Monitoring System – Summary of Aging Management Evaluation.

**Table 2.3.3.25-1**
**Radiation Monitoring System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Monitor | Pressure Boundary |
| Panel-Cabinet | Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Valve | Pressure Boundary |

| Component Type | Intended Functions* |
|---|---|
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Reactor Containment Building<br>Unit 1 Safeguards Building<br>Unit 1 Service Building<br>Unit 2 Auxiliary Building<br>Unit 2 Diesel Generator Building<br>Unit 2 Main Steam Valve and Cable Vault Area | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.26 Reactor Plant Sample System

System Description

The Reactor Plant Sample System transfers liquid and gaseous samples from the various contaminated and potentially contaminated systems to the Auxiliary Building Sample Room for monitoring and/or collection of grab samples, or pressurized vessel samples for laboratory analysis. Sample lines from systems that normally operate at high temperatures or high pressures are routed through the sample system coolers or pressure reducers, as required, before sampling.

The Reactor Plant Sample System meets 10 CFR 54.4(a)(1) because portions of the system form a part of the reactor coolant pressure boundary, the system provides a containment isolation function, a portion of the system provides a barrier against the potential release of radioactivity, the system provides for isolation of the steam generator blowdown sample lines upon AFW actuation, and the system provides a means for assessing plant conditions during and following an accident. It also meets 10 CFR 54.4(a)(2) because it provides for isolation of the steam generator blowdown sample lines upon the start of one AFW pump and because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Environmental Qualification (10 CFR 50.49) and Anticipated Transients Without Scram (10 CFR 50.62).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 22, Section 9.6, Sampling System
- BVPS Unit 2 UFSAR, Revision 15, Section 9.3.2.1, Reactor Plant and Process Sample System

License Renewal Drawings

The Reactor Plant Sample System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-406-1, Sheet 1, Revision 11, Valve Operating No. Diagram – Reactor Coolant System
- 8700-RM-406-2, Sheet 2, Revision 15, Valve Operating No. Diagram – Reactor Coolant System
- 8700-RM-409-1, Sheet 1, Revision 8, Valve Operating No. Diagram – Vent and Drain System
- 8700-RM-410-1, Sheet 1, Revision 9, Piping and Instrumentation Diagram – Residual Heat Removal System
- 8700-RM-411-2, Sheet 2, Revision 8, Valve Operating No. Diagram – Safety Injection System
- 8700-RM-414A-1, Sheet 1, Revision 12, Valve Operating No. Diagram – Sample System
- 8700-RM-425-1, Sheet 1, Revision 8, Valve Operating No. Diagram – Steam Generator Blowdown

Unit 2:

- 10080-RM-406-1, Sheet 1, Revision 17, Valve Operating No. Diagram – Reactor Coolant System
- 10080-RM-414A-1, Sheet 1, Revision 13, Valve Operating No. Diagram – Reactor Plant Sample – Hood 1
- 10080-RM-414A-2, Sheet 2, Revision 10, Valve Operating No. Diagram – Reactor Plant Sample – Hood 2

Components Subject to AMR

The Reactor Plant Sample System component types subject to aging management review and their intended functions are shown in Table 2.3.3.26-1 below. The aging management review results for these components are provided in Table 3.3.2-26, Auxiliary Systems – Reactor Plant Sample System – Summary of Aging Management Evaluation.

**Table 2.3.3.26-1**
**Reactor Plant Sample System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Piping | Pressure Boundary |

| Component Type | Intended Functions* |
|---|---|
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Reactor Containment Building<br>Unit 1 Safeguards Building<br>Unit 2 Auxiliary Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Reactor Containment Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.27 River Water System

System Description

The River Water System is a Unit 1 system that is the counterpart to Unit-2's Service Water System (Section 2.3.3.29). The River Water System supplies cooling water from the Ohio River to reactor plant component coolers. The system contains three Reactor Plant River Water Pumps which take their suction from individual screened bays within the Main Intake Structure. Each pump is 100% of the required cooling capacity. The pumps deliver cooling water to the Diesel Generator Heat Exchangers, the Charging Pump Lube Oil Coolers, the Control Room Air Conditioning Equipment and the Reactor Plant Component Cooling Water Heat Exchangers during normal operating conditions.

The Auxiliary River Water System can supply cooling water from the Ohio River to accommodate unit shutdown from 100% reactor power and subsequent cooldown of the RCS to cold shutdown conditions. This system is designed to operate in the event that the Main Intake Structure is disabled. The system contains two Auxiliary River Water Pumps which take suction from a screened bay within the Alternate Intake Structure. Each pump can deliver 100% of the required cooling capacity. The pumps deliver cooling water through a common header which then connects to their respective River Water System headers downstream of the Main Intake Structure.

The River Water System meets 10 CFR 54.4(a)(1) because system safety related components provide the means for assessing plant conditions during and following an accident, the system provides a containment isolation function, the system provides a backup QA Category I water supply for the Auxiliary Feedwater System, and it provides cooling water to equipment under accident and normal operating conditions. It also meets 10 CFR 54.4(a)(2) because the Auxiliary River Water System provides a backup source of cooling water to shut down the plant and maintain it in a cold shutdown condition in the event of a loss of the main intake structure and because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3)

because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection, (10 CFR 30.48), Environmental Qualification (10 CFR 50.49), and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.9, River Water System
- BVPS Unit 1 UFSAR, Revision 20, Section 9.16, Auxiliary River Water System

License Renewal Drawings

The River Water System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 10080-RM-430-1, Sheet1, Revision 21, Valve Operating No. Diagram – Service Water Supply and Distribution
- 10080-RM-430-1A, Sheet 1A, Revision 4, Valve Operating No. Diagram - Standby Service Water Supply
- 8700-RM-414C-1, Sheet 1, Revision 7, Valve Operating No. Diagram - Post Accident Sampling System
- 8700-RM-420-1, Sheet 1, Revision 5, Piping and Instrumentation Diagram - Fuel Pool Cooling and Purification System
- 8700-RM-424-2, Sheet 2, Revision 8, Valve Operating No. Diagram - Feedwater System
- 8700-RM-429-2, Sheet 2, Revision 6, Valve Operating No. Diagram - Component Cooling Water
- 8700-RM-430-1, Sheet 1, Revision 22, Piping and Instrumentation Diagram - River Water System
- 8700-RM-430-2, Sheet 2, Revision 15, Piping and Instrumentation Diagram - River Water System
- 8700-RM-430-3, Sheet 3, Revision 15, Piping and Instrumentation Diagram - River Water System
- 8700-RM-430-4, Sheet 4, Revision 15, Piping and Instrumentation Diagram - River Water System
- 8700-RM-443-2, Sheet 2, Revision 4, Valve Operating No. Diagram - Radiation Monitoring System

Unit 2:

- None. The River Water System is a Unit 1 system (The Service Water System is the equivalent Unit 2 system).

Components Subject to AMR

The River Water System component types subject to aging management review and their intended functions are shown in Table 2.3.3.27-1 below. The aging management review results for these components are provided in Table 3.3.2-27, Auxiliary Systems – River Water System – Summary of Aging Management Evaluation.

**Table 2.3.3.27-1**
**River Water System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| External Surfaces | Pressure Boundary |
| Heat Exchanger | Pressure Boundary |
| Orifice | Flow Restriction<br>Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Strainer | Filtration<br>Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Diesel Generator Building<br>Unit 1 Safeguards Building<br>Common Intake Structure | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.28 Security

System Description

The Security Diesel Generator provides power to Station Blackout and Safe Shutdown outdoor security perimeter lighting used for outdoor access/egress paths for both Unit 1 and Unit 2. The Security Diesel Generator is a Unit 1 component.

The Security System meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- None

License Renewal Drawings

The Security aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-445F-1, Sheet 1, Revision 2, Valve Operating No. Diagram – Security Diesel Generator System

Unit 2:

- None. Security is a Unit 1 system.

Components Subject to AMR

The Security System component types subject to aging management review and their intended functions are shown in Table 2.3.3.28-1 below. The aging management review results for these components are provided in Table 3.3.2-28, Auxiliary Systems – Security – Summary of Aging Management Evaluation.

**Table 2.3.3.28-1**
**Security**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| External Surfaces | Pressure Boundary |
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Tank | Pressure Boundary |
| Valve | Pressure Boundary |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.29 Service Water System

System Description

The Service Water System is a Unit 2 system that is the counterpart to Unit-1's River Water System (Section 2.3.3.27). This system includes both the Service Water System (SWS) and the Standby Service Water System (SWE). The SWS is a safety-related system which provides cooling water to remove heat from the power plant auxiliary systems during all modes of

operation. Three SWS pumps are provided with the system. The three SWS pumps share the main intake structure with Unit 1 systems. Each SWS pump is located in a separate bay of the main intake structure and supplies Ohio River water to the two 30 inch SWS headers.

The Standby Service Water System (SWE) is designed to accommodate unit shutdown from 100% reactor power and subsequent cooldown of the RCS after the postulated loss of the Seismic Category I main intake structure. The SWE system consists of two pumps which take suction from individual screened bays within the Alternate Intake Structure, discharging to one common 30 inch line and connected to the redundant 30 inch Seismic Category I service water supply lines.

The Service Water System meets 10 CFR 54.4(a)(1) because system safety related components provide the means for assessing plant conditions during and following an accident, the system provides a backup QA Category I water supply for the Auxiliary Feedwater System and spent fuel pool, it provides cooling water to equipment under accident and normal operating conditions, and it provides its own safety grade source of seal and motor cooling water to the service water pumps. It also meets 10 CFR 54.4(a)(2) because the Standby Service Water System provides a backup source of cooling water to shut down the plant and maintain it in a cold shutdown condition in the event of a loss of the main intake structure and because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection, (10 CFR 30.48), Environmental Qualification (10 CFR 50.49), and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 2 UFSAR, Revision 12, Section 9.2.1, Station Service Water System

License Renewal Drawings

The Service Water System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- None. The Service Water System is a Unit 2 system (The River Water System is the equivalent Unit 1 system.)

Unit 2:

- 8700-RM-430-1, Sheet 1, Revision 22, Piping and Instrumentation Diagram - River Water System
- 10080-RM-414C-1, Sheet 1, Revision 6, Valve Operating No. Diagram - PAS System-Liquid Samples

- 10080-RM-420-1, Sheet 1, Revision 9, Valve Operating No. Diagram - Fuel Pool Cooling and Purification
- 10080-RM-424-3, Sheet 1, Revision 8, Valve Operating No. Diagram - Auxiliary Feedwater
- 10080-RM-428-1, Sheet 1, Revision 9, Valve Operating No. Diagram - Turb Plant Comp Clng Wtr System
- 10080-RM-429-4, Sheet 4, Revision 8, Valve Operating No. Diagram - Chilled Water - Containment
- 10080-RM-430-1A, Sheet 1A, Revision 4, Valve Operating No. Diagram - Standby Service Water Supply
- 10080-RM-430-1, Sheet 1, Revision 21, Valve Operating No. Diagram - Service Water Supply and Distribution
- 10080-RM-430-2, Sheet 2, Revision 23, Valve Operating No. Diagram - Service Water Primary Cooling
- 10080-RM-430-3, Sheet 3, Revision 11, Valve Operating No. Diagram - Service Water Primary Cooling
- 10080-RM-430-4, Sheet 4, Revision 10, Valve Operating No. Diagram - Service Water Secondary Cooling

Components Subject to AMR

The Service Water System component types subject to aging management review and their intended functions are shown in Table 2.3.3.29-1 below. The aging management review results for these components are provided in Table 3.3.2-29, Auxiliary Systems – Service Water System – Summary of Aging Management Evaluation.

**Table 2.3.3.29-1**
**Service Water System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| External Surfaces | Pressure Boundary |
| Indicator | Pressure Boundary |
| Orifice | Flow Restriction<br>Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | NSR Functional Support<br>Pressure Boundary |
| Pump | Pressure Boundary |
| Strainer | Filtration<br>Pressure Boundary |
| Valve | NSR Functional Support<br>Pressure Boundary |

| Component Type | Intended Functions* |
|---|---|
| NSR fluid-retaining components in the following buildings and areas:<br><br>Common Intake Structure<br>Unit 2 Auxiliary Building<br>Unit 2 Diesel Generator Building<br>Unit 2 Pipe Tunnels<br>Unit 2 Safeguards Building<br>Unit 2 Service Water Valve Pits | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.30 Solid Waste Disposal System

System Description

The Solid Waste Disposal System provides for the handling, holdup, packaging, transfer, storage, and ultimately disposal of solid radioactive wastes. Concentrated liquid wastes can be processed to a solid form. Resins and filter cartridges are also processed.

The equipment provided consists of cement storage bins or silos, cement feeder, mixer feeder, resin waste hold tank, evaporator bottoms hold tank, resin hold and bottoms hold tank feed pumps, spent resin booster pump, resin waste hold tank, evaporator bottoms hold tank, spent resin dewatering pump, resin waste decant tank metering pump, caustic buffering tank and pump, drumming station and drum processing enclosure, and the necessary piping, valves, instrumentation, electronics, and other hardware for the systems to function.

The Solid Waste Disposal System meets 10 CFR 54.4(a)(1) because system connections to the Chemical Volume and Control System demineralizers up to the designated safety class breaks maintain a pressure boundary with that system to prevent an excessive release of radioactivity into the Auxiliary Building. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions.

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 11.2.5, Solid Waste Disposal System
- BVPS Unit 2 UFSAR, Revision 12, Section 11.4 (Solid Radwaste Management System)

License Renewal Drawings

The Solid Waste Disposal System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- Unit 1 components subject to aging management review are in scope for 10 CFR 54.4(a)(2) only, as a result of the additional review discussed in Section 2.1.1.3. They are not highlighted on any drawing.

Unit 2:

- 10080-RM-418-1, Sheet 1, Revision 7, Valve Operating No. Diagram - Solid Waste Disposal Piping

Components Subject to AMR

The Solid Waste Disposal System component types subject to aging management review and their intended functions are shown in Table 2.3.3.30-1 below. The aging management review results for these components are provided in Table 3.3.2-30, Auxiliary Systems – Solid Waste Disposal System – Summary of Aging Management Evaluation.

**Table 2.3.3.30-1**
**Solid Waste Disposal System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Piping | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Fuel Building<br>Unit 2 Auxiliary Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.31 Supplementary Leak Collection and Release System

System Description

The primary function of the Supplementary Leak Collection and Release System is to ensure that radioactive leakage from the primary containment following a design basis accident or

radioactive material released in the waste gas storage area is collected and filtered for iodine removal prior to discharge to the atmosphere.

An important secondary function of the system is the removal of heat from areas where equipment important to safety is located.

The Supplementary Leak Collection and Release System consists of two emergency-bus-powered leak collection exhaust fans at Unit 1 (Unit 2 has two normal-powered and two emergency-bus-powered exhaust fans). The capacity of each fan is in excess of the estimated air in-leakage to the containment contiguous areas and the other buildings and areas exhausted, which ensures a minimum of the required negative pressure in the exhausted areas.

One of the leak collection exhaust fans is normally used to exhaust the various areas. The other fan is used as a standby. The leak collection exhaust fans discharge through a duct to a vent, located on top of the containment structure.

The Supplementary Leak Collection and Release System meets 10 CFR 54.4(a)(1) because the system provides a containment isolation function, it provides a means for assessing plant conditions during and following an accident, it provides for heat removal from areas containing SR equipment to maintain temperatures below limits, and it provides the capability to maintain pressure in the areas exhausted by the system slightly negative with respect to atmosphere. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 22, Section 6.6, Supplementary Leak Collection and Release System

- BVPS Unit 2 UFSAR, Revision 15, Section 6.5.3.2, Supplementary Leak Collection and Release System

License Renewal Drawings

The Supplementary Leak Collection and Release System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-416-1, Sheet 1, Revision 12, Piping and Instrumentation Diagram – Vent and Air Cond Primary Plant

Unit 2:

- 10080-RM-416-1, Sheet 1, Revision 10, Valve Operating No. Diagram – Supplementary Leak Collection and Release
- 10080-RM-416-2, Sheet 2, Revision 6, Valve Operating No. Diagram – Supplementary Leak Collection
- 10080-RM-426-3, Sheet 3, Revision 10, Valve Operating No. Diagram – Condenser Air Removal and Gland Exhaust
- 10080-RM-444C-2, Sheet 2, Revision 4, Valve Operating No. Diagram - Containment Area Ventilation System
- 10080-RM-444D-2, Sheet 2, Revision 8, Valve Operating No. Diagram – Aux Bldg Ventilation System

Components Subject to AMR

The Supplementary Leak Collection and Release System component types subject to aging management review and their intended functions are shown in Table 2.3.3.31-1 below. The aging management review results for these components are provided in Table 3.3.2-31, Auxiliary Systems – Supplementary Leak Collection and Release System – Summary of Aging Management Evaluation.

**Table 2.3.3.31-1**
**Supplementary Leak Collection and Release System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| Collar | Pressure Boundary |
| Conditioner | Pressure Boundary |
| Damper Housing | Fire Barrier<br>Pressure Boundary |
| Duct | Pressure Boundary |
| Element | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Fan | Pressure Boundary |
| Filter | Filtration<br>Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | Pressure Boundary |
| Seal | Pressure Boundary |
| Separator | Pressure Boundary |
| Tank | Pressure Boundary |
| Valve | Pressure Boundary |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.3.32 Water Treating System

System Description

Raw river water is normally supplied by one of two water treating supply pumps taking suction from the turbine plant river water system and discharging through a weir box into the clarifier in the water treatment room. After processing as demineralized water it may be used for make-up to a 600,000 gallon Demineralized Water Storage Tank or to supply the demineralized water distribution header. The system consists of piping, valves, tanks, pumps, orifices, filters, strainers, accumulators, heaters, demineralizers, fans, indicators and switches. Unit 2 is supplied from the Unit 1 Water Treating System.

The Water Treating System meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions.

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.11.2, Primary Treatment Water System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.2.3, Demineralized Water Makeup System

License Renewal Drawings

- Unit 1 and 2 components subject to aging management review are in scope for 10 CFR 54.4(a)(2) only, as a result of the additional review discussed in Section 2.1.1.3. They are not highlighted on any drawing.

Components Subject to AMR

The Water Treating System component types subject to aging management review and their intended functions are shown in Table 2.3.3.32-1 below. The aging management review results for these components are provided in Table 3.3.2-32, Auxiliary Systems – Water Treating System – Summary of Aging Management Evaluation.

**Table 2.3.3.32-1**
**Water Treating System**
**Component Types Subject to Aging Management Review (AMR)**

| Component Types | Intended Function* |
|---|---|
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Intake Structure | NSR Functional Support |

**Table 2.3.3.32-1**
**Water Treating System**
**Component Types Subject to Aging Management Review (AMR)**

| Component Types | Intended Function* |
|---|---|
| Unit 1 Safeguards Building<br>Unit 1 Service Building<br>Unit 2 Auxiliary Building<br>Unit 2 Decontamination Building<br>Unit 2 Diesel Generator Building<br>Unit 2 Fuel Building<br>Unit 2 Main Steam and Cable Vault Area<br>Unit 2 Pipe Tunnels<br>Unit 2 Safeguards Building<br>Unit 2 Service Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

## 2.3.4 Steam and Power Conversion Systems

Steam and Power Conversion Systems act as a heat sink to remove heat from the reactor and convert the heat generated in the reactor to the plant's electrical output. The following systems are included in this subsection.

- Auxiliary Feedwater System (2.3.4.1)
- Auxiliary Steam and Condensate System (2.3.4.2)
- Condensate System (2.3.4.3)
- Main Feedwater System (2.3.4.4)
- Main Steam System (2.3.4.5)
- Main Turbine and Condenser System (2.3.4.6)
- Steam Generator Blowdown System (2.3.4.7)

### 2.3.4.1 Auxiliary Feedwater System

System Description

The Auxiliary Feedwater System is used as an emergency source of feedwater supply to the steam generators. It is required to ensure safe shutdown in the event of a main turbine trip with complete loss of normal electric power to the station. It is also started on a safety injection signal.

A turbine-driven steam generator auxiliary feed pump and two motor-driven steam generator auxiliary feed pumps are furnished. The turbine drive can be supplied with steam from each steam generator outlet header. The electric motors receive power from the emergency diesel generator emergency buses. The steam generator auxiliary feed pumps normally take suction

from the primary plant demineralized water storage tank. The pumps can also be supplied with water by the River Water System (Service Water System for Unit 2). Feedwater from the steam generator auxiliary feed pumps is pumped to each steam generator through normally open automatic control valves.

The auxiliary feedwater is discharged to the steam generators through a connection in each main feedwater line outside the reactor containment but downstream of the containment isolation trip and check valve at Unit 1, and inside the reactor containment at Unit 2.

Unit 1 has an additional dedicated auxiliary feedwater pump whose function is to provide feedwater following a loss of main and auxiliary feedwater associated with a fire and loss of offsite power.

The Auxiliary Feedwater System meets 10 CFR 54.4(a)(1) because it delivers cooling water to the steam generators in emergency situations, it includes backup water supplies, it is designed with check valves to prevent loss of auxiliary feedwater in the event of a header rupture, and it has sufficient redundancy to ensure the required flow to a minimum of two steam generators; also, system safety related components provide the means for assessing plant conditions during and following an accident, and the system provides a containment isolation function. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. The system also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 10.3.5.2.2, Auxiliary Feedwater System
- BVPS Unit 1 UFSAR, Revision 20, Section 10.3.5.1.2, Auxiliary Feedwater System
- BVPS Unit 1 UFSAR, Revision 20, Section 10.3.5.2.3, Dedicated Auxiliary Feedwater System

- BVPS Unit 2 UFSAR, Revision 12, Section 10.4.9, Auxiliary Feedwater System
- BVPS Unit 2 UFSAR, Revision 12, Section 7.3.2.3.2, Further Considerations – Auxiliary Feedwater System

License Renewal Drawings

The Auxiliary Feedwater System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-424-1, Sheet 1, Revision 9, Valve Operating No. Diagram - Feedwater System

- 8700-RM-424-2, Sheet 2, Revision 8, Valve Operating No. Diagram - Feedwater System
- 8700-RM-424-3, Sheet 3, Revision 7, Valve Operating No. Diagram - Feedwater System
- 8700-RM-432-7, Sheet 7, Revision 5, Valve Operating No. Diagram - Water Treating

Unit 2:

- 10080-RM-424-2A, Sheet 2, Revision 8, Valve Operating No. Diagram - Main Feedwater System
- 10080-RM-424-3, Sheet 1, Revision 8, Valve Operating No. Diagram - Auxiliary Feedwater
- 10080-RM-424-5, Sheet 1, Revision 1, Valve Operating No. Diagram - Aux Feed Pumps Lube Oil System

Components Subject to AMR

The Auxiliary Feedwater System component types subject to aging management review and their intended functions are shown in Table 2.3.4.1-1 below. The aging management review results for these components are provided in Table 3.4.2-1, Steam and Power Conversion – Auxiliary Feedwater System – Summary of Aging Management Evaluation.

**Table 2.3.4.1-1**
**Auxiliary Feedwater System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Heat Exchanger | Pressure Boundary<br>Heat Transfer |
| Orifice | Flow Restriction<br>Pressure Boundary |
| Pipe Fittings | Pressure Boundary |
| Piping | Pressure Boundary |
| Pump | Pressure Boundary |
| Strainer | Pressure Boundary |
| Tank | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Safeguards Building<br>Unit 2 PDWS | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.4.2 Auxiliary Steam and Condensate System

System Description

The Auxiliary Steam and Condensate System (Auxiliary Steam System in Unit 1) supplies steam at 150 psig to various components in the turbine plant and primary plant.

The Auxiliary Steam and Condensate System is normally supplied from the main steam header through a pressure reducing valve. Discharge from most of the auxiliary steam loads flows to the auxiliary steam condensate receiver tank. The condensate from the auxiliary steam condensate receiver tank is normally discharged to the main condenser. The supply of auxiliary steam is not required to support any intended functions.

The Auxiliary Steam and Condensate System meets 10 CFR 54.4(a)(1) because auxiliary steam supply to the Auxiliary Building and the Safeguards Area (Unit 1) is isolated in the event of a high energy line break. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 10.3.2, Auxiliary Steam System
- BVPS Unit 2 UFSAR, Revision 12, Section 10.4.10, Auxiliary Steam and Condensate System

License Renewal Drawings

The Auxiliary Steam and Condensate System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-427-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Auxiliary Steam and Air Removal

Unit 2:

- 10080-RM-427A-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Auxiliary Steam and Condensate - Steam

Components Subject to AMR

The Auxiliary Steam and Condensate System component types subject to aging management review and their intended functions are shown in Table 2.3.4.2-1 below. The aging management review results for these components are provided in Table 3.4.2-2, Steam and Power Conversion – Auxiliary Steam and Condensate System – Summary of Aging Management Evaluation.

**Table 2.3.4.2-1**
**Auxiliary Steam and Condensate System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Pipe Tunnels<br>Unit 1 Primary Water Storage Building<br>Unit 1 Safeguards Building<br>Unit 2 Auxiliary Building<br>Unit 2 Decontamination Building<br>Unit 2 Fuel Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Pipe Tunnels | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.4.3 Condensate System

System Description

The Condensate System is only in scope for Unit 1. The Condensate System generally functions to remove condensate from the Main Condenser hotwell and provide preheated water to the suction of the Main Feedwater pumps. The system also provides cooling for the blowdown heat exchanger, condenser air ejectors, and gland steam condensers. It also provides a source of water for the dedicated auxiliary feedwater pump.

The Unit 1 Condensate System meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 10.3.5.2.1, Condensate and Feedwater Systems
- BVPS Unit 1 UFSAR, Revision 20, Section 10.3.5.2.3, Dedicated Auxiliary Feedwater System

License Renewal Drawings

The Condensate System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-422-1, Sheet 1, Revision 9, Valve Operating No. Diagram - Condensate
- 8700-RM-432-7, Sheet 7, Revision 5, Valve Operating No. Diagram - Water Treating

Unit 2:

- None. The Unit 2 Condensate System is not in scope for license renewal.

Components Subject to AMR

The Condensate System component types subject to aging management review and their intended functions are shown in Table 2.3.4.3-1 below. The aging management review results for these components are provided in Table 3.4.2-3, Steam and Power Conversion – Condensate System – Summary of Aging Management Evaluation.

**Table 2.3.4.3-1**
**Condensate System (Unit 1 only)**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| External Surfaces | NSR Functional Support |
| Piping | NSR Functional Support |
| Tank | NSR Functional Support |
| Valve | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.4.4 Main Feedwater System

System Description

The Main Feedwater System supplies heated feedwater to the steam generators. Two steam generator feed pumps are furnished to supply feedwater to the three steam generators in each unit. Minimum flow for each pump is maintained by flow nozzles in the discharge lines, which control the recirculation valves. From the common discharge header, the feedwater goes to either of two feedwater heaters, then combines and goes to the common feed header. Three individual steam generator feed lines are supplied by the feedwater header. Each line contains a flow measuring device, a feed regulation valve, a bypass flow control valve, flow control valve isolation valves, a connection for chemical feed, and (at Unit 1) a motor operated containment isolation stop-check valve. Unit 2 has separate check and hydraulically-operated containment isolation valves.

For Unit 2, a start-up feed pump is also provided to minimize operation of the main feed pumps at low flow during plant start-up and loads below 30%.

The Auxiliary Feedwater System (Section 2.3.4.1) uses the main feedwater lines to provide flow to the steam generators.

The Main Feedwater System meets 10 CFR 54.4(a)(1) because it automatically isolates main feedwater following a feedwater isolation signal, it provides the means for assessing plant conditions during and following an accident, it contains instrumentation channels that provide inputs to protection systems, it provides the flow path for auxiliary feedwater to the steam generators and it provides a containment isolation function. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 10.3.5.2.1, Condensate and Feedwater Systems

- BVPS Unit 2 UFSAR, Revision 12, Section 10.4.7, Condensate and Feedwater Systems

License Renewal Drawings

The Main Feedwater System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-424-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Feedwater System
- 8700-RM-424-3, Sheet 3, Revision 7, Valve Operating No. Diagram - Feedwater System

Unit 2:

- 10080-RM-424-2A, Sheet 2, Revision 8, Valve Operating No. Diagram - Main Feedwater System

Components Subject to AMR

The Main Feedwater System component types subject to aging management review and their intended functions are shown in Table 2.3.4.4-1 below. The aging management review results for these components are provided in Table 3.4.2-4, Steam and Power Conversion – Main Feedwater System – Summary of Aging Management Evaluation.

**Table 2.3.4.4-1**
**Main Feedwater System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| Element | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Heat Exchanger | Pressure Boundary |
| Orifice | Pressure Boundary |
| Piping | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Safeguards Building<br>Unit 1 Service Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Service Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.4.5 Main Steam System

System Description

The Main Steam System supplies dry saturated steam to the Main Turbine, the Turbine Steam Bypass System, the Gland Sealing System, the Auxiliary Steam System, the reheaters, and the

turbine-driven auxiliary feedwater pump. The Main Steam System also provides for reactor decay heat removal and reactor plant cooldown.

Steam from each of three steam generators in each unit passes through individual pipes to the main steam isolation valves. Following the isolation valves, the three main steam lines enter a single manifold. From the manifold, steam passes to the turbine main steam stop and governor valves.

One main steam line bypass trip valve is installed around each main steam line isolation valve. Five steam generator safety valves are located in each main steam line outside the containment and upstream of the main steam isolation valves.

An atmospheric steam dump valve is installed on each steam line, upstream of the main steam isolation valve outside containment. A single residual heat release valve with supply from each main steam line, upstream of the main steam isolation valves outside containment, is also provided for heat removal.

A flow restrictor in each main steam line limits steam flow in the event of a steam line break downstream of the flow restrictor.

The Main Steam System meets 10 CFR 54.4(a)(1) because it provides secondary isolation of a ruptured or faulted steam generator, it provides the means for assessing plant conditions during and following an accident, it contains instrumentation channels that provide inputs to protection systems, it provides a supply of steam for the turbine-drive AFW pump, it provides relief from steam generator overpressurization, it provides for RCS cooldown and secondary plant depressurization via the atmospheric dump valves and the residual heat release valves, and it provides a containment isolation function. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), Environmental Qualification (10 CFR 50.49), Anticipated Transients Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63).

<u>Additional information can be found in the following UFSAR sections:</u>

- BVPS Unit 1 UFSAR, Revision 20, Section 10.3.1, Main Steam System
- BVPS Unit 1 UFSAR, Revision 20, Section 14.1.13, Accidental Depressurization of the Main Steam System
- BVPS Unit 2 UFSAR, Revision 12, Section 10.3, Main Steam Supply System
- BVPS Unit 2 UFSAR, Revision 12, Section 15.1.4, Inadvertent Opening of a Steam Generator Relief or Safety Valve Causing a Depressurization of the Main Steam System

License Renewal Drawings

The Main Steam System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-421-1, Sheet 1, Revision 12, Valve Operating No. Diagram - Main Steam
- 8700-RM-421-2, Sheet 2, Revision 8, Valve Operating No. Diagram - Main Steam
- 8700-RM-426-4, Sheet 4, Revision 8, Valve Operating No. Diagram - Misc Drains-Secondary Plant

Unit 2:

- 10080-RM-421-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Main Steam System
- 10080-RM-421-2, Sheet 2, Revision 14, Valve Operating No. Diagram - AFW Pump Steam and Residual Heat Rel.
- 10080-RM-421-3, Sheet 3, Revision 9, Valve Operating No. Diagram - Steam Drains
- 10080-RM-426-1, Sheet 1, Revision 11, Valve Operating No. Diagram - Moisture Separator and Reheat

Components Subject to AMR

The Main Steam System component types subject to aging management review and their intended functions are shown in Table 2.3.4.5-1 below. The aging management review results for these components are provided in Table 3.4.2-5, Steam and Power Conversion – Main Steam System – Summary of Aging Management Evaluation.

**Table 2.3.4.5-1**
**Main Steam System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Orifice | Flow Restriction<br>Pressure Boundary |
| Piping | Pressure Boundary |
| Turbine | Pressure Boundary |
| Valve | Pressure Boundary |

| Component Type | Intended Functions* |
|---|---|
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Reactor Containment Building<br>Unit 1 Safeguards Building<br>Unit 1 Service Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Pipe Tunnels<br>Unit 2 Safeguards Building<br>Unit 2 Service Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.4.6 Main Turbine and Condenser System

System Description

The main turbine utilizes steam from the steam generators to provide the motive force for the main unit generator, which generates electrical power for use on the system grid. The main unit turbine is composed of three separate turbines, coupled in tandem, end-to-end, including one high pressure turbine and two low pressure turbines. As the steam exits the last turbine, it flows into the vacuum of the condenser.

The Main Turbine and Condenser System meets 10 CFR 54.4(a)(1) because it provides the means for assessing plant conditions during and following an accident, it contains instrumentation channels that provide inputs to protection systems, and it provides a containment isolation function. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Environmental Qualification (10 CFR 50.49) and Anticipated Transients Without Scram (10 CFR 50.62).
Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 10.3.3, Turbine-Generator
- BVPS Unit 2 UFSAR, Revision 12, Section 10.2, Turbine Generator, and 10.4.1, Main Condenser

License Renewal Drawings

The Main Turbine and Condenser System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-426-6, Sheet 6, Revision 9, Valve Operating No. Diagram - Auxiliary Steam and Air Removal

Unit 2:

- None: Components subject to aging management review that are in scope for 10 CFR 54.4(a)(2) as a result of the additional review discussed in Section 2.1.1.3 are not highlighted on any drawing.

Components Subject to AMR

The Unit 1 Main Turbine and Condenser System component types subject to aging management review and their intended functions are shown in Table 2.3.4.6-1 below. The aging management review results for these components are provided in Table 3.4.2-6, Steam and Power Conversion – Main Turbine and Condenser System – Summary of Aging Management Evaluation.

**Table 2.3.4.6-1**
**Main Turbine and Condenser System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| External Surfaces | Pressure Boundary |
| Piping | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Safeguards Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Service Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.3.4.7 Steam Generator Blowdown System

System Description

The Steam Generator Blowdown System is used in conjunction with the chemical feed system to control the secondary side water chemistry within limits. The system also controls the buildup of solids and minimizes the buildup of corrosion products in the steam generator water. Continuous blowdown of the steam generators is necessary during operation because the boiling action concentrates the chemicals and impurities introduced into the steam generator from the feedwater.

The Steam Generator Blowdown System meets 10 CFR 54.4(a)(1) because it provides for isolation of blowdown lines in the event of a high energy line break outside containment, it provides the means for assessing plant conditions during and following an accident, and it provides a containment isolation function. It also meets 10 CFR 54.4(a)(2) because failure of NSR fluid-retaining system components in certain SR areas of the plant could prevent satisfactory accomplishment of safety-related functions. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Environmental Qualification (10 CFR 50.49) and Anticipated Transients Without Scram (10 CFR 50.62).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 10.3.8, Secondary Vent and Drain System
- BVPS Unit 2 UFSAR, Revision 12, Section 10.4.8, Steam Generator Blowdown System

License Renewal Drawings

The Steam Generator Blowdown System aging management review boundaries are highlighted on the following drawings:

Unit 1:

- 8700-RM-425-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Steam Generator Blowdown

Unit 2:

- 10080-RM-414A-1, Sheet 1, Revision 13, Valve Operating No. Diagram - Reactor Plant Sample - Hood 1
- 10080-RM-425-1, Sheet 1, Revision 8, Valve Operating No. Diagram - Steam Generator Blowdown

Components Subject to AMR

The Steam Generator Blowdown System component types subject to aging management review and their intended functions are shown in Table 2.3.4.7-1 below. The aging management review results for these components are provided in Table 3.4.2-7, Steam and Power Conversion – Steam Generator Blowdown System – Summary of Aging Management Evaluation.

**Table 2.3.4.7-1**
**Steam Generator Blowdown System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Bolting | Pressure Boundary |
| External Surfaces | Pressure Boundary |
| Piping | Pressure Boundary |
| Valve | Pressure Boundary |
| NSR fluid-retaining components in the following buildings and areas:<br><br>Unit 1 Auxiliary Building<br>Unit 1 Service Building<br>Unit 1 Safeguards Building<br>Unit 2 Auxiliary Building<br>Unit 2 Main Steam Valve and Cable Vault Area<br>Unit 2 Pipe Tunnels<br>Unit 2 Service Building | NSR Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

## 2.4 SCOPING AND SCREENING RESULTS FOR STRUCTURES

The determination of structures within the scope of license renewal was made by initially identifying Beaver Valley Power Station structures and their design functions. Each structure was then reviewed to determine those that satisfy one or more of the criteria contained in 10 CFR 54.4. This process is described in Section 2.1 and the results of the structures review are included in Section 2.2. Section 2.1 also provides the methodology for determining the components within the scope of 10 CFR 54.4 that meet the requirements contained in 10 CFR 54.21(a)(1). The structural components that meet these screening requirements are identified in this section. These identified components require an aging management review for license renewal. The following drawing highlights the site structures that have components that require an aging management review:

- LR-Figure 2.4-1, Site Plan, Beaver Valley Power Station, Updated Final Safety Analysis Report

The results include the following structures. The groupings are based on common locations.

- Reactor Containment Building (2.4.1)
  - Unit 1 Reactor Containment Building
  - Unit 2 Reactor Containment Building
  - Unit 1 Equipment Hatch Platform
  - Unit 2 Equipment Hatch Platform
- Alternate Intake Structure (2.4.2.1)

- Auxiliary Building (2.4.2.2)
  - Unit 1 Auxiliary Building
  - Unit 2 Auxiliary Building
  - Unit 1 Service Building
  - Unit 2 Service Building
  - Unit 1 Diesel Generator Building
  - Unit 2 Diesel Generator Building
  - Unit 1 Fuel Building
  - Unit 1 Primary Water Storage Building
  - Unit 1 Safeguards Building
  - Unit 1 Solid Waste Building
- Component Supports (2.4.2.3)
- Containment System Structural Components (2.4.2.4)
- Control Building (2.4.2.5)
- Cranes and Hoists (2.4.2.6)
  - Unit 1 Cranes and Hoists
  - Unit 2 Cranes and Hoists
  - Unit 1 Fuel Transfer System and Tools
  - Unit 2 Fuel Transfer System and Tools
- Essential Yard Structures (2.4.2.7)
  - Unit 1 Chemical Addition Building
  - Unit 1 Primary Demineralized Water Storage Tank Enclosure
  - Unit 1 Pipe Tunnels
  - Unit 1 Refueling Water Storage Tank Foundation Mat and Shield Wall
  - Unit 2 Cable Tunnel
  - Unit 2 Emergency Outfall Structure
  - Unit 2 Pipe Tunnels
  - Common Relay Building
  - Others (structural areas not listed in Table 2.2-1):
    - Line anchors
    - SBO Switchyard Structures
    - Unit 1 and 2 Electrical Manholes and Duct Lines
    - Unit 1 Diesel Generator Fuel Oil Tanks Foundation Slabs and Cover Slab
    - Unit 1 Valve Pit
    - Unit 1 West Pipe Trench
- Fire Barriers (2.4.2.8)
- Intake Structure (2.4.2.9)
- Safeguards Building (2.4.2.10)
  - Unit 2 Safeguards Building
  - Unit 2 Fuel and Decontamination Building
  - Unit 2 Main Steam Valve and Cable Vault Area
  - Unit 2 Primary Demineralized Water Storage Tank Enclosure
  - Unit 2 Refueling Water Storage Tank Foundation Mat and Shield Wall
  - Unit 2 Service Water Valve Pits

- Turbine Building (2.4.2.11)
  - Unit 1 Turbine Building
  - Unit 2 Turbine Building
  - Unit 1 Water Treatment Building

### 2.4.1 Reactor Containment Building

Structure Description

For the purpose of license renewal, this section includes the Unit 1 and Unit 2 Reactor Containment Buildings and also the Unit 1 and Unit 2 Equipment Hatch Platforms.

The Reactor Containment Building for each unit is a heavily reinforced concrete, steel-lined vessel with a flat base mat, cylindrical walls, and a hemispherical dome. The base mat is a soil-bearing concrete slab 10 feet thick, without projections below its lower surface. A 4-inch thick (minimum) layer of porous concrete sub-base underlies the mat and consists of coarse aggregate bound with a water-cement paste.

The inside diameter of the containment cylinder is 126 feet and the cylinder wall is 4 feet-6 inches thick. The distance from the top of the mat to the inside of the dome crown is approximately 185 feet. The dome has a thickness of 2 feet-6 inches and an inside radius of 63 feet.

The inside faces of the containment wall, dome, and mat are lined with steel liner plates. The liner plate is anchored to the concrete containment. The steel liner is not considered as making any contribution to the structural integrity of the containment shell. The containment internal structures consist of heavily reinforced concrete walls and slabs.

These structures meet 10 CFR 54.4(a)(1) because they provide curbs for directing flow (e.g., safety injection flow to the containment sump), provide filtration, provide a flood protection barrier (internal and external flooding events), provide a heat sink during design basis accidents, provide missile barriers (internally or externally generated), provide pipe whip restraint, provide pressure boundary or essentially leak tight barriers to protect public health and safety in the event of any postulated design basis events, provide rated fire barriers to confine or retard a fire from spreading to or from adjacent areas of the plant, provide shelter/protection to safety-related components, provide shielding against high energy line breaks, provide shielding against radiation, and they provide structural and/or functional support to safety-related equipment. They also meet 10 CFR 54.4(a)(2) because they provide functional support to non safety related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions, provide heat sink during design basis accidents, provide an essentially leak tight barrier, and they provide missile barriers (internally or externally generated). They also meet 10 CFR 54.4(a)(3) because they contain SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Appendix A, Table A.1-1, Category I Structures, Systems and Components
- BVPS Unit 1 UFSAR, Revision 20, Appendix B, Seismic Design
- BVPS Unit 1 UFSAR, Revision 20, Figure 1.2-1, Site Plan
- BVPS Unit 1 UFSAR, Revision 20, Section 5.2.1, Containment Structure - General Description
- BVPS Unit 1 UFSAR, Revision 20, Section 5.2.4.1, Containment Liner Description
- BVPS Unit 1 UFSAR, Revision 20, Section 5.1, General Description (Containment)
- BVPS Unit 1 UFSAR, Revision 20, Section 5.2.6, Missiles and Pipe Ruptures
- BVPS Unit 1 UFSAR, Revision 20, Section 11.3.2.8, Accident Shielding

- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.1.1.1, Concrete Containment - General Description
- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.1.1.2, Concrete Containment - Reinforcing Steel Arrangement
- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.1.1.3, Containment Liner, Penetrations, and Access Openings
- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.3.1, Description of Internal Structures
- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.4.1.12, Equipment Hatch Platform
- BVPS Unit 2 UFSAR, Revision 12, Section 6.2.1.1, Containment Structure
- BVPS Unit 2 UFSAR, Revision 12, Section 12.3.2.4, Containment Structure Shielding

Components Subject to AMR

The component types that require aging management review and were not assessed in a structural commodity group are indicated in Table 2.4.1-1. The aging management review results for these components are provided in Table 3.5.2-1, Containment, Structures, and Component Supports – Reactor Containment Building – Summary of Aging Management Evaluation.

**Table 2.4.1-1**
**Reactor Containment Building**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Concrete at Expansion/Grouted Anchors in Air | Structural/Functional Support |
| Concrete in Air | Direct Flow<br>Fire Barrier<br>Flood Protection<br>Heat Sink<br>High Energy Line Break Shielding<br>Missile Barrier<br>Pipe Whip Restraint<br>Pressure Boundary<br>Radiation Shielding<br>Shelter/Protection<br>Structural/Functional Support |
| Concrete in Soil Above the Ground Water Table | Flood Protection<br>Heat Sink<br>Shelter/Protection<br>Structural/Functional Support |
| Expansion/Grouted Anchors in Air | Structural/Functional Support |
| Polymer in Soil Above the Ground Water Table | Flood Protection |
| Structural Steel in Air | Filtration<br>Fission Product Barrier<br>Heat Sink<br>Missile Barrier<br>NSR Functional Support<br>Pipe Whip Restraint<br>Pressure Boundary<br>Radiation Shielding<br>Structural Support for NSR<br>Structural/Functional Support |
| Structural Steel in Treated Water, Less Than 140 deg F | Heat Sink<br>Pressure Boundary<br>Structural/Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

## 2.4.2 Other Structures

### 2.4.2.1 Alternate Intake Structure

Structure Description

The common Alternate Intake Structure is a non-Seismic Category I structure located adjacent to the Ohio River approximately one-quarter mile upstream of the common Intake Structure. It is approximately 42 by 60 by 82 feet high. Above the reinforced concrete operating floor, the structure is steel framed and enclosed with insulated metal siding and roof deck. The periphery of the structure below the operating floor is formed by sheet piling driven to refusal on bedrock. Sheet piling driven through the center of the periphery forms two separate cells. These cells are the river water bays to which the Standby Service Water and Auxiliary River Water Pumps take suction.

Extending away from the sheet piling on the south side of the structure is the reinforced concrete pipe chamber. Embedded within the lower concrete floor and providing support for the pipe chamber are steel H-piles driven to refusal.

This structure meets 10 CFR 54.4(a)(2) because it provides structural support to non safety related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions and it provides filtration.

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.16, Auxiliary River Water System

- BVPS Unit 2 UFSAR, Revision 12, Figure 1.2-1, Site Plan
- BVPS Unit 2 UFSAR, Revision 12, Section 2.2.3.1.5, Liquid Spills

Components Subject to AMR

The component types that require aging management review and were not assessed in a structural commodity group are indicated in Table 2.4.2.1-1. The aging management review results for these components are provided in Table 3.5.2-2, Containment, Structures, and Component Supports – Alternate Intake Structure – Summary of Aging Management Evaluation.

**Table 2.4.2.1-1**
**Alternate Intake Structure**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Concrete at Expansion/Grouted Anchors in Air | Structural Support for NSR |
| Concrete in Air | Structural Support for NSR |
| Concrete in Raw Water | Structural Support for NSR |

| Component Type | Intended Functions* |
|---|---|
| Concrete in Soil Above the Ground Water Table | Structural Support for NSR |
| Expansion/Grouted Anchors in Air | Structural Support for NSR |
| Foundation Piles in Undisturbed Soil | Structural Support for NSR |
| Structural Steel in Air | Structural Support for NSR |
| Structural Steel in Raw Water | Filtration<br>Structural Support for NSR |
| Structural Steel in Soil Above the Ground Water Table | Structural Support for NSR |
| Structural Steel in Soil Below the Ground Water Table | Structural Support for NSR |
| Structural Steel in Undisturbed Soil | Structural Support for NSR |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.4.2.2 Auxiliary Building

Structure Description

For the purpose of license renewal, this section includes all of the following buildings and structures:

- Unit 1 Auxiliary Building
- Unit 2 Auxiliary Building
- Unit 1 Service Building
- Unit 2 Service Building
- Unit 1 Diesel Generator Building
- Unit 2 Diesel Generator Building
- Unit 1 Fuel Building
- Unit 1 Primary Water Storage Building
- Unit 1 Safeguards Building
- Unit 1 Solid Waste Building (also known as the Coolant Recovery Tank Structure)

The Unit 1 Auxiliary Building is a Seismic Category 1 structure consisting of a basement and three upper stories. It is approximately 120 feet wide by 104 feet long by 69 feet high. It is located adjacent to, and south of, the Unit 1 Service Building. The Auxiliary Building is supported on a reinforced concrete foundation mat. The roof and walls of the top story are predominately steel framed with metal siding and metal roof deck. The remainder of the structure is reinforced concrete. The Auxiliary Building contains concrete block walls that meet the criteria of IE Bulletin 80-11.

The Unit 2 Auxiliary Building is a Seismic Category I structure consisting of a basement and three upper stories and is approximately 120 feet wide by 145 feet long by 63 feet high. It is

located adjacent to, and south of, the Unit 2 Fuel and Decontamination Building, and adjacent to, and west of, the Unit 2 Service Building and Unit 2 Main Steam Valve and Cable Vault Area. The Auxiliary Building is supported on a reinforced concrete foundation mat. The roof and walls of the top story are predominantly steel framed with metal siding and metal roof deck, with the exception of the ventilation core area, component cooling surge tank cubicle, and the air conditioning room, which are reinforced concrete. The remainder of the structure is reinforced concrete.

The Unit 1 Service Building is a Seismic Category 1 structure. The Seismic Category 1 portions include: Main Control Room, Emergency Switchgear and Relay Room, Battery Rooms, Cable Tray Area in the Service Building, Cable Tunnel, and Air Conditioning Equipment Room for the Main Control Room. The Service Building is a four-story structure approximately 135 by 275 by 88 feet high. It is located adjacent to, and south of, the Unit 1 Turbine Building. It is supported on a reinforced concrete foundation mat. The roof and walls of the top two stories are predominately steel framed with metal siding and metal roof deck. The Service Building contains concrete block walls that meet the criteria of IE Bulletin 80-11.

The Unit 2 Service Building is a Seismic Category I structure located adjacent to, and north of, the Unit 2 Turbine Building, and west of the Unit 2 Diesel Generator Building. It is a four-story structure approximately 54 by 186 by 70 feet high. The Service Building is supported on a reinforced concrete foundation mat. The roof and walls of the top story are steel framed with metal siding and roof deck. The remainder of the structure is reinforced concrete. The top-story steel framed structure is non-Category I.

The Unit 1 Diesel Generator Building is a Seismic Category 1 structure. It is located adjacent to, and south of, the Unit 1 Fuel Building. It is a reinforced concrete structure approximately 57 by 61 by 60 feet high. The Diesel Generator Building is supported on a reinforced concrete foundation mat. The roof and walls are of reinforced concrete.

The Unit 2 Diesel Generator Building is a Seismic Category I structure located east of the Unit 2 Service Building and adjacent to, and north of, the east end of the Unit 2 Turbine Building. It is a two-story structure approximately 78 by 88 by 57 feet high. The Diesel Generator Building is supported on a reinforced concrete foundation mat. The roof and walls are of reinforced concrete.

The Unit 1 Fuel Building is a Seismic Category 1 structure approximately 41 by 107 by 60 feet high. It is located adjacent to, and south of, the Unit 1 Auxiliary Building. The Fuel Building is supported on a continuous reinforced concrete foundation mat. The fuel pool is a reinforced concrete structure. The seismic superstructure is constructed of structural steel clad with metal siding and metal roof deck. The Fuel Building contains concrete block walls that meet the criteria of IE Bulletin 80-11.

The Unit 1 Primary Water Storage Building is a Seismic Category 1 structure located east of the Diesel Generator Building. It is approximately 64 by 50 feet by 13 feet high above ground level. The Primary Water Storage Building is a reinforced concrete structure.

The Unit 1 Safeguards Building is a Seismic Category 1 structure approximately 17 by 123 by 40 feet high. It is located adjacent to, and west of, the Unit 1 Reactor Containment Structure. The Safeguards Building is supported on a reinforced concrete foundation mat. The roof and walls are of reinforced concrete. The Safeguards Building includes the following areas: Cable Vault and Cable Tunnel, Main Steam Valve Area, Pump Room below the Main Steam Valve Area, Safeguards Areas, and the Safeguards and Main Steam Valve Area Ventilation Rooms. The Safeguards Building contains concrete block walls that meet the criteria of IE Bulletin 80-11.

The Unit 1 Solid Waste Building (also know as the Coolant Recovery Tank Structure) is 40 by 120 by 47 feet high. It is located directly east of the Unit 1 Auxiliary Building. It is constructed of reinforced concrete walls.

These structures meet 10 CFR 54.4(a)(1) because they provide a flood protection barrier (internal and external flooding events), provide a heat sink during design basis accidents, provide missile barriers (internally or externally generated), provide pipe whip restraint, provide pressure boundary or essentially leak tight barriers to protect public health and safety in the event of any postulated design basis events, provide rated fire barriers to confine or retard a fire from spreading to or from adjacent areas of the plant, provide shelter/protection to safety-related components, provide shielding against high energy line breaks, provide shielding against radiation, they contain components that absorb neutrons to ensure subcriticality, and they provide structural and/or functional support to safety-related equipment. They also meet 10 CFR 54.4(a)(2) because they provide structural support to non safety related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions, provide shielding against high energy line breaks, and they provide missile barriers (internally or externally generated). They also meet 10 CFR 54.4(a)(3) because they contain SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Appendix A, Table A.1-1, Category I Structures, Systems and Components
- BVPS Unit 1 UFSAR, Revision 20, Appendix B, Seismic Design
- BVPS Unit 1 UFSAR, Revision 20, Figure 1.2-1, Site Plan
- BVPS Unit 1 UFSAR, Revision 20, Section 2.6.3.3, Bearing Values
- BVPS Unit 1 UFSAR, Revision 20, Section 9.12.1.1, Prevention of Fuel Storage Criticality

- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.4.1.1, Auxiliary Building
- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.4.1.6, Diesel Generator Building
- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.4.1.7, Service Building

Components Subject to AMR

The component types that require aging management review and were not assessed in a structural commodity group are indicated in Table 2.4.2.2-1. The aging management review results for these components are provided in Table 3.5.2-3, Containment, Structures, and Component Supports – Auxiliary Building – Summary of Aging Management Evaluation.

**Table 2.4.2.2-1**
**Auxiliary Building**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Aluminum Alloys in Air | NSR Functional Support |
| Block Wall in Air | Fire Barrier<br>Structural Support for NSR<br>Structural/Functional Support |
| Boral in Treated Water, Less Than 140 deg F | Absorb Neutrons |
| Cellular Concrete in Air | Flood Protection |
| Concrete at Expansion/Grouted Anchors in Air | Structural/Functional Support<br>Structural Support for NSR |
| Concrete in Air | Fire Barrier<br>Flood Protection<br>Heat Sink<br>HELB Shielding<br>Missile Barrier<br>Radiation Shielding<br>Shelter/Protection<br>Structural Support for NSR<br>Structural/Functional Support |
| Concrete in Soil Above the Ground Water Table | Flood Protection<br>Heat Sink<br>Shelter/Protection<br>Structural Support for NSR<br>Structural/Functional Support |
| Door | Fire Barrier<br>Flood Protection<br>HELB Shielding<br>Missile Barrier |
| Expansion/Grouted Anchors in Air | Structural Support for NSR<br>Structural/Functional Support |
| Fire Stop in Air | Shelter/Protection |
| Polymer in Air | Flood Protection |
| Polymer in Soil Above the Ground Water Table | Flood Protection |

| Component Type | Intended Functions* |
|---|---|
| Structural Steel in Air | Missile Barrier<br>Pipe Whip Restraint<br>Structural Support for NSR<br>Structural/Functional Support |
| Structural Steel in Treated Water, Less Than 140 deg F | Pressure Boundary<br>Structural/Functional Support |
| Transite in Air | Shelter/Protection |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.4.2.3 Component Supports

Commodity Description

Component supports are defined as connections between a system component and a plant structural member such as a concrete wall or floor or structural steel beam or column. Supports for both the distributive portion of systems (e.g., piping or cable raceways), and the system's equipment items are included as part of this commodity group. Supported components include vessels, piping, passive pump components, and heat exchangers. Supports for electrical cables, cable trays, conduits, HVAC ducting, tubing, MCC cabinets, electrical enclosures, fans, filters, and heaters are also included in the Component Supports commodity. For embedded anchor bolts associated with component supports, the portion protruding above the concrete is considered part of the component supports system, while the embedded portion of the anchor bolt is considered to be part of the concrete asset which is included under the associated structure. Component supports in scope for license renewal are those that provide support for any mechanical, structural, or electrical component that is in scope for license renewal.

Component supports meet 10 CFR 54.4(a)(1) because they provide structural and/or functional support to safety-related equipment and they provide a heat sink during design basis accidents. They also meet 10 CFR 54.4(a)(2) because they provide structural support to non safety related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions and they provide a heat sink during design basis accidents. They also meet 10 CFR 54.4(a)(3) because they contain 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).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Appendix B, Seismic Design
- BVPS Unit 1 UFSAR, Revision 20, Section 1.3.2.1, Overall Station Requirements (Criterion 2)
- BVPS Unit 1 UFSAR, Revision 20, Section 5.2.1, Containment Structure - General Description
- BVPS Unit 1 UFSAR, Revision 20, Section 5.2.2.3, Reactor Coolant System Equipment Supports

- BVPS Unit 1 UFSAR, Revision 20, Section 6.2.2, Engineered Safety Features - Equipment - Design and Criteria – Piping
- BVPS Unit 1 UFSAR, Revision 20, Section 9.4.2, Component Cooling Water System - Piping and Valves (Check and Manually - Operated Gate, Butterfly, Ball and Globe)
- BVPS Unit 1 UFSAR, Revision 20, Section 9.5.2, Fuel Pool Cooling and Purification System - System Description
- BVPS Unit 1 UFSAR, Revision 20, Section 9.6.1.3, Sampling System - Codes and Standards
- BVPS Unit 1 UFSAR, Revision 20, Section 9.7.2, Vent and Drain System – Description
- BVPS Unit 1 UFSAR, Revision 20, Section 10.3.1.1, Main Steam System - Design Basis
- BVPS Unit 1 UFSAR, Revision 20, Section 10.3.5.1.1, Condensate and Feedwater Systems
- BVPS Unit 1 UFSAR, Revision 20, Table 4.1-11, Reactor Coolant System Code Requirements
- BVPS Unit 1 UFSAR, Revision 20, Table 9.1-1, Chemical and Volume Control System Code Requirements
- BVPS Unit 1 UFSAR, Revision 20, Table 9.3-1, Residual Heat Removal System Code Requirements

- BVPS Unit 2 UFSAR, Revision 12, Section 3.9B.3.4.1, Equipment Component Supports
- BVPS Unit 2 UFSAR, Revision 12, Section 3.9B.3.4.2.2, Piping Component Support Structures
- BVPS Unit 2 UFSAR, Revision 12, Section 3.9B.3.4.2.3, Standard Prefabricated Piping (Hanger) Supports
- BVPS Unit 2 UFSAR, Revision 12, Section 3.9N.3.4, Component Supports
- BVPS Unit 2 UFSAR, Revision 12, Section 3.9N.3.4.1, Tanks and Heat Exchangers
- BVPS Unit 2 UFSAR, Revision 12, Section 3.9N.3.4.2, Auxiliary Pumps
- BVPS Unit 2 UFSAR, Revision 12, Section 5.4.14.1, Component Supports - Design and Fabrication Bases
- BVPS Unit 2 UFSAR, Revision 12, Table 7.1-1, Listing of Applicable Criteria
- BVPS Unit 2 UFSAR, Revision 12, Table 8.1-1, Acceptance Criteria for Electric Power

Components Subject to AMR

The component types that require aging management review are indicated in Table 2.4.2.3-1. The aging management review results for these components are provided in Table 3.5.2-4, Containment, Structures, and Component Supports – Component Supports – Summary of Aging Management Evaluation.

**Table 2.4.2.3-1**
**Component Supports**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Aluminum Alloys in Air | Structural Support for NSR<br>Structural/Functional Support |
| Concrete at Expansion/Grouted Anchors in Air | Structural/Functional Support<br>Structural Support for NSR |
| Copper Alloys with Zinc Greater Than 15% and Aluminum Bronze in Air | Structural/Functional Support |
| Expansion/Grouted Anchors in Air | Structural Support for NSR<br>Structural/Functional Support |
| Grout in Air | Structural Support for NSR<br>Structural/Functional Support |
| Polymer in Air | Structural Support for NSR<br>Structural/Functional Support |
| Structural Steel in Air | Heat Sink<br>Structural Support for NSR<br>Structural/Functional Support |
| Structural Steel in Raw Water | Structural Support for NSR<br>Structural/Functional Support |
| Structural Steel in Treated Water, Less Than 140 deg F | Heat Sink<br>Structural Support for NSR<br>Structural/Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.4.2.4 Containment System Structural Components

Structure Description

Note: The Containment System contains components subject to aging management review that are mechanical, structural, and electrical in nature. The structural components are accounted for here (Section 2.4.2.4), the mechanical components are accounted for in Section 2.3.3.13 (Containment System), and the electrical components are accounted for in Section 2.5.7 (Containment Electrical Penetrations).

The Containment System comprises the components that provide services and communications through the exterior reactor containment wall. These services and communications are performed through leak tight penetrations. These penetrations are classified as follows:

- Piping penetrations, thermally hot and/or cold
- Electrical penetrations
- Personnel air lock
- Equipment access hatch

- Emergency airlock
- Fuel transfer tube

The piping penetrations through the containment wall are provided with isolation valves. The isolation valves provide inside and outside containment isolation in the event of a Design Basis Accident (DBA).

The personnel airlock is a primary means by which plant personnel can enter or leave the containment. The personnel airlock is a double closure penetration. The airlock is designed such that, under normal operating and accident conditions, it will be impossible to have both doors unsealed at the same time.

The removable equipment hatch is a single closure penetration which is bolted to the inside of the containment wall. The 14' 6" opening is sealed with double "O" rings. Prior to bringing any major mechanical equipment into the Reactor Containment Building, the 14' 6" diameter hatch head must be unbolted from the shell head flange.

The emergency airlock located in the equipment hatch provides a second entrance/exit for the containment. It is not used for personnel entrance or exit under normal conditions. The removable emergency airlock is a double closure penetration which is bolted to the equipment hatch. The 30 inch doors are sealed with double "O" rings.

The fuel transfer tube is part of the fuel handling system. The fuel transfer canal and the spent fuel pool are connected by the fuel transfer tube.

The Containment System meets 10 CFR 54.4(a)(1) because it provides a pressure boundary or essentially leak tight barrier to protect the public health and safety in the event of any postulated design basis events. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 5, Containment Systems

- BVPS Unit 2 UFSAR, Revision 12, Section 6.2, Containment Systems

Components Subject to AMR

The component types that require aging management review and were not assessed in a structural commodity group are indicated in Table 2.4.2.4-1. The aging management review results for these components are provided in Table 3.5.2-5, Containment, Structures, and Component Supports – Containment System Structural Components – Summary of Aging Management Evaluation.

**Table 2.4.2.4-1**
**Containment System Structural Components**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Copper Alloys w/Zinc Greater Than 15% and Aluminum Bronze in Air | Pressure Boundary |
| Copper Alloys with Zinc Less Than 15% in Air | Pressure Boundary |
| Glass in Air | Pressure Boundary |
| Nickel-Based Alloys in Treated Water, Less Than 140 deg F | Structural/Functional Support |
| Polymer in Air | Pressure Boundary |
| Structural Steel in Air | Pressure Boundary<br>Structural/Functional Support |
| Structural Steel in Treated Water, Less Than 140 deg F | Pressure Boundary<br>Structural/Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.4.2.5 Control Building

Structure Description

The Control Building is a Unit 2 structure. It is a Seismic Category I three-story structure built adjacent to, and as an extension of, the Unit 1 control room. It is approximately 69 by 89 by 45 feet high. The Control Building is located west of the Unit 2 Fuel Building and Unit 2 Auxiliary Building and is connected to the Unit 2 Auxiliary Building by the Electrical Cable Tunnel. The Control Building is supported on a reinforced concrete foundation mat. The roof and walls are of reinforced concrete. The top story of the Control Building contains the control room, computer room, and the heating, ventilation and air conditioning equipment room. The lower two stories house switchgear, cable spreading areas, and other associated equipment.

The Control Building meets 10 CFR 54.4(a)(1) because it provides a flood protection barrier (internal and external flooding events), provides missile barriers (internally or externally generated), provides an essentially leak tight barrier to protect control room personnel, provides rated fire barriers to confine or retard a fire from spreading to or from adjacent areas of the plant, provides shelter/protection to safety-related components, provides shielding against radiation, and it provides structural and/or functional support to safety-related equipment. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Station Blackout (10 CFR 50.63).
.
Additional information can be found in the following UFSAR sections:

- BVPS Unit 2 UFSAR, Revision 15, Section 3.8.4.1.5, Control Building

- BVPS Unit 2 UFSAR, Revision 15, Section 6.4.2.3, Leaktightness
- BVPS Unit 2 UFSAR, Revision 15, Section 6.4.4.2, Toxic Gas Protection

Components Subject to AMR

The component types that require aging management review and were not assessed in a structural commodity group are indicated in Table 2.4.2.5-1. The aging management review results for these components are provided in Table 3.5.2-6, Containment, Structures, and Component Supports – Control Building – Summary of Aging Management Evaluation.

**Table 2.4.2.5-1**
**Control Building**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Concrete at Expansion/Grouted Anchors in Air | Structural/Functional Support |
| Concrete in Air | Fire Barrier<br>Flood Protection<br>Heat Sink<br>Missile Barrier<br>Radiation Shielding<br>Shelter/Protection<br>Structural/Functional Support |
| Concrete in Soil Above the Ground Water Table | Flood Protection<br>Heat Sink<br>Shelter/Protection<br>Structural/Functional Support |
| Door | Fire Barrier |
| Expansion/Grouted Anchors in Air | Structural/Functional Support |
| Polymer in Air | Pressure Boundary |
| Polymer in Soil Above the Ground Water Table | Flood Protection |
| Structural Steel in Air | Structural/Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.4.2.6 Cranes and Hoists

System Description

This system is primarily composed of the components credited for control of heavy loads per NUREG-0612. For the purpose of license renewal, the Unit 1 and 2 Cranes and Hoists System also includes the component types associated with lifting and transport (e.g., fuel handling tools, fuel transport cars, lifting rigs) from Unit 1 and 2 Fuel Transfer System and Tools. Items

addressed include overhead cranes, monorail hoists, platform cranes, lifting rigs, winches, elevators, jib cranes, load cells, switches, and dumbwaiters.

The Unit 1 and 2 Polar Cranes are the main overhead cranes located in the containments. Each operates over its entire associated Containment Building. They are used for maintenance and refueling activities. Each unit also has a Reactor Vessel Internals Lifting Rig that attaches to the Polar Crane to engage and handle both the upper and lower internals packages during refueling operations.

Additional cranes and hoists that are within scope include:

- Unit 1 Auxiliary Building Manual Hoists
- Unit 1 Auxiliary Building Monorail Hoists
- Unit 1 Fuel Cask Overhead Traveling Crane
- Unit 1 Moveable Platform Crane and Fuel Handling Trolley
- Unit 1 PCA Shop Crane
- Unit 1 Reactor Vessel Head Lifting Rig
- Unit 1 Reactor Vessel Internals Lifting Rig
- Unit 1 Screenwell Overhead Crane

- Common Reactor Coolant Pump Motor Lift Sling Spreader Assembly

- Unit 2 Charging Pump Removal Monorails
- Unit 2 Component Cooling Water Heat Exchanger Monorails
- Unit 2 Component Cooling Water Pump Monorail
- Unit 2 Filter/Demineralizer/Charging Pump Monorail
- Unit 2 Fuel Handling Platform Crane
- Unit 2 Monorail for Cable Vault and Rod Control Area
- Unit 2 Pipe Chase Slab Removal Monorail
- Unit 2 Reactor Cavity Head Lifting Rig
- Unit 2 Reactor Vessel Internals Lifting Rig
- Unit 2 Rod Cluster Control Change Fixture Tool
- Unit 2 Refueling Cavity Crane Changing Winch
- Unit 2 Residual Heat Removal Pump Monorail
- Unit 2 Spent Fuel Cask Crane - Auxiliary Hoist
- Unit 2 Spent Fuel Cask Crane - Main Hoist
- Unit 2 Spent Fuel Handling Tool
- Unit 2 Sweep Gas System Monorail

These systems meet 10 CFR 54.4(a)(1) because they provide a heat sink. The also meet 10 CFR 54.4(a)(2) because they provide structural support to non safety related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions. The components and subcomponents within the scope of license renewal involve the

structural load-bearing elements of cranes and hoists that support the lift in a passive manner as identified in the BVPS response to NUREG 0612.

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.12.2.1, Fuel Handling System – System Description
- BVPS Unit 2 UFSAR, Revision 12, Section 9.1.5, Overhead Heavy Load Handling Systems

Components Subject to AMR

The component types that require aging management review are indicated in Table 2.4.2.6-1. The aging management review results for these components are provided in Table 3.5.2-7, Containment, Structures, and Component Supports – Cranes and Hoists – Summary of Aging Management Evaluation.

**Table 2.4.2.6-1**
**Cranes and Hoists**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Structural Steel in Air | Heat Sink<br>Structural Support for NSR |
| Structural Steel in Treated Water, Less Than 140 deg F | Structural Support for NSR |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.4.2.7 Essential Yard Structures

Structure Description

For the purpose of license renewal, this section includes all of the following buildings and structures:

- Unit 1 Chemical Addition Building
- Unit 1 Primary Demineralized Water Storage Tank Enclosure
- Unit 1 Pipe Tunnel
- Unit 1 Refueling Water Storage Tank Foundation Mat and Shield Wall
- Unit 2 Cable Tunnel
- Unit 2 Emergency Outfall Structure
- Unit 2 Pipe Tunnels
- Common Relay Building
- Others (structural areas not listed in Table 2.2-1):

- Line anchors
- SBO Switchyard Structures
- Unit 1 and 2 Electrical Manholes and Duct Lines
- Unit 1 Diesel Generator Fuel Oil Tanks Foundation Slabs and Cover Slab
- Unit 1 Valve Pit
- Unit 1 West Pipe Trench

The Unit 1 Chemical Addition Building is approximately 31 by 19 by 11 feet high and is located northwest, and adjacent to, the Refueling Water Storage Tank. It is a Seismic Category I Structure. The Chemical Addition Building is supported on a reinforced concrete foundation mat. The roof and walls of the structure are steel framed with metal siding and roof deck.

The Unit 1 Primary Demineralized Water Storage Tank (PDWST) Enclosure is approximately 38 by 41 by 45 feet high. It is a Seismic Category I Structure. It is located west of the Unit 1 Safeguards and Reactor Containment Buildings. The PDWST is supported on a reinforced concrete foundation mat and the walls of the surrounding structure are of reinforced concrete. The reinforced concrete roof slab is supported by steel beams and decking.

The Unit 1 Pipe Tunnel connecting the Unit 1 Refueling Water Storage Tank to the Unit 1 Safeguards Area is approximately 13 by 20 by 12 feet high. It is a Seismic Category I Structure. The tunnel is a reinforced concrete subsurface structure, with the top of the tunnel approximately level with the ground grade.

The Unit 1 Refueling Water Storage Tank (RWST) Foundation Mat and Shield Wall is approximately 42 by 42 by 25 feet high. It is a Seismic Category I Structure. It is located west of the Unit 1 Safeguards and Cable Vault Areas and adjacent to the Chemical Addition Building. The RWST is supported on a reinforced concrete foundation mat and the walls of the surrounding structure are of reinforced concrete.

The Unit 2 Cable Tunnel is a Seismic Category I subsurface structure extending approximately 82 feet from the Unit 2 Auxiliary Building to the Unit 2 Control Building. The foundation mat, walls, and roof of the Cable Tunnel are reinforced concrete.

The Unit 2 Emergency Outfall Structure is a Seismic Category I dual-chambered overflow weir structure. It is approximately 21 by 35 by 24 feet high, located about 1,900 feet west of the center of the Unit 2 Containment Building. The Emergency Outfall Structure is constructed of reinforced concrete.

There are two Seismic Category I Unit 2 Pipe Tunnels. One is approximately 42 feet long by 10 feet wide by 13 feet deep. It connects the Unit 2 Service Building and the Unit 2 Safeguards Building. The other is approximately 7 feet wide by 6 feet deep with one portion enlarging to approximately 14 feet wide by 8 feet deep. It has a total length of approximately 164 feet, connecting the piping area of the Unit 2 Cable Tunnel with the Unit 2 Fuel and Decontamination Building. The Pipe Tunnels are reinforced concrete subsurface structures, with the top of the tunnel covers approximately level with the ground grade.

The Common Relay Building (Relay House) is approximately 97 by 45 by 16 feet high with an addition 37 by 47 by 16 feet high. The Common Relay House is located in the Switchyard. The structure foundation has spread footings with a concrete slab on-grade. The walls are constructed from masonry block and the exterior is brick faced. The roof consists of precast concrete sections topped with built-up roofing.

Others:

Line anchors are concrete structures supporting buried piping. Line anchors within the scope of license renewal are located on River Water and Service Water System piping exiting the Intake Structure and also on River Water System piping entering the Unit 1 Solid Waste Building.

SBO Switchyard Structures: The various foundations for the Common 138 KV switchyard structures are constructed of concrete in either the spread footing or slab on-grade designs. The foundation for Tower 5019-1 also utilizes steel H-piles. The 138 KV towers are constructed of structural steel. Sub-grade concrete duct lines connect electrical lines from the various 138 KV Switchyard structures to the Relay House.

The Unit 1 and 2 Electrical Manholes and Duct Lines within the scope of license renewal are those structures which house safety related cabling. These subsurface structures are constructed of reinforced concrete.

The Unit 1 Diesel Generator Fuel Oil Tanks are each supported on reinforced concrete subsurface foundation slabs. Each slab is approximately 12 by 33 by 3 feet thick. Located above the tanks is a 50 by 63 by 2 feet thick reinforced concrete cover slab that is approximately level with the ground grade. The slabs are located east of the Unit 1 Primary Water Storage Building.

The Unit 1 Valve Pit is approximately 13 by 17 by 13 feet high and is located between the Unit 1 and Unit 2 Auxiliary Buildings, just south of the Unit 2 Cable Tunnel. It is a subsurface structure that is supported on a reinforced concrete foundation mat. The walls and roof are constructed of reinforced concrete.

The Unit 1 West Pipe Trench is approximately 85 by 3.5 by 2.5 feet high with one portion of the trench enlarging to approximately 4 feet high. It is located west of, and adjacent to, the Unit 1 Safeguards Building. The trench is a reinforced concrete subsurface structure, with the top of the trench approximately level with the ground grade.

The Essential Yard Structures meet 10 CFR 54.4(a)(1) because they provide a flood protection barrier (internal and external flooding events), provide missile barriers (internally or externally generated), provide rated fire barriers to confine or retard a fire from spreading to or from adjacent areas of the plant, provide shelter/protection to safety-related components, and they provide structural and/or functional support to safety-related equipment. They also meet 10 CFR 54.4(a)(3) because they contain SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Figure 1.2-1, Site Plan
- BVPS Unit 1 UFSAR, Revision 20, Section 9.9.2, River Water System - Description
- BVPS Unit 1 UFSAR, Revision 20, Table B.1-1, Structures and Systems Requiring Design for Seismic Loading

- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.4.1.8, Electrical Cable Tunnel
- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.4.1.11, Emergency Outfall Structure
- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.4.1.14, Pipe Trenches

Components Subject to AMR

The component types that require aging management review and were not assessed in a structural commodity group are indicated in Table 2.4.2.7-1. The aging management review results for these components are provided in Table 3.5.2-8, Containment, Structures, and Component Supports – Essential Yard Structures – Summary of Aging Management Evaluation.

**Table 2.4.2.7-1**
**Essential Yard Structures**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Block Wall in Air | Structural Support for NSR |
| Block Wall in Soil Above the GWT | Structural Support for NSR |
| Concrete at Expansion/Grouted Anchors in Air | Structural/Functional Support |
| Concrete in Air | Fire Barrier<br>Flood Protection<br>Missile Barrier<br>Shelter/Protection<br>Structural Support for NSR<br>Structural/Functional Support |
| Concrete in Raw Water | Missile Barrier<br>Shelter/Protection<br>Structural/Functional Support |
| Concrete in Soil Above the Ground Water Table | Fire Barrier<br>Flood Protection<br>Missile Barrier<br>Shelter/Protection<br>Structural Support for NSR<br>Structural/Functional Support |
| Concrete in Soil Below the Ground Water Table | Missile Barrier<br>Shelter/Protection<br>Structural/Functional Support |

| Component Type | Intended Functions* |
|---|---|
| Expansion/Grouted Anchors in Air | Structural/Functional Support |
| Foundation Piles in Undisturbed Soil | Structural Support for NSR |
| Polymer in Soil Above the Ground Water Table | Flood Protection |
| Structural Steel in Air | Missile Barrier<br>Shelter/Protection<br>Structural Support for NSR<br>Structural/Functional Support |
| Structural Steel in Soil Above the Ground Water Table | Shelter/Protection<br>Structural/Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.4.2.8 Fire Barriers

Commodity Description

The Fire Barriers commodity includes the Unit 1 and Unit 2 fire barriers, such as fire stops and fire wrap used on components, cables, and raceways. Fire stops are construction features that prevent fire propagation through a penetration along the length of cables, pipe, or other penetrations that prevent spreading of fire through established fire barriers. Fire stops are installed within fire barriers to maintain fire prevention. Fire wrap materials have specific fire ratings and are produced in various forms which may be sprayed on, troweled on, or box-clad/wrapped onto structural steel members and other items including, but not limited to, metal decks, electrical cable trays and conduits, HVAC ducts, and instrumentation.

The Fire Barriers commodity group meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.10.5.3, Fire Rated Assemblies
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5.1.6.1, Building Design

Components Subject to AMR

The component types that require aging management review are indicated in Table 2.4.2.8-1. The aging management review results for these components are provided in Table 3.5.2-9, Containment, Structures, and Component Supports – Fire Barriers – Summary of Aging Management Evaluation.

**Table 2.4.2.8-1**
**Fire Barriers**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Cellular Concrete in Air | Fire Barrier |
| Fire Stop in Air | Fire Barrier |
| Fire Wrap in Air | Fire Barrier |
| Structural Steel in Air | Structural Support for NSR |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.4.2.9 Intake Structure

Structure Description

The common Intake Structure is shared between Unit 1 and Unit 2. The structure is located adjacent to the Ohio River. It is an 88 by 84 by 85 feet high Seismic Category I structure, founded on a reinforced concrete mat which was placed on compacted select granular fill overlying dense original granular soil extending to bedrock. The structure is constructed of reinforced concrete to approximately half its height. Above this, construction consists of a steel frame structure. The roof is constructed of steel decking supported on the steel framing. The structure is clad in metal siding similar to that used throughout the plant. The Intake Structure houses the safety-related Unit 1 river water pumps, the safety-related Unit 2 service water pumps and the fire pumps.

The Intake Structure meets 10 CFR 54.4(a)(1) because it provides a flood protection barrier (internal and external flooding events), provides missile barriers (internally or externally generated), provides rated fire barriers to confine or retard a fire from spreading to or from adjacent areas of the plant, provides shelter/protection to safety-related components, and it provides structural and/or functional support to safety-related equipment. It also meets 10 CFR 54.4(a)(2) because it provides structural support to non safety related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions and it provides filtration. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Figure 1.2-1, Site Plan
- BVPS Unit 1 UFSAR, Revision 20, Section 1.7.1, Identification of Shared Systems, Structures and Components
- BVPS Unit 1 UFSAR, Revision 20, Section 2.1.7.1, Potential Impact of Barges or Ice on the Intake Structure
- BVPS Unit 1 UFSAR, Revision 20, Section 2.3.10, Storm Drainage

- BVPS Unit 1 UFSAR, Revision 20, Section 2.7.3.2.2, Intake Structure
- BVPS Unit 1 UFSAR, Revision 20, Section 9.9.2, River Water System – Description

- BVPS Unit 2 UFSAR, Revision 12, Figure 2.5.4-66, Main Intake Structure Typical Section
- BVPS Unit 2 UFSAR, Revision 12, Section 3.6B.1.3.4.2, Internal Flooding
- BVPS Unit 2 UFSAR, Revision 12, Table 3.2-2, Classification of Structures
- BVPS Unit 2 UFSAR, Revision 12, Table 3.7B-2, Foundation Information and Structural Dimensions

Components Subject to AMR

The component types that require aging management review and were not assessed in a structural commodity group are indicated in Table 2.4.2.9-1. The aging management review results for these components are provided in Table 3.5.2-10, Containment, Structures, and Component Supports – Intake Structure – Summary of Aging Management Evaluation.

**Table 2.4.2.9-1**
**Intake Structure**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Cellular Concrete in Air | Flood Protection |
| Concrete at Expansion/Grouted Anchors in Air | Structural Support for NSR<br>Structural/Functional Support |
| Concrete in Air | Fire Barrier<br>Flood Protection<br>Missile Barrier<br>Shelter/Protection<br>Structural Support for NSR<br>Structural/Functional Support |
| Concrete in Raw Water | Structural Support for NSR<br>Structural/Functional Support |
| Concrete in Soil Above the Ground Water Table | Structural Support for NSR<br>Structural/Functional Support |
| Concrete in Soil Below the Ground Water Table | Structural Support for NSR<br>Structural/Functional Support |
| Door | Fire Barrier<br>Flood Protection |
| Expansion/Grouted Anchors in Air | Structural Support for NSR<br>Structural/Functional Support |
| Polymer in Air | Fire Barrier<br>Flood Protection |

| Component Type | Intended Functions* |
|---|---|
| Structural Steel in Air | Flood Protection<br>Shelter/Protection<br>Structural Support for NSR<br>Structural/Functional Support |
| Structural Steel in Raw Water | Filtration<br>Structural Support for NSR |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.4.2.10 Safeguards Building

Structure Description

The Unit 1 Safeguards Building is assessed with the Unit 1 Auxiliary Building (Section 2.4.2.2).

For the purpose of license renewal, this section includes all of the following buildings and structures:

- Unit 2 Safeguards Building
- Unit 2 Fuel and Decontamination Building
- Unit 2 Main Steam Valve and Cable Vault Area
- Unit 2 Primary Demineralized Water Storage Tank Enclosure
- Unit 2 Refueling Water Storage Tank Foundation Mat and Shield Wall
- Unit 2 Service Water Valve Pits

The Unit 2 Safeguards Building is a Seismic Category I structure approximately 60 by 106 by 59 feet high. It is located adjacent to, and east of, the Unit 2 Containment Structure. The Safeguards Building is supported on a reinforced concrete foundation mat and the remainder of the structure is reinforced concrete.

The Unit 2 Fuel and Decontamination Building is a Seismic Category I L-shaped structure with the main portion approximately 44 by 110 by 71 feet high. It is located adjacent to, and west of, the Unit 2 Containment Building and north of, and adjacent to, the Unit 2 Auxiliary Building. The Fuel and Decontamination Building is supported on a continuous reinforced concrete foundation mat. The roof and walls are of reinforced concrete. The Fuel and Decontamination Building contains the new and spent fuel and associated fuel handling facilities. The spent fuel pool has a cask loading area, storage rack area, and transfer canals.

The Unit 2 Main Steam Valve and Cable Vault Area is a Seismic Category I multi-level structure, approximately 94 feet wide (at its widest part) by 138 feet long by 77 feet high, located adjacent to, and south of, the Unit 2 Containment Structure. The Main Steam Valve and Cable Vault Area is supported on a reinforced concrete foundation mat. The remainder of the structure

is reinforced concrete, with the exception of one portion of roof that is steel framed with metal roof deck. The steel frame roof portion is non-Seismic Category I.

The Unit 2 Primary Demineralized Water Tank Enclosure is a Seismic Category I structure located east of the Unit 2 Safeguards Building and south of the Unit 2 Refueling Water Storage Tank. It is approximately 38 by 40 by 46 feet high. The Primary Demineralized Water Tank Enclosure is supported on a reinforced concrete foundation mat which also supports the tank. The roof and walls of the enclosure are of reinforced concrete.

The Unit 2 Refueling Water Storage Tank (RWST) and Foundation Mat and Shield Wall are located east of the Unit 2 Safeguards Building. The RWST and foundation mat and surrounding shield wall are Seismic Category I. The shield wall is approximately 56 by 67 by 16 feet high. The RWST is supported on a reinforced concrete foundation mat. The walls of the surrounding structure are of reinforced concrete.

There are two Seismic Category I Unit 2 Service Water Valve Pits. One is approximately 14 by 20 by 15 feet high and is located adjacent to, and north of, the Unit 2 Safeguards Building. The other is approximately 24 feet by 36 feet by 18 feet high and is located northwest of the Unit 2 Fuel and Decontamination Building. They are subsurface structures. The Service Water Valve Pits are supported on reinforced concrete foundation mats. The walls and roofs are of reinforced concrete.

These structures meet 10 CFR 54.4(a)(1) because they provide a flood protection barrier (internal and external flooding events), provide a heat sink during design basis accidents, provide missile barriers (internally or externally generated), provide pipe whip restraint, provide pressure boundary or essentially leak tight barriers to protect public health and safety in the event of any postulated design basis events, provide rated fire barriers to confine or retard a fire from spreading to or from adjacent areas of the plant, provide shelter/protection to safety-related components, and they provide structural and/or functional support to safety-related equipment. They also meet 10 CFR 54.4(a)(2) because they provide structural support to non safety related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions, provide shielding against high energy line breaks, and they provide missile barriers (internally or externally generated). They also meet 10 CFR 54.4(a)(3) because they contain SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 2 UFSAR, Section 3.8.4.1.2, Safeguards Area
- BVPS Unit 2 UFSAR, Section 3.8.4.1.3, Main Steam Valve and Cable Vault Area
- BVPS Unit 2 UFSAR, Section 3.8.4.1.4, Fuel and Decontamination Building
- BVPS Unit 2 UFSAR, Section 3.8.4.1.9, Service Water Valve Pit
- BVPS Unit 2 UFSAR, Section 3.8.4.1.10, Primary Demineralized Water Tank Enclosure

- BVPS Unit 2 UFSAR, Section 3.8.4.1.13, Refueling Water Storage Tank and Chemical Addition Tank Enclosure

Components Subject to AMR

The component types that require aging management review and were not assessed in a structural commodity group are indicated in Table 2.4.2.10-1. The aging management review results for these components are provided in Table 3.5.2-11, Containment, Structures, and Component Supports – Safeguards Building – Summary of Aging Management Evaluation.

**Table 2.4.2.10-1**
**Safeguards Building**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Concrete at Expansion/Grouted Anchors in Air | Structural/Functional Support |
| Concrete in Air | Fire Barrier<br>Flood Protection<br>Heat Sink<br>Missile Barrier<br>Shelter/Protection<br>Structural/Functional Support |
| Concrete in Soil Above the Ground Water Table | Flood Protection<br>Heat Sink<br>Missile Barrier<br>Shelter/Protection<br>Structural/Functional Support |
| Door | Fire Barrier<br>Flood Protection<br>HELB Shielding<br>Missile Barrier |
| Expansion/Grouted Anchors in Air | Structural/Functional Support |
| Polymer in Air | Flood Protection<br>HELB Shielding |
| Polymer in Soil Above the Ground Water Table | Flood Protection |
| Structural Steel in Air | Flood Protection<br>Missile Barrier<br>Pipe Whip Restraint<br>Pressure Boundary<br>Structural Support for NSR<br>Structural/Functional Support |
| Structural Steel in Treated Water, Less Than 140 deg F | Pressure Boundary<br>Structural/Functional Support |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.4.2.11 Turbine Building

Structure Description

For the purpose of license renewal, this section includes the following buildings:

- Unit 1 Turbine Building
- Unit 2 Turbine Building
- Unit 1 Water Treatment Building

The Unit 1 Turbine Building is located adjacent to, and north of, the Unit 1 Service Building and adjacent to, and east of, the Unit 1 Water Treatment Building. It is approximately 135 feet by 275 feet by 113 feet high. The Turbine Building and major equipment, including the turbine generator, are supported on reinforced concrete spread footings and foundation mats. The ground floor is a reinforced concrete slab. The mezzanine and operating floors consist of partial area platforms of steel grating or reinforced concrete supported by steel framing. The Turbine Building is steel framed. The building is enclosed with insulated metal siding and roof deck. The Unit 1 Turbine Building is not a Seismic Category I Structure.

The Unit 2 Turbine Building is located adjacent to, and south of, the Unit 2 Auxiliary and Service Buildings and adjacent to, and east of, the Unit 2 Waste Handling Building. It is approximately 135 by 275 by 115 feet high. The Turbine Building and major equipment, including the turbine generator, are supported on reinforced concrete spread footings and foundation mats. The ground floor is a reinforced concrete slab. The mezzanine floor consists of partial area platforms of steel grating or reinforced concrete supported by steel framing. The operating floor is a reinforced concrete slab supported by steel framing. The Turbine Building is steel framed. The building is enclosed with insulated metal siding and roof deck. The Turbine Building steel frame is designed to remain in place with the siding blown off during a tornado. The Unit 2 Turbine Building is a non-Seismic Category I structure.

The Unit 1 Water Treatment Building is a two story structural steel building supported on a reinforced concrete foundation. It is approximately 58 feet by 135 feet by 48 feet high. It is enclosed with insulated metal siding and covered with a built up roofing system. It is located directly adjacent to, and west of, the Unit 1 Turbine Building. It is also directly adjacent to, and north of, the Unit 1 Service Building. The Unit 1 Water Treatment Building is not a Seismic Category I Structure.

These structures meet 10 CFR 54.4(a)(2) because they provide structural and/or functional support to non safety related components whose failure could prevent satisfactory accomplishment of any of the required safety-related functions. They also meet 10 CFR 54.4(a)(3) because they contain SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Appendix B, Seismic Design
- BVPS Unit 1 UFSAR, Revision 20, Figure 1.2-1, Site Plan
- BVPS Unit 1 UFSAR, Revision 20, Section 2.3.3, Floods and Dam Failure Upstream
- BVPS Unit 1 UFSAR, Revision 20, Section 2.7.2.2, Structures and Systems Requiring Protection
- BVPS Unit 1 UFSAR, Revision 20, Table B.1-1, Structures and Systems Requiring Design for Seismic Loading

- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.1.19, Turbine Building
- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.4.1.16, Waste Handling Building
- BVPS Unit 2 UFSAR, Revision 12, Section 3.8.4.1.17, Condensate Polishing Building

Components Subject to AMR

The component types that require aging management review and were not assessed in a structural commodity group are indicated in Table 2.4.2.11-1. The aging management review results for these components are provided in Table 3.5.2-12, Containment, Structures, and Component Supports – Turbine Building – Summary of Aging Management Evaluation.

**Table 2.4.2.11-1**
**Turbine Building**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Block Wall in Air | Structural Support for NSR |
| Concrete at Expansion/Grouted Anchors in Air | Structural Support for NSR |
| Concrete in Air | Fire Barrier<br>Structural Support for NSR |
| Concrete in Soil Above the Ground Water Table | Structural Support for NSR |
| Door | Fire Barrier |
| Expansion/Grouted Anchors in Air | Structural Support for NSR |
| Siding in Air | NSR Functional Support |
| Structural Steel in Air | Structural Support for NSR |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

## 2.5 SCOPING AND SCREENING RESULTS FOR ELECTRICAL AND INSTRUMENTATION AND CONTROLS

The determination of electrical systems within the scope of license renewal was made by initially identifying Beaver Valley Power Station electrical systems and their design functions. Each

system was then reviewed to determine those that satisfy one or more of the criteria contained in 10 CFR 54.4. This process is described in Section 2.1 and the results of the electrical systems review are included in Section 2.2. Section 2.1 also provides the methodology for determining the components within the scope of 10 CFR 54.4 that meet the requirements contained in 10 CFR 54.21(a)(1). The components that meet these screening requirements are identified in this section. These identified components require an aging management review for license renewal.

The results include the following electrical items:

- 120 VAC Distribution and Lighting System (2.5.1)
- 125 VDC Distribution System (2.5.2)
- 480 Volt Station Service System (2.5.3)
- 4KV Station Service System (2.5.4)
- Annunciator System (2.5.5)
- ATWS Mitigating System Actuation Circuitry (AMSAC) (2.5.6)
- Containment Electrical Penetrations (2.5.7)
- Electric Heat Tracing System (2.5.8)
- Electrical Busbars (2.5.9)
- Electrical Cables and Connections (2.5.10)
- Electrical Grid System (2.5.11)
- ERF Communications System (2.5.12)
- Incore Instrumentation System (2.5.13)
- Plant Process Control System (2.5.14)
- Plant Safety Monitoring System (2.5.15)
- Reactor Control and Protection System (2.5.16)
- Reactor Excore Instrumentation System (2.5.17)
- Station Communications System (2.5.18)

### 2.5.1 120 VAC Distribution and Lighting System

System Description

The 120 VAC Distribution and Lighting System is composed of various equipment that distributes 120 VAC power to its loads. This distribution equipment includes emergency and normal uninterruptible power systems (UPS), emergency and normal distribution panels, which consist primarily of a 480 VAC feeder breaker, step down transformer and the distribution panel, and normal and emergency lighting panels. The remaining distribution panels consist essentially of a step down transformer and a distribution panel. Some of the lighting panels are equipped with a 125 VDC backup power supply.

UPS 1-1, 1-2, 1-3 and 1-4 (Vital Buses) are Quality Assurance (QA) Category I and include two AC feeds and a DC feed. Upon loss of the AC supply, the inverter will operate off of the DC supply for at least two hours, which provides an uninterrupted 120 VAC, supply to the connected

loads. UPS 1-5 is QA Category II and primarily supplies the plant computer equipment. UPS 2-1, 2-2, 2-3 and 2-4 (Vital Buses) are QA Category I and include two AC feeds and a DC feed. Upon loss of the AC supply, the inverter will operate off of the DC supply for at least two hours, which provides an uninterrupted 120 VAC, supply to the connected loads. UPS 2-5 and 2-6 are QA Category II.

The 120 VAC Distribution and Lighting System meets 10 CFR 54.4(a)(1) because it provides 120 VAC power to the various safety-related and nonsafety-related plant loads, it provides UPS power to safety related loads, it provides electrical protection for the 120 VAC System by devices which will selectively isolate portions of the system if an over current condition is detected, and it provides normal and emergency 120 VAC distribution, consisting of a step down transformer and its associated distribution panels. The system also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), Anticipated Transients Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 8.5.4, 120 V A-C Vital Bus System
- BVPS Unit 1 UFSAR, Revision 20, Section 8.4.4, Lighting System

- BVPS Unit 2 UFSAR, Revision 12, Section 8.3.1.1.1, AC Power Systems - System Structure (Network)
- BVPS Unit 2 UFSAR, Revision 12, Section 8.3.1.1.17, AC Power Systems - 120 V AC Vital Bus Uninterruptible Power Supply System
- BVPS Unit 2 UFSAR, Revision 12, Section 9.5A.1.2.3.1.14, Fire Hazards Analysis - Electrical Systems

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections. No other components in this system are subject to aging management review.

### 2.5.2 125 VDC Distribution System

System Description

The primary purpose of the 125 VDC System at Units 1 and 2 is to ensure continuous 125 VDC power is available for the plant equipment to perform its required functions. The Unit 1 125 VDC Distribution System consists of five lead-acid batteries, battery chargers and associated battery breakers and distribution switchgear. The Unit 2 system consist of six lead-acid batteries, four static chargers (with a fifth charger available as a spare), two rectifier/chargers and

associated battery breakers and distribution switchgear. Certain DC Buses provide power to plant emergency equipment while others provide power to various non-safety related equipment.

DC Buses 1-1, 1-2, 1-3, and 1-4 are QA Category I, which provide power to plant emergency equipment, while DC Bus 1-5 is QA Category II, which provides power to various non-safety related equipment. DC Buses 2-1, 2-2, 2-3, and 2-4 are QA Category I while DC Bus 2-5 and 2-6 are QA Category II.

The 125 VDC Distribution System meets 10 CFR 54.4(a)(1) because DC buses provide 125 VDC power to safety-related loads and electrical protection for the 125 VDC System is provided by devices which will selectively isolate portions of the system if an overcurrent condition is detected. The system also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 8.5.3, Electrical Systems - 125 V D-C Power Systems

- BVPS Unit 2 UFSAR, Revision 12, Section 8.3.2, DC Power Systems

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections. No other components in this system are subject to aging management review.

### 2.5.3 480 Volt Station Service System

System Description

The 480 VAC Station Service System consists of ten (eight in Unit 2) 480 VAC substations fed through transformers from various 4160 VAC buses. Two of the ten (two of eight in Unit 2) substations are referred to as emergency substations, and are fed from the emergency 4160 VAC buses. The substations are further divided into a total of seventeen (fourteen in Unit 2) buses. Two of the buses are referred to as emergency 480 VAC buses.

The substation buses supply power, through air circuit breakers, directly to large 480 VAC motors and heaters, and through motor control centers, to smaller 480 VAC loads. There are fifty-seven (forty-six in Unit 2) 480 VAC motor control centers, fourteen (fifteen in Unit 2) of which are emergency 480 VAC motor control centers and are powered from the emergency buses.

The 480 VAC Station Service System meets 10 CFR 54.4(a)(1) because it provides the means for ensuring the availability of power to vital buses, it supplies 480 VAC electrical power to station battery chargers, it provides electrical power to emergency substations, electrical protection for the 480V System is provided by devices which will selectively isolate portions of the system if an over-current condition is detected, and the system provides undervoltage protection intended to prevent damage to rotating machinery. The system also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Station Blackout (10 CFR 50.63) (including Station Blackout recovery).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 8.4.5, Emergency Response Facility Power Station
- BVPS Unit 1 UFSAR, Revision 20, Section 8.5.4, 120 V A-C Vital Bus System
- BVPS Unit 1 UFSAR, Revision 20, Section 8.4.3, Station Service Systems - 480V System

- BVPS Unit 2 UFSAR, Revision 12, Section 8.3.1.1.3, AC Power Systems - Loads Supplied From Each Bus

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections. No other components in this system are subject to aging management review.

### 2.5.4 4KV Station Service System

System Description

The 4KV Station Service System is a three phase, grounded neutral system which consists of four normal buses, two Class 1E emergency buses, System Station Service Transformers (SSSTs), and Unit Station Service Transformers (USSTs). The Class 1E emergency buses are normally powered from 4160 V Buses. After a loss of normal AC electrical power the Class 1E emergency buses are powered from their respective diesel generators.

The normal 4KV buses distribute electrical power to the various non-safety related 4KV loads. Each normal 4KV bus has two supply breakers; one breaker ties the bus to the System 138 KV bus and the other breaker ties the bus to the Unit 22 KV electrical supply.

When the Main Generator is shutdown, the 4160 V normal buses are electrically powered from the SSSTs. When the Main Generator is operating, the 4160 V normal buses are powered from the USSTs.

The 4KV Station Service System meets 10 CFR 54.4(a)(1) because it provides highly reliable 4160 VAC electrical power to the various safety-related Class 1E electrical loads connected to the two safety-related buses during both normal and postulated accident conditions, electrical protection for the 4KV System is provided by devices which will selectively isolate portions of the system if an over-current condition is detected, the system provides undervoltage protection intended to prevent damage to rotating machinery, and it strips selected electrical loads under accident conditions for containment isolation. The system also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Station Blackout (10 CFR 50.63) (including Station Blackout recovery).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 8.4.2, Station Service Systems - 4,160 V System

- BVPS Unit 2 UFSAR, Revision 12, Section 8.3.1, Onsite Power Systems - AC Power Systems

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections. No other components in this system are subject to aging management review.

### 2.5.5 Annunciator System

System Description

The Annunciator System is only in scope for Unit 2.

The Unit 2 Annunciator System provides the electrical separation between the field sensors and the Annunciator System components. Electrical separation is provided by isolation relays located in the Annunciator Isolation Cabinets. The Annunciator System is designed to provide dual functions utilizing only one set of field trouble contacts. The first function is to provide termination means, field interrogation power, and inputs to the plant computer system. The second function of the Annunciator System is to monitor the field inputs and provide visual and audible indications of field contact status to the control room personnel.

The Unit 2 Annunciator System meets 10 CFR 54.4(a)(1) because electrical separation between safety-related power supplies and non-safety-related components is provided by isolation relays.

Additional information can be found in the following UFSAR sections:

- None

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections. No other components in this system are subject to aging management review.

### 2.5.6 ATWS Mitigating System Actuation Circuitry (AMSAC)

System Description

The Anticipated Transient Without Scram (ATWS) Mitigating System Actuation Circuitry (AMSAC) is a Unit 1 system. AMSAC components exist for Unit 2 but are included in the Reactor Control and Protection Systems (Section 2.5.16). The basic function of AMSAC is to provide adequate assurance that the Reactor Coolant System will not be subject to potential damage as a result of overpressure in the event of an ATWS with a coincident loss of feedwater.

AMSAC meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Anticipated Transients Without Scram (10 CFR 50.62).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 7.2.2.3.6, Specific Control and Protection Interaction – Anticipated Transients Without Scram (ATWS) Mitigating System Actuation Circuitry (AMSAC)
- BVPS Unit 1 UFSAR, Revision 20, Section 7.2.1.1.10, Anticipated Transient Without Scram (ATWS) Mitigating System Actuation Circuitry (AMSAC)

- BVPS Unit 2 UFSAR, Revision 12, Section 4.3.1.7, Anticipated Transients Without Trip

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections. No other components in this system are subject to aging management review.

### 2.5.7 Containment Electrical Penetrations

Note: The Containment System contains components subject to aging management review that are mechanical, structural, or electrical in nature. The electrical items are accounted for here (Section 2.5.7), the structural components are accounted for in Section 2.4.2.4 (Containment System Structural Components), and the mechanical components are accounted for in Section 2.3.3.13 (Containment System).

System Description

Containment Electrical Penetrations provide a leak-tight method for electrical conductors to pass power, control, and instrumentation signals through the containment boundary. Electrical conductors penetrating the reactor containment vary in size. Each penetration group passes through 8-inch or 12-inch diameter pipe sleeves at Unit 1, and through 12-inch or 18-inch sleeves at Unit 2.

The Containment Electrial Penetrations meet 10 CFR 54.4.(a)(1) because they provide a leak-tight method for electrical conductors to pass through the containment boundary and because they provide electrical conductors to pass power and control and instrumentation signals through the containment boundary. They also meet 10 CFR 54.4(a)(3) because they contain SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Environmental Qualifications (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 5.2.4.8, Penetration Design and Thermal Testing
- BVPS Unit 2 UFSAR, Revision 12, Section 8.3.1.1.16.5, Containment Electrical Penetrations

Components Subject to AMR

The Containment Electrical Penetrations component types that require aging management review and their intended functions are indicated in Table 2.5.7-1 below. The aging management review results for these components are provided in Table 3.6.2-1, Electrical and Instrumentation and Controls – Containment Electrical Penetrations – Summary of Aging Management Evaluation.

**Table 2.5.7-1**
**Containment Electrical Penetrations**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Non-environmentally Qualified Electrical Penetration | Electrical Continuity<br>Pressure Boundary |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.5.8 Electric Heat Tracing System

System Description

The primary function of the Heat Tracing System and components is to prevent boron precipitation in piping and components containing concentrated boric acid solutions and to prevent other piping and components from freezing. This function is performed by electrical heating elements that are in contact with the susceptible piping components. Heat traced components are also normally insulated.

The Heat Tracing System meets 10 CFR 54.4(a)(1) because it provides a source of heat to various safety-related and non safety-related system flow paths to prevent boric acid precipitation and /or to prevent the fluid in the piping system from freezing. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 8.5.2.8, A-C Emergency Power System - Electric Heat Trace
- BVPS Unit 2 UFSAR, Revision 12, Section 8.3.1.1.3, AC Power Systems - Loads Supplied From Each Bus

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections. No other components in this system are subject to aging management review.

### 2.5.9 Electrical Busbars

System Description

The Electrical Busbars commodity evaluation addressed all BVPS Unit 1 and 2 busbars. These busbars fall into two categories, phase bus and switchyard bus.

Phase bus is bus that is enclosed and not part of an active component such as switchgear, load centers, or motor control centers. There are typically four types of phase bus:

- Isolated Phase Bus
- Non-Segregated Phase Bus
- Phase Bus Enclosed in a Vault
- Segregated Phase Bus

The only passive, long-lived phase bus within the scope of license renewal for BVPS is Non-Segregated Phase Bus. Non-Segregated Phase Bus is electrical bus constructed with all phase conductors (bus bar) in a common metal enclosure without barriers. This Non-Segregated Phase Bus exists at BVPS, Unit 2 only. The phase bus is between the 4160V/480V transformers and 480-volt unit substations.

Switchyard Bus is an uninsulated, unenclosed, rigid, electrical conductor used in switchyards and switching stations to connect two or more elements of an electrical power circuit such as disconnect switches and transmission conductors. It is supported by steel structures on footings. The evaluation of the switchyard bus includes the bus itself and the hardware used to connect to other components. The structures and footings supporting the bus are evaluated in structural evaluations. Insulators supporting the bus are associated with station blackout and recovery and are accounted for in Section 2.5.11, Electrical Grid System.

The Electrical Busbars meet 10 CFR 54.4(a)(1) because Non-Segregated Phase Bus provides power to emergency 480 VAC substations at Unit 2 required to safely shut down the plant. They also meet 10 CFR 54.4(a)(3) because they are relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), Anticipated Transients Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 19, Section 8.1,General Description and Summary
- BVPS Unit 1 UFSAR, Revision 20, Section 8.4.2, Station Service Systems-4160 V System

- BVPS Unit 2 UFSAR, Revision 12, Section 8.1.4, Transmission System at the Site
- BVPS Unit 2 UFSAR, Revision 12, Section 8.2.1, Offsite Power System

Components Subject to AMR

The Electrical Busbars component types that require aging management review and their intended functions are indicated in Table 2.5.9-1 below. The aging management review results for these components are provided in Table 3.6.2-2, Electrical and Instrumentation and Controls – Electrical Busbars – Summary of Aging Management Evaluation.

**Table 2.5.9-1**
**Electrical Busbars Commodity**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Non-Segregated Bus (Unit 2) | Electrical Continuity |
| Switchyard Bus and Connections | Electrical Continuity |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.5.10 Electrical Cables and Connections

System Description

The Electrical Cables and Connections commodity evaluation addressed all documented electrical cables and connections at BVPS Units 1 and 2. Cables and connections were identified through a review of the design, procurement and as-built information, resulting in a list of cable and connector manufacturers and types at BVPS.

An evaluation published by the Department of Energy (DOE), SAND96-0344, dated September 1996, "*Aging Management Guideline for Commercial Nuclear Power Plants – Electrical Cable and Terminations,"* provides a comprehensive compilation and evaluation of information on the topic of insulated cables and connections. The information, evaluations and conclusions contained in that guideline were used in this review.

An insulated cable is an assembly of a single electrical conductor (wire) with an insulation covering or a combination of conductors insulated from one another with overall jackets. Cable connections are used to connect the cable conductors to other cables or electrical devices. Types of cable connections (or terminations) are listed below.

- Compression Connectors
- Fusion Connectors
- Plug-in Connectors
- Splice Insulation Systems (heat-shrink or tape)
- Terminal Blocks

Insulated cable connections may be used in combinations such as a compression or fusion connection inside a plug-in connector.

The cables and connections internal to enclosures are also considered a part of the scope of this evaluation. However, some cables terminate at a connector which directly connects with and is considered part of the end device (e.g., the pressurizer heater cable connectors). Such connectors are not within the scope of this evaluation.

Low voltage power electrical containment penetrations provide an electrical connection between two sections of the Electrical/I&C circuit. The pigtail at each end of the penetration is connected to the field cable in various ways. The connection method is included in this evaluation. The boundary for the electrical penetrations ends at the pigtail and is included in Section 2.5.7, Containment Electrical Penetrations.

Fuse holders for fuses that are not part of a larger, active assembly are also included in this evaluation.

The Electrical Cables and Connections meet 10 CFR 54.4(a)(1) and (3) because they provide electrical continuity to circuits involving electrical components that meet 10 CFR 54.4(a)(1) and (3).

Additional information can be found in the following UFSAR sections:

- None

Components Subject to AMR

The Electrical Cables and Connections component types that require aging management review and their intended functions are indicated in Table 2.5.10-1 below. The aging management review results for these components are provided in Table 3.6.2-3, Electrical and Instrumentation and Controls – Electrical Cables and Connections – Summary of Aging Management Evaluation.

**Table 2.5.10-1**
**Electric Cables and Connections**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Electrical Cables and Connections not Subject to 10 CFR 50.49 EQ Requirements | Electrical Continuity |
| Electrical Cables Used In Instrumentation Circuits For High Voltage, Low Current Circuits Not Subject to 10 CFR 50.49 EQ Requirements | Electrical Continuity |
| Inaccessible Medium-Voltage Cables (e.g., installed in conduit or direct buried) Not Subject to 10 CFR 50.49 EQ Requirements | Electrical Continuity |
| Electrical Connectors Not Subject to 10 CFR 50.49 EQ Requirements That Are Exposed To Borated Water Leakage | Electrical Continuity |

**Table 2.5.10-1**
**Electric Cables and Connections**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| Fuse Holders | Electrical Continuity |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.5.11 Electrical Grid System

System Description

This Electrical Grid System description discusses the BVPS bulk power supply system and the portion of the BVPS offsite power system used to provide "recovery" power for a Station Blackout (SBO) event.

The bulk power supply transmission system consists of 345KV and 138KV high voltage aerial distribution lines which transmit electric power between the various switching points and facilities comprising the transmission system.

BVPS Unit 1 and BVPS Unit 2 generators, six transmission lines, and three 345KV/138KV autotransformers are connected to the 345KV buses in the 345KV switchyard. Seven transmission lines are connected to the 138KV buses in the 138KV switchyard.

Reliable offsite power is available to supply BVPS Unit 1 station service and essential systems, since offsite power is supplied by two BVPS Unit 1 station service transformers, one from each bus of the 138KV switchyard.

The path that is used to connect the plant to the offsite power system typically includes the switchyard circuit breakers that connect to the offsite power system transformers (startup transformers), the transformers themselves, the intervening overhead or underground circuits between circuit breaker and transformer, onsite electrical distribution system, and the associated control circuits and structures. The offsite power system passive, long-lived structures and components that are part of this circuit path, required to support the recovery of offsite power, are subject to an aging management review.

For Unit 1, two station service lines connect to the plant via the 138KV switchyard. These lines are connected to 138KV bus #1 and 138KV bus #2.

The line from 138KV bus #1 connects via a disconnect switch to breaker #92. From breaker #92 the line is connected through another disconnect switch to a switchyard bus structure, and transitions from the switchyard bus structure to an aerial transmission line. The transmission line then travels via transmission towers to a tower mounted disconnect switch, and is then connected to the primary side (138KV) of System Station Service Transformer #1A. The secondary sides

of System Station Service Transformer 1A (4.36KV) connects via a 5KV cable duct to 4160 volt bus #1A (via breaker # 41A) and 4160 volt bus #1B (via breaker # 141A).

The line from 138KV bus #2 connects via a disconnect switch to breaker #83. From breaker #83, the line is connected through another disconnect switch to a switchyard bus structure, and transitions from the switchyard bus structure to an aerial transmission line. The transmission line then travels via transmission towers to a tower mounted disconnect switch, and is then connected to the primary side (138KV) of System Station Service Transformer #1B. The secondary side of System Station Service Transformer 1B (4.36KV) connects via a 5KV cable duct to 4160 volt bus #1C (via breaker # 241B) and 4160 volt bus #1D (via breaker # 341B).

For Unit 2, offsite power is supplied to the two independent, redundant onsite power systems by two system station service transformers, each powered from a different bus of the 138KV switchyard.

The line from 138KV bus #1 connects via a disconnect switch to breaker #94. From breaker #94 the line is connected to a switchyard bus structure, and transitions from the switchyard bus structure to an aerial transmission line. The transmission line then travels via transmission towers to a tower mounted disconnect switch, and is then connected to the primary side (138KV) of System Station Service Transformer #TR-2B. The secondary sides of System Station Service Transformer # TR-2B (4.36KV) connects via a 5KV cable duct to 4160 volt bus #2C (via breaker # 242B) and 4160 volt bus #2D (via breaker # 342B).

The line from 138KV bus #2 connects via a disconnect switch to breaker #85. From breaker #85, the line is connected through another disconnect switch to a switchyard bus structure, and transitions from the switchyard bus structure to an aerial transmission line. The transmission line then travels via transmission towers to a tower where the line is split and serves both Midland line #Z30 and BVPS Unit 2 System Station Service Transformer #TR-2A. The BVPS Unit 2 transmission line continues via transmission towers to a tower mounted disconnect switch, and is then connected to the primary side (138KV) of System Station Service Transformer #TR-2A. The secondary side of System Station Service Transformer #TR-2A (4.36KV) connects via a 5KV cable duct to 4160 volt bus #2A (via breaker # 42A) and 4160 volt bus #2B (via breaker # 142A).

The above described offsite power components and structures are included in the scope of license renewal to support the "recovery" portion of the SBO LR review.

The Electrical Grid System meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Station Blackout (10 CFR 50.63) (Station Blackout recovery, in particular, for this system).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 8.3, System Interconnections

- BVPS Unit 1 UFSAR, Revision 20, Figure 8.3-1, Electrical Interconnections Switchyard – Power Station

- BVPS Unit 2 UFSAR, Revision 12, Section 8.1.4, Transmission System at the Site
- BVPS Unit 2 UFSAR, Revision 12, Figure 8.1-2, Electrical Interconnections

Components Subject to AMR

The Electrical Cables and Connections in this system are subject to aging management review and are evaluated in Section 2.5.10, Electrical Cables and Connections. Busbars in this system are subject to aging management review and are evaluated in Section 2.5.9, Electrical Busbars. The other Electrical Grid System component types that require aging management review and their intended functions are indicated in Table 2.5.11-1 below. The aging management review results for these components are provided in Table 3.6.2-4, Electrical and Instrumentation and Controls – Electrical Grid System – Summary of Aging Management Evaluation.

**Table 2.5.11-1**
**Electrical Grid System**
**Component Types Subject to Aging Management Review**

| Component Type | Intended Functions* |
|---|---|
| High Voltage Insulator | Electrically Insulate |
| Transmission Conductors | Electrical Continuity |
| Steel Transmission Towers and Poles | Structural Support for NSR |
| Wooden Transmission Towers | Structural Support for NSR |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

### 2.5.12 ERF Communications System

System Description

The Emergency Response Facility (ERF) Communications System utilizes the public telephone system as the primary means of communications with agencies and support groups in the surrounding communities and off-duty Beaver Valley Power Station personnel. Other communications systems are described below. This system description mainly applies to those portions that are located outside the protected area.

The Private Automatic Exchange (PAX) System has the capability for calling on the public telephone network. A digital switchboard is located in the ERF. The Mobile Radio System operates on the VHF band, with base and portable transceiver units. It is the primary communication system for the Emergency Preparedness Plan (EPP) monitoring units and some offsite support groups, and serves as a backup for the direct line and the PAX System.

The page party system is used to contact and communicate with onsite personnel. Voice paging system desktop handsets are located in the Technical Support Center (TSC) and the Emergency Operating Facility (EOF) for the purpose of notification or paging personnel within the ERF Building.

Emergency direct line telephones located in the EOF are provided for use in an emergency situation for direct communications with the Control Room and other locations indicated at each telephone. Two additional communications circuits are located in the ERF. These are the radiological assessment (Radcon) and Operational Control (Ops) circuits.

The ERF also includes several other separate and completely independent telephone "hotline" systems to provide direct communications with several offsite agencies.

The ERF Communications System meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48).

Additional information can be found in the following UFSAR sections:

- None

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections. No other components in this system are subject to aging management review.

### 2.5.13 Incore Instrumentation System

System Description

The Incore Instrumentation System consists of 51 thermocouples at fixed core outlet positions to measure fuel assembly coolant outlet temperature and 50 incore axial flux thimbles into which detectors can be positioned at the center of certain fuel assemblies anywhere along the length of the fuel assembly vertical axis. The thermocouples are installed within selected guide tubes, which penetrate the reactor vessel head and terminate at the exit flow end (top) of the selected fuel assemblies. In Unit 1, four of the incore thermocouples have the capability to have their signals transferred to the backup indicating panel.

The Incore Instrumentation System meets 10 CFR 54.4(a)(1) because it provides core temperature indication. It also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Environmental Qualification (10 CFR 50.49).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 7.7.1.9, Unit Control Systems - Incore Instrumentation
- BVPS Unit 1 UFSAR, Revision 20, Section 3.4.5.1, Reactor - Incore Instrumentation

- BVPS Unit 2 UFSAR, Revision 12, Section 4.4.6.1, Thermal and Hydraulic Design - Incore Instrumentation
- BVPS Unit 2 UFSAR, Revision 12, Section 7.7.1.9, Control Systems Not Required for Safety – Incore Instrumentation

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections. No other components in this system are subject to aging management review.

### 2.5.14 Plant Process Control System

System Description

The elements of the Plant Process Control System include the cabinets which house the electronic process control and protection instrumentation components used to provide reactor protection, control of the various plant processes, and indication of various plant parameters. The actual instrumentation components are included in the specific mechanical system included in the component mark number. Since the rack power supplies used in the process control instrumentation system provide power for numerous instrumentation channels covering many systems, these power supplies are included as part of the Plant Process Control System.

The Plant Process Control System meets 10 CFR 54.4(a)(1) because it provides the power necessary for the instrumentation channels to properly perform their control and/or protective function, and it provides for the proper mounting and housing of nearly all plant process electronic instrumentation components. The system also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), Anticipated Transients Without Scram (10 CFR 50.62), and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- None

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections.

The cabinets in this system are evaluated in Section 2.4.2.3, Component Supports. No other components in this system are subject to aging management review.

### 2.5.15 Plant Safety Monitoring System

System Description

The Plant Safety Monitoring System (PSMS) only exists in Unit 2. The PSMS is a dual train processing and display system for operational and post-accident monitoring of critical plant parameters. The system receives inputs from a variety of plant instrumentation sources, performs the required processing, and then displays the results on either of two plasma display screens. Selected data from PSMS is also sent to the Main Control Board, the Plant Computer System, and the Emergency Response Facility Computer System.

The PSMS is a modular system consisting of three major types of the following number of subunits: five Remote Processing Units (RPUs), two Database Processing Units (DPUs), and two Plasma Display Modules (PDM). Each plasma display module consists of a display chassis and a separate keyboard.

The PSMS meets 10 CFR 54.4(a)(1) because it functions to provide a modular, microprocessor-based instrumentation system for the operational and post accident monitoring of critical plant parameters.

Additional information can be found in the following UFSAR sections:

- BVPS Unit 2 UFSAR, Revision 12, Section 7.7.2.10, Plant Safety Monitoring System

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections. No other components in this system are subject to aging management review.

### 2.5.16 Reactor Control and Protection System

System Description

The Reactor Control and Protection Systems provide for the safe regulation of the nuclear reaction used to generate electric power. The Reactor Protection System (RPS) constantly monitors the process control and excore instrumentation systems for abnormal or unsafe conditions and automatically terminates the fission reaction by inserting (tripping) the reactor control rod clusters. The system uses sensors that monitor various unit parameters. The system also contains the digital logic circuitry necessary to automatically open the reactor trip breakers. The digital circuitry consists of two redundant logic trains, which receive input from the analog protection channels. Subsystems of the Reactor Protection System are:

- Reactor Trip Subsystem
- Engineered Safety Features Actuation Subsystem
- Miscellaneous Reactor Protection Actuations
- Protective System Interlocks
- Protective System Inputs

The Reactor Control System provides the necessary equipment to automatically or manually control the fission reaction in response to reactor coolant temperature changes. Subsystems of the Reactor Control System are:

- Automatic Reactor Control
- Full-Length Rod Control System
- Reactor Control System Interlocks

Two separate Rod Position Indication Systems have been provided to sense and display the rod position within the core. Alarms are also provided. Subsystems of the Rod Position Indication System are:

- Rod Position Indication System (analog for Unit 1, digital for Unit 2)
- Demand Position Indication System
- Control Bank Rod Insertion Monitoring
- Rod Deviation Alarm

For Unit 2, the ATWS Mitigating System Actuation Circuitry (AMSAC) serves as a nonsafety-related backup to the Reactor Protection System (RPS) for a loss of feedwater accidents with no protective action taken by the RPS. For Unit 1, AMSAC is a separate system and is covered in Section 2.5.6.

The Reactor Control and Protection Systems meets 10 CFR 54.4(a)(1) because it provides the capability of either automatically or manually tripping the reactor and it provides signals to actuate the Engineered Safety Features components to mitigate accidents or transients. The system also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Anticipated Transients Without Scram (10 CFR 50.62).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 1.3.2.3, General Design Criteria - Nuclear and Radiation Controls
- BVPS Unit 1 UFSAR, Revision 20, Section 7.2, Reactor Trip System
- BVPS Unit 1 UFSAR, Revision 20, Section 7.7, Unit Control Systems

- BVPS Unit 2 UFSAR, Revision 12, Section 4.3.1.7, Anticipated Transients Without Trip
- BVPS Unit 2 UFSAR, Revision 12, Section 7.1.2.1.1, Reactor Trip System

- BVPS Unit 2 UFSAR, Revision 12, Section 7.7.1, Reactor Control and Rod Control

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections. No other components in this system are subject to aging management review.

### 2.5.17 Reactor Excore Instrumentation System

System Description

The primary function of the Reactor Excore Instrumentation System is to protect the reactor by monitoring the neutron flux and generating appropriate trips and alarms for various phases of the reactor operating and shutdown conditions. It also provides secondary control functions and indicates reactor status during startup and power operation. The system is capable of monitoring neutron flux leakage from the reactor from cold shutdown through 120% power in three overlapping detector ranges:

- Source Range
- Intermediate Range
- Power Range

The Source Range subsystem consists of two redundant channels, each with a BF3 proportional counter and associated electronics. The Intermediate Range subsystem also consists of two redundant channels, each with a compensated ion chamber and associated electronics. The Power Range subsystem consists of four redundant channels, each with a dual section uncompensated ion chamber and associated electronics.

The Reactor Excore Instrumentation Systems meets 10 CFR 54.4(a)(1) because it protects the reactor by monitoring neutron flux and generating appropriate reactor trip input signals to the Reactor Control and Protection System. The system also meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48), Environmental Qualification (10 CFR 50.49), and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 3.2.3.5, Reactivity Control System - Instrumentation Applications
- BVPS Unit 1 UFSAR, Revision 20, Section 7.2.1.1.1, Nuclear Overpower Trips

- BVPS Unit 2 UFSAR, Revision 12, Section 7.2.1.1.6, Reactor Trip System - Analog System

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections. No other components in this system are subject to aging management review.

### 2.5.18 Station Communications System

System Description

Four independent voice communications systems are provided for communications to outside agencies such as government agencies support groups and individuals. This system description mainly applies to those portions located inside the protected area. Separate systems are provided for onsite routine communications, general area alarms and dedicated communications for alternate safe shutdown capabilities.

The station utilizes the public telephone system as the primary communications system between BVPS, agencies, support groups in the community and off duty BVPS personnel. An Alternate Safe Shutdown Communications System utilizes several Private Automatic Exchange (PAX) phone line circuits of the Emergency Response Facility (ERF) switchboard to provide dedicated communications for alternate safe shutdown of the plant in the event of a normal PAX communications system failure due to a fire. This system is independent of BVPS PAX communications system. Thus a fire occurring in the control room, cable-spreading area, process instrument room or the communications equipment and relay room will not affect this system.

The Mobile Radio System operates on the VHF band with the base and portable transceiver units. It is the primary communications system for communication with the system Emergency Preparedness Plan (EPP) monitoring units and offsite support groups. The Mobile Radio System consists of a high band radio station and associated Handie-Talkies, and a low band, base radio station and associated Handie-Talkies and mobile emergency high band radio transceiver. The high band radio is used for all normal radio communications with the system operator. The low band radio is used as a backup in the event that the high band radio is unavailable.

The Page Party System is used to contact and communicate with the onsite personnel between the control room and another phone station or from phone station-to-phone station. It is the primary means of communications for directing plant activities including those associated with an emergency. The Page Party system also provides the annunciation throughout the plant of the Standby Alarm, the Evacuation Alarm and the Fire Alarm.

The Station Communications System meets 10 CFR 54.4(a)(3) because it contains SSCs relied upon in safety analyses or plant evaluations to perform a function that demonstrates compliance with regulations for Fire Protection (10 CFR 50.48) and Station Blackout (10 CFR 50.63).

Additional information can be found in the following UFSAR sections:

- BVPS Unit 1 UFSAR, Revision 20, Section 9.17, Auxiliary and Emergency System - Communications Systems

- BVPS Unit 2 UFSAR, Revision 12, Section 9.5.2, Other Auxiliary Systems - Communications Systems

Components Subject to AMR

The electrical cables and connections in this system are subject to aging management review. The cables in this system are evaluated in Section 2.5.10, Electrical Cables and Connections. No other components in this system are subject to aging management review.

# 3.0 AGING MANAGEMENT REVIEW

A listing of the acronyms used in this application is provided in Section 1.12.

This section provides the results of the aging management review for those structures and components identified in Section 2.0 as being subject to aging management review.

Descriptions of the internal and external service environments which were used in the aging management review to determine aging effects requiring management are included in Table 3.0-1, Service Environments for Aging Management Review. The environment titles used in the aging management reviews are listed in the Environment column.

The Aging Management Review (AMR) results information in Section 3 are presented in the following two tables:

- **Table 3.x.1** - where '**3**' indicates the LRA section number, '**x**' indicates the subsection number from NUREG-1801, Volume 1, and '**1**' indicates that this is the first table type in Section 3. For example, in the Reactor Coolant System subsection, this table would be number 3.1.1, in the Engineered Safety Features subsection, this table would be 3.2.1, and so on. For ease of discussion, this table will hereafter be referred to in this Section as "Table 1."

- **Table 3.x.2-y** - where '**3**' indicates the LRA section number, '**x**' indicates the subsection number from NUREG-1801, Volume 1, '**2**' indicates that this is the second table type in Section 3, and '**y**' indicates the system table number. For example, for the Reactor Vessel, within the Reactor Coolant System subsection, this table would be 3.1.2-3, and for the Reactor Vessel Internals, it would be table 3.1.2-4. For the Containment Depressurization System, within the Engineered Safety Features subsection, this table would be 3.2.2-1. For the next system within the ESF subsection, it would be table 3.2.2-2. For ease of discussion, this table will hereafter be referred to in this section as "Table 2."

## 3.0.1 TABLE DESCRIPTION

NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," contains the staff's generic evaluation of the existing plant programs. It documents the technical basis for determining where existing programs are adequate without modification, and where existing programs should be enhanced for the period of extended operation. The evaluation results documented in the report indicate that many of the existing programs are adequate to manage the aging effects for particular structures or components within the scope of license renewal without enhancement. The report also contains recommendations on specific areas for which existing programs should be enhanced for license renewal. In order to take full advantage of NUREG-1801, a comparison between the AMR results and the tables of NUREG-1801 has been made. The results of that comparison are provided in two tables, briefly introduced above and explained fully below.

### 3.0.1.1 Table 1 (FIGURE 3.0-1)

The purpose of Table 1 is to provide a summary comparison of how BVPS aligns with the corresponding tables of NUREG-1801, Volume 1. The table is essentially the same as Tables 1 through 6 provided in NUREG-1801, Volume 1, except that the "Type" column has been replaced by an "Item Number" column and the "Item Number in GALL" column has been replaced by a "Discussion" column.

The "Item Number" column provides the reviewer with a means to cross-reference from Table 2 to Table 1.

The "Discussion" column is used by BVPS to provide clarifying/amplifying information. The following are examples of information that might be contained within this column:

- "Further Evaluation Recommended" information or reference to where that information is located (including a hyperlink if possible)
- The name of a plant specific program being used (and a hyperlink to the program if possible)
- Exceptions to the NUREG-1801 assumptions
- A discussion of how the line is consistent with the corresponding line item in NUREG-1801, Volume 1, when that may not be intuitively obvious
- A discussion of how the item is different than the corresponding line item in NUREG-1801, Volume 1, when it may appear to be consistent (e.g., when there is exception taken to an aging management program that is listed in NUREG-1801, Volume 1)

The format of Table 1 provides the reviewer with a means of aligning a specific Table 1 row with the corresponding NUREG-1801, Volume 1 table row, thereby allowing for the ease of checking consistency.

### 3.0.1.2 Table 2 (FIGURE 3.0-2)

Table 2 provides the detailed results of the aging management review for those structures and components identified in LRA Section 2 as being subject to aging management review. There will be a Table 2 for each of the subsystems within a "system" grouping. For example, for a PWR, the Engineered Safety Features System Group contains tables specific to Containment Depressurization, Residual Heat Removal, Safety Injection System, etc.

Table 2 consists of the following nine columns:

- Component Type
- Intended Function
- Material
- Environment
- Aging Effect Requiring Management
- Aging Management Programs
- NUREG-1801 Volume 2 Item

- Table 1 Item
- Notes

Component Type

The first column identifies all of the component types from Section 2 of the LRA that are subject to aging management review. They are listed in alphabetical order.

Intended Function

The second column contains the license renewal intended functions (including abbreviations where applicable) for the listed component types. Definitions and abbreviations of intended functions are contained in Table 2.0-1, Intended Function Definitions.

Material

The third column lists the materials of construction for the component type.

Environment

The fourth column lists the environment to which the component types are exposed. A description of these environments is provided in Table 3.0-1, Service Environments for Aging Management Review.

Aging Effect Requiring Management

As part of the aging management review process, BVPS determines any aging effects requiring management for the material and environment combination in order to maintain the intended function of the component type. These aging effects requiring management are listed in column five.

Aging Management Programs

The aging management programs used to manage the aging effects requiring management are listed in column six of Table 2.

NUREG-1801 Vol. 2 Item

Each combination of component type, material, environment, aging effect requiring management, and aging management program that is listed in Table 2 is compared to NUREG-1801, Volume 2, with consideration given to the standard notes, to identify consistencies. When they are identified, they are documented by noting the appropriate NUREG-1801, Volume 2 item number in column seven of Table 2. If there is no corresponding item number in NUREG-1801, Volume 2, "N/A" is entered in column seven. That way, a reviewer can readily identify where

there is correspondence between the plant specific tables and the NUREG-1801, Volume 2 tables.

Table 1 Item

Each combination of component, material, environment, aging effect requiring management, and aging management program that has an identified NUREG-1801 Volume 2 item number must also have a Table 3.x.1 line item reference number. The corresponding line item from Table 1 is listed in column eight of Table 2. If there is no corresponding item in NUREG-1801, Volume 1, "N/A" is entered in column eight. That way, the information from the two tables can be correlated.

Notes

In order to realize the full benefit of NUREG-1801, each applicant needs to identify how the information in Table 2 aligns with the information in NUREG-1801, Volume 2. This is accomplished through a series of notes. Note references with letters "A" through "J" are standard notes that will be the same from application to application throughout the industry. Notes with letters "K" through "V" provide further information for comparison with NUREG - 1801 for situations not specifically addressed by the standard industry notes. An explanation of the notes is provided following the last subsystem table of each system group.

## 3.0.2 TABLE USAGE

### 3.0.2.1 Table 1

The reviewer evaluates each row in Table 1 by moving from left to right across the table. Since the Component, Aging Effect/Mechanism, Aging Management Programs and Further Evaluation Recommended information is taken directly from NUREG-1801, Volume 1, no further analysis of those columns is required. The information intended to help the reviewer the most in this table is contained within the Discussion column. Here the reviewer will be given information necessary to determine, in summary, how the applicant's evaluations and programs align with NUREG-1801, Volume 1. This may be in the form of descriptive information within the Discussion column or the reviewer may be referred to other locations within the LRA for further information (including hyperlinks where possible/practical).

### 3.0.2.2 Table 2

Table 2 contains all of the aging management review information for the structures and components subject to aging management review, whether or not they align with NUREG-1801. For a given row within the table, the reviewer is able to see the intended function, material, environment, aging effect requiring management, and aging management program combination for a particular component type within a system. In addition, if there is a correlation between the combination in Table 2 and a combination in NUREG-1801, Volume 2, this will be identified by

a referenced item number in column seven, NUREG-1801, Volume 2 Item. The reviewer can refer to the item number in NUREG-1801, Volume 2, if desired, to verify the correlation. If the column is marked with an "N/A", BVPS was unable to locate an appropriately corresponding combination in NUREG-1801, Volume 2. As the reviewer continues across the table from left to right, within a given row, the next column is labeled Table 1 Item. If there is a reference number in this column, the reviewer is able to use that reference number to locate the corresponding row in Table 1 and see how the aging management program for this particular combination aligns with NUREG-1801. There normally is a hyperlink directly to the corresponding row in Table 1 as well.

Table 2 provides the reviewer with a means to navigate from the structures and components subject to aging management review (AMR) first listed in LRA Section 2 all the way through the evaluation of the programs that will be used to manage the effects of aging of those structures and components.

**Table 3.0-1 Service Environments for Aging Management Review**

| Environment | Description |
|---|---|
| Adverse Localized Environment Caused by Heat, Radiation, or Moisture in the Presence of Oxygen (Sheltered or Indoor) | Heat from temperatures as high as 105 deg F (containment) or 120 deg F (other areas).<br><br>Radiation as high as:<br><br>• 3.0E7 rads (Unit 1 containment)<br>• 2.6E7 rads (Unit 2 containment)<br>• 13.5E8 rads (Unit 2 Auxiliary Building harsh environments)<br>• 9.45E6 rads (Unit 1 Auxiliary Building)<br>• 4.5E6 rads (Unit 2 balance of Auxiliary Building)<br>• Lesser levels in various other areas<br><br>Moisture is defined as periodic exposure to moisture that lasts more than a few days (e.g., cable in standing water). |
| Adverse Localized Environment Caused by Moisture and Voltage Stress (Buried) | Applies to buried cables with an adverse localized environment caused by moisture (periodic exposure to moisture that lasts more than a few days (e.g., cable in standing water ) and voltage stress. Voltage stress is exposure to normal system voltage for more than 25% of the time. |
| Air | Air includes indoor and outdoor, air-conditioned and non air-conditioned atmospheres. Air is assumed to contain some humidity; however, significant amounts of condensation, pooling of water, or alternate wetting and drying do not occur. Air does not contain significant amounts of chloride, nor does salt spray occur. |
| Air, Moisture or Wetting, Temperature Less Than 140 deg F | This environment applies to components having a metal temperature below 140 deg F that may be wetted or subject to pooling of water, but are not located near brackish water or seawater, and are not subject to salt spray. |
| Air, Potential for Leaking Borated Water | This is the external environment for treated water systems containing borated water, such as PWR reactor coolant or chemical and volume control systems, that have a potential to develop leaks from flanged piping connection or other bolted connections. |

| Environment | Description |
|---|---|
| Air, Potential for Leaking Borated Water, Subject to Thermal Cycling | This environment is identical to Air, Potential for Leaking Borated Water, with the addition of thermal cycling that causes fatigue to be an AERM. This environment applies to components that do not have a wetted internal environment but are subject to operating temperatures above 212 deg F (e.g., support skirts for pressurizers are subjected to this environment). |
| Air, Relative Motion Between Components | This environment is identical to air with the addition of relative motion between components. Common sources of relative motion include flow-induced vibrations and differential thermal expansion during plant heat-up and cool-down. Wear caused by installation and removal of bolts, studs, or other fasteners is not considered an aging effect. |
| Air, Cyclic Loading | This environment is applied to components exposed to air, that are also subject to cyclic loading of sufficient magnitude for fatigue to be a concern. Components will typically be in direct contact with process piping or vessels of systems having a maximum internal temperature of 212 deg F or greater.<br><br>The fuel transfer tube enclosure bellows are subjected to thermal cycles associated with the flooding down of the fuel transfer canal and refueling cavity during refueling operations. The bellows are subject to a maximum temperature of 140 deg F. |
| Bolting, Potential for Exposure to Leaking Borated Water At Temperatures of 212 deg F or Greater | This environment applies to bolts and studs that experience operating temperatures of 212 deg F or greater and may be exposed to borated water leakage. |
| Buried | The buried environment consists of granular bedding material of sand or rock fines, backfill of dirt and rock, and filler material of crushed stone. Soil is assumed to contain levels of oxygen, moisture (including ground water), biological organisms, and contaminants. A buried environment may include such items as pipe, duct banks, and conduits. |
| Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than or Equal To 212 deg F | This environment applies only to pressure retaining bolting (bolts and studs) in fluid systems with temperatures greater than or equal to 212 deg F. |
| Dried Air or Gas | This environment includes the internal environment for systems whose internal fluid is air, nitrogen gas, hydrogen, carbon dioxide, or fluorocarbon refrigerant where the system features in-line driers that remove moisture. Air and refrigerants may be mixed with an oil lubricant. |
| Demineralized Untreated Water | For systems that use demineralized water that is not treated either with corrosion inhibitors or chemically treated to remove or add oxygen, the demineralized untreated water environment should be assigned. This type of water chemistry is only used in systems having water temperatures < 140 deg F. |

| Environment | Description |
|---|---|
| Exhaust | This environment applies to components exposed to hot diesel engine exhaust gasses containing moisture and particulates. |
| Exposure to Borated Water Leakage (Sheltered or Indoor) | This environment applies to cables and connections that may be exposed to borated water leakage. |
| Fuel Oil | This environment is diesel fuel oil. The fuel oil is assumed to be contaminated with some water or moisture. |
| Fuel Oil without Water Contamination | This environment is identical to "Fuel Oil" except there is no water contamination. |
| Lubricating Oil | This environment consists of oil used for lubrication of major rotating equipment, such as pumps, compressors, or diesel generator engines. |
| Lubricating Oil with Contamination | This environment consists of oil used for lubrication of major rotating equipment, such as pumps, compressors, or diesel generator engines. The oil can be contaminated with moisture from condensation. |
| Moisture, Temperature, Radiation | Applies to containment electrical penetrations.<br><br>Moisture.<br><br>Temperature as high as:<br>• 98.2 deg F (Unit 1 containment) or 105 deg F (Unit 2 containment)<br>• 84.5 deg F (Unit 1 cable vaults) or 88.5 deg F (Unit 2 cable vaults)<br><br>Radiation as high as:<br>• 6.0E4 rads (Unit 1 containment) or 1.5E5 rads (Unit 2 containment)<br>• 1.35E3 rads (Unit 1 cable vaults) or 1.5E3 rads (Unit 2 cable vaults) |
| Outdoor | The outdoor environmental conditions consists of air temperatures typically ranging from -5 deg F – 100 deg F, relative humidity from 0%-100%, and an average annual precipitation of approximately 39.85 inches. |
| Raw Water | Raw water includes all untreated water used in open-cycle cooling systems. The water source is natural water such as river water, well water, lake water, sea water and brackish water. The water is oxygenated and may contain aquatic life and microbes. The water is not treated to deoxygenate or inhibit corrosion, but biocides or chlorination may be applied to limit biofouling. All raw water is at temperatures less than 140 deg F.<br><br>The raw water environment can be caused by the uncontrolled water chemistry of sumps, drains, and tanks. For example, the containment sump collects water that is splashed, dripped or condensed in the containment and runs on the floor to the sump. As a result, this water contains many impurities that can promote MIC, pitting, crevice corrosion, galvanic corrosion, etc. |
| Raw Water, Low Flow | This environment is chemically identical to raw water, but has a flow rate of 6 ft/second or less. |

| Environment | Description |
|---|---|
| Raw Water, Low Flow, Relative Motion Between Components | This environment is identical to Raw Water, Low Flow with the addition of relative motion between components. Common sources of relative motion include flow-induced vibrations and differential thermal expansion during plant heat-up and cool-down. Wear caused by installation and removal of bolts, studs, or other fasteners is not considered an aging effect. |
| Sheltered<br><br>or<br><br>Sheltered (or Indoor) | The sheltered environment consists of indoor ambient conditions where components are protected from outdoor moisture. Conditions outside containment consists of normal room air temperatures ranging from 55 deg F to 120 deg F, and a relative humidity ranging from 0%-90%.<br><br>The sheltered environment atmosphere is an air environment with humidity. Components in systems with external surfaces temperatures the same or higher than ambient conditions are expected to be dry. Lack of a liquid moisture source in direct contact with a given component precludes the concern of external surface corrosion degradation of metallic components as an effect requiring aging management. |
| Soil, Above the Water Table | This is the external environment for all components buried in the earth located above the water table. This will be the environment for buried pipes and most other buried metal components. Soil is assumed to contain groundwater some of the time due to drainage of rainwater. Components in this environment are therefore subject to alternating wetting and drying conditions, but are not continuously immersed. |
| Soil, Below the Water Table | This environment applies to components buried in the earth located below the water table. Components in the soil, below the water table, environment will be continually immersed in wet soil that is essentially a mixture of soil and groundwater. The chemistry for the groundwater is essentially similar to raw water. |
| Steam Generator Secondary Side | This environment is specific to the external surfaces of PWR steam generator tubing. The environment is similar to Treated Water, Temperature Greater Than or Equal To 482 deg F. However, the transport of corrosion products from the secondary piping to the steam generator causes the accumulation of corrosion products on the secondary face of the tubesheet. The accumulated corrosion products form a “sludge pile” where contaminants, such as chlorides, sodium, and sulfate, can become concentrated far above levels in the bulk fluid. |
| Treated Water | All treated water environments share the following parameters. The water source is demineralized water that is chemically treated to remove oxygen. Corrosion inhibitors may be added to the water. Administrative limits are placed on dissolved oxygen and contaminants, and in some cases suspended solids. The concentration of contaminants is generally controlled by filtration, ion exchangers, or both, but other methods such as feed-and bleed (dilution) may be used to meet administrative limits. For reactor coolant, the maximum normal operating dissolved oxygen concentration is 200 ppb or less, and the maximum chloride, fluoride and sulfate concentrations during normal operation are 1000 ppb. The water may be borated. As an alternative, or in addition to controlling oxygen, some systems specify control of water conductivity. Treated water systems using conductivity control must limit the conductivity to 0.3 μS/cm or less during operation, except that systems with maximum operating temperatures of 140 deg F or less may limit conductivity to 1.0 μS/cm or less. |

| Environment | Description |
|---|---|
| Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | This environment includes, but is not limited to, PWR and BWR reactor coolant, and PWR and BWR main steam systems. |
| Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 1E17 n/sq. cm But Less Than 5E20 n/sq. cm | This environment is identical to Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, except that the fast neutron fluence (E Greater Than 1.0 MeV) will equal or exceed 1E17 n/sq. cm, but will not exceed 5E20 n/sq. cm during the component lifetime. This environment is generally found only in the beltline region of PWR reactor vessels and lower-fluence parts of PWR reactor vessel internals. |
| Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI Beltline Region) | This environment is identical to Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, except that the fast neutron fluence (E Greater Than or Equal To 1.0 MeV) will equal or exceed 5E20 n/sq. cm during the component lifetime. This environment is found only in the beltline regions of PWR reactor vessel internals. |
| Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI Beltline Region), Plus Preload | This environment is identical to Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm, with the addition of preload. Fasteners, such as bolts or studs, installed with specific torque values, are considered to be preloaded. Springs subjected to tension or compression are also considered to be preloaded. This environment applies to any component that must be preloaded to maintain its intended function, whose environment is otherwise Treated Water or Steam with an operating temperature Greater Than or Equal To 482 deg F, Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm. |
| Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI Beltline Region), Relative Motion Between Components | This environment is identical to Treated Water or Steam with an operating temperature Greater Than or Equal To 482 deg F, Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm, with the addition of relative motion between components. Common sources of relative motion include flow-induced vibrations and differential thermal expansion during plant heat-up and cool-down. Wear caused by installation and removal of bolts, studs, or other fasteners is not considered an aging effect. |
| Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | This environment is identical to Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, except that the flow rate is less than 6 ft/sec. |

| Environment | Description |
|---|---|
| Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Relative Motion Between Components | This environment is identical to Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, with the addition of relative motion between components. Common sources of relative motion include flow-induced vibrations and differential thermal expansion during plant heat-up and cool-down. Wear caused by installation and removal of bolts, studs, or other fasteners is not considered an aging effect. |
| Treated Water, Temperature Less Than 140 deg F | The water source is demineralized water that is chemically treated to remove oxygen. Corrosion inhibitors may be added to the water. Administrative limits are placed on dissolved oxygen and contaminants, and in some cases suspended solids. The concentration of contaminants is generally controlled by filtration, ion exchangers, or both, but other methods such as feed-and bleed (dilution) may be used to meet administrative limits. The maximum normal operating dissolved oxygen concentration is 200 ppb or less, and the maximum chloride, fluoride and sulfate concentrations during normal operation are 1000 ppb. The water may be borated. As an alternative to controlling oxygen, some systems specify control of water conductivity. |
| Treated Water, Temperature Less Than 140 deg F, Low Flow | This environment is identical to Treated Water, Temperature Less Than 140 deg F, except that the flow rate is Less Than 6 ft/second. At low flow rates buildup of deposits may cause fouling in components with heat transfer functions. |
| Treated Water, Temperature Less Than 140 deg F, Cyclic Loading | This environment is identical to Treated Water, Temperature Less Than 140 deg F, with the addition of cyclic loading of sufficient magnitude for fatigue to be a concern. Components that are typically subjected to this environment are bellows. |
| Treated Water or Steam, Temperature Greater Than or Equal To 212 deg F But Less Than 482 deg F | The water source is demineralized water that is chemically treated to remove oxygen. Corrosion inhibitors may be added to the water. Administrative limits are placed on dissolved oxygen and contaminants, and in some cases suspended solids. The concentration of contaminants is generally controlled by filtration, ion exchangers, or both, but other methods such as feed-and bleed (dilution) may be used to meet administrative limits. The maximum normal operating dissolved oxygen concentration is 200 ppb or less, and the maximum chloride, fluoride and sulfate concentrations during normal operation are 1000 ppb. The water may be borated. As an alternative to controlling oxygen, some systems specify control of water conductivity. |
| Treated Water or Steam, Temperature Greater Than or Equal To 212 deg F But Less Than 482 deg F, Low Flow | This environment is identical to Treated Water or Steam, Temperature Greater Than or Equal To 212 deg F But Less Than 482 deg F, except that the flow rate is 6 ft/second or less. |

| Environment | Description |
|---|---|
| Treated Water, Temperature Greater Than or Equal To 140 deg F But Less Than 212 deg F | The water source is demineralized water that is chemically treated to remove oxygen. Corrosion inhibitors may be added to the water. Administrative limits are placed on dissolved oxygen and contaminants, and in some cases suspended solids. The concentration of contaminants is generally controlled by filtration, ion exchangers, or both, but other methods such as feed-and bleed (dilution) may be used to meet administrative limits. The maximum normal operating dissolved oxygen concentration is 200 ppb or less, and the maximum chloride, fluoride and sulfate concentrations during normal operation are 1000 ppb. The water may be borated. As an alternative to controlling oxygen, some systems specify control of water conductivity. |
| Undisturbed Soil | Undisturbed Soil is defined as soil that has not been subjected to any excavation and/or subsequent backfill. This soil environment is only applicable to driven structural steel piles and sheet piling. |

**Figure 3.0-1: Table 1**

**Table 3.x.1 Summary of Aging Management Evaluations in Chapter__ of NUREG-1801 for _____**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.x.1.01 | | | | | |
| 3.x.1.02 | | | | | |
| 3.x.1.03 | | | | | |
| 3.x.1.04 | | | | | |
| 3.x.1.05 | | | | | |
| 3.x.1.06 | | | | | |

**Figure 3.0-2: Table 2**

**Table 3.x.2-y Section 3 Title – Plant Specific System – Summary of Aging Management Evaluation**

| Component Type | Intended Function | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

## 3.1 AGING MANAGEMENT OF REACTOR COOLANT SYSTEMS

### 3.1.1 Introduction

This section provides the results of the aging management review for those components identified in Section 2.3.1, Reactor Coolant Systems (RCS), as being subject to aging management review. The systems, or portions of systems, which are addressed in this section, are described in the indicated sections.

- Reactor Coolant System (Section 2.3.1.1)
- Reactor Plant Vents and Drains System (Section 2.3.1.2)
- Reactor Vessel (Section 2.3.1.3)
- Reactor Vessel Internals (Section 2.3.1.4)

Table 3.1.1, Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for the Reactor Coolant System, provides the summary of the programs evaluated in NUREG-1801 for the Reactor Coolant Systems component groups that are relied on for license renewal.

This table uses the format described in Section 3.0 above. Note that this table only includes those component groups that are applicable to a PWR.

### 3.1.2 Results

The following tables summarize the results of the aging management review for systems in the RCS systems group. The tables appear after Table 3.1.1, which appears after Section 3.1.3, Conclusion.

Table 3.1.2-1, Reactor Coolant System - Reactor Coolant System - Summary of Aging Management Evaluation

Table 3.1.2-2, Reactor Coolant System - Reactor Plant Vents and Drains System - Summary of Aging Management Evaluation

Table 3.1.2-3, Reactor Coolant System - Reactor Vessel - Summary of Aging Management Evaluation

Table 3.1.2-4, Reactor Coolant System - Reactor Vessel Internals - Summary of Aging Management Evaluation

The materials that specific components are fabricated from, the environments to which components are exposed, the aging effects requiring management, and the aging management programs used to manage these aging effects are provided for each of the above systems in the following subsections of Section 3.1.2.1, Materials, Environments, Aging Effects Requiring Management and Aging Management Programs:

Section 3.1.2.1.1, Reactor Coolant System

Section 3.1.2.1.2, Reactor Plant Vents and Drains System

Section 3.1.2.1.3, Reactor Vessel

Section 3.1.2.1.4, Reactor Vessel Internals

### 3.1.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

#### 3.1.2.1.1 Reactor Coolant System

**Materials**

The materials of construction for the Reactor Coolant System components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Nickel Based Alloy
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel
- Cast Austenitic Stainless Steel
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Nickel Based Alloy
- Wrought Austenitic Stainless Steel

**Environments**

The Reactor Coolant System components are exposed to the following environments:

- Air
- Air, Potential for Leaking Borated Water
- Air, Potential for Leaking Borated Water, Subject to Thermal Cycling
- Bolting, Potential for Exposure to Leaking Borated Water At Temperatures of 212 deg F or Greater
- Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than or Equal To 212 deg F
- Dried Air or Gas
- Steam Generator Secondary Side
- Treated Water
- Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F

- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F
- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow
- Treated Water, Temperature Less Than 140 deg F
- Treated Water, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Reactor Coolant System, require management:

- Crack Initiation and Growth
- Loss of Fracture Toughness
- Loss of Heat Transfer Capability
- Loss of Material
- Loss of Preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the Reactor Coolant System components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD
- Bolting Integrity
- Boric Acid Corrosion
- Flow-Accelerated Corrosion
- Metal Fatigue of Reactor Coolant Pressure Boundary
- Nickel-Alloy Nozzles & Penetrations
- One-Time Inspection
- One-Time Inspection of Small-Bore Piping
- Steam Generator Tubing Integrity
- System Monitoring
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)
- Water Chemistry

### 3.1.2.1.2 Reactor Plant Vents and Drains System

**Materials**

The materials of construction for the Reactor Plant Vents and Drains System components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Wrought Austenitic Stainless Steel

**Environments**

The Reactor Plant Vents and Drains System components are exposed to the following environments:

- Air, Potential for Leaking Borated Water
- Dried Air or Gas
- Raw Water, Low Flow
- Treated Water
- Treated Water, Temperature Less Than 140 deg F
- Treated Water, Temperature Less than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Reactor Plant Vents and Drains System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Reactor Plant Vents and Drains System components:

- Boric Acid Corrosion
- One-Time Inspection
- System Monitoring
- Water Chemistry

### 3.1.2.1.3 Reactor Vessel

**Materials**

The materials of construction for the Reactor Vessel components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel
- Cast Austenitic Stainless Steel
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Nickel Based Alloy
- Wrought Austenitic Stainless Steel

**Environments**

The Reactor Vessel components are exposed to the following environments:

- Air, Potential for Leaking Borated Water
- Bolting, Potential for Exposure to Leaking Borated Water At Temperatures of 212 deg F or Greater
- Treated Water or Steam, Temperature Greater Than or Equal to 482 deg F and Neutron Fluence Greater Than or Equal to 1E17 n/sq. cm But Less than 5E20 n/sq. cm
- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F
- Treated Water, Temperature Less Than 140 deg F

**Aging Effects Requiring Management**

The following aging effects, associated with the Reactor Vessel, require management:

- Crack Initiation and Growth
- Loss of Fracture Toughness
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Reactor Vessel components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD
- Boric Acid Corrosion
- Metal Fatigue of Reactor Coolant Pressure Boundary
- Nickel-Alloy Nozzles and Penetrations
- One-Time Inspection
- PWR Vessel Internals
- Reactor Head Closure Studs
- Reactor Vessel Surveillance
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)
- Water Chemistry

### 3.1.2.1.4 Reactor Vessel Internals

**Materials**

The materials of construction for the Reactor Vessel Internals components are:

- Cast Austenitic Stainless Steel
- Nickel Based Alloy
- Wrought Austenitic Stainless Steel

**Environments**

The Reactor Vessel Internals components are exposed to the following environments:

- Treated Water or Steam, Temperature Greater Than or Equal to 482 deg F and Neutron Fluence Greater Than or Equal to 1E17 n/sq. cm But Less than 5E20 n/sq. cm
- Treated Water or Steam, Temperature Greater Than or Equal to 482 deg F
- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI Beltline Region)
- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region), Plus Preload
- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI Beltline Region) Relative Motion Between Components
- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Relative Motion Between Components
- Treated Water, Temperature Less Than 140 deg F

**Aging Effects Requiring Management**

The following aging effects, associated with the Reactor Vessel Internals, require management:

- Change in Dimensions
- Crack Initiation and Growth
- Loss of Fracture Toughness
- Loss of Material
- Loss of Preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the Reactor Vessel Internals components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD
- Flux Thimble Tube Examination Program
- Metal Fatigue of Reactor Coolant Pressure Boundary
- Nickel-Alloy Nozzles and Penetrations
- PWR Vessel Internals
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)
- Water Chemistry

#### 3.1.2.2 Time-Limited Aging Analyses

The time-limited aging analyses (TLAA) identified below are associated with the RCS systems components. The section of the LRA that contains the TLAA review results is indicated in parenthesis.

- ASME Fatigue Analysis (Section 4.3.1)
- Charpy Upper Shelf Energy (Section 4.2.2)
- Criteria for B31.1 System (Section 4.3.5)
- Environmental Qualification (Section 4.4)
- Leak Before Break (LBB) (Section 4.7.3)
- LTOP PORV Setpoints (Section 4.2.4)
- Motor Operated Valve Fatigue (Section 4.3.6)
- Pressure Temperature Limits (Section 4.2.3)
- Pressurized Thermal Shock Analysis (Section 4.2.1)
- Pressurizer Surge Line Thermal Stratification (Section 4.3.3)
- Reactor Coolant Pump Flywheel (Section 4.7.2)
- Reactor Vessel Underclad Cracking (Section 4.3.4)

### 3.1.3 Conclusion

The RCS systems components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the RCS components are identified in the summary tables and Section 3.1.2.1.

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 RCS components will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

## Results Tables: Reactor Coolant Systems

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-01 | Reactor coolant pressure boundary components | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) | Yes, TLAA | Consistent with NUREG-1801 except as noted below.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>• Closure head flange<br>• CRDM modified vent cap<br>• Diffuser plate<br>• Head vent<br>• Instrumentation port<br>• Pressurizer safety and relief nozzles<br>• Steam Generator tubesheet (secondary side)<br><br>The aging management program also includes fatigue of Class 2 and 3 components.<br><br>Further evaluation is discussed in TLAA (Section 4.3), Metal Fatigue Analysis. |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-02 | Steam generator shell assembly | Loss of material due to pitting and crevice corrosion | Inservice inspection; water chemistry | Yes, detection of aging effects is to be further evaluated | Not applicable because FAC is identified as an AERM in the BVPS results and will dominate the listed aging effects. The Steam Generator Tube Integrity program will manage the listed aging effects.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.29), Steam Generator Tube Integrity |
| 3.1.1-03 | BWR Only | | | | |
| 3.1.1-04 | Pressure vessel ferritic materials that have a neutron fluence greater than $10^{17}$ n/sq. cm (E Greater Than 1 MeV) | Loss of fracture toughness due to neutron irradiation embrittlement | TLAA, evaluated in accordance with Appendix G of 10 CFR 50 and RG 1.99 | Yes, TLAA | Consistent with NUREG-1801.<br><br>Neutron Irradiation Embrittlement is a TLAA for BVPS. Further evaluation is documented in TLAA (Section 4.2). |
| 3.1.1-05 | Reactor vessel beltline shell and welds | Loss of fracture toughness due to neutron irradiation embrittlement | Reactor vessel surveillance | Yes, plant specific | Consistent with NUREG-1801.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.27), Reactor Vessel Surveillance. |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-06 | Westinghouse and Babcock and Wilcox (B&W) baffle/ former bolts | Loss of fracture toughness due to neutron irradiation embrittlement and void swelling | Plant specific | Yes, plant specific | Consistent with NUREG-1801.<br><br>BVPS results also include the mechanism Void Swelling for baffle bolts. Void Swelling is not included in the NUREG-1801 results for Westinghouse internals.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.25), PWR Vessel Internals. |
| 3.1.1-07 | Small-bore reactor coolant system and connected systems piping | Crack initiation and growth due to stress corrosion cracking (SCC), intergranular stress corrosion cracking (IGSCC), and thermal and mechanical loading | Inservice inspection; water chemistry; one-time inspection | Yes, parameters monitored/ inspected and detection of aging effects are to be further evaluated | Consistent with NUREG-1801, with ASME Section XI Inservice Inspection, Subsection IWB, IWC and IWD program exceptions (see Appendix B, Section B.2.1.2).<br><br>Further evaluation is documented in Appendix B, ASME Section XI Inservice Inspection, Subsection IWB, IWC and IWD (Section B.2.1.2), Water Chemistry (Section B.2.1.33) and One-Time Inspection (Section B.2.1.22). The One-Time Inspection program includes small-bore piping. |
| 3.1.1.08 | BWR Only | | | | |
| 3.1.1-09 | BWR Only | | | | |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-10 | Vessel shell | Crack growth due to cyclic loading | TLAA | Yes, TLAA | Not applicable because the material for BVPS RPVs is SA533, which is not susceptible to underclad cracking.<br><br>Further evaluation is not applicable. |
| 3.1.1-11 | Reactor internals | Changes in dimension due to void swelling | Plant specific | Yes, plant specific | Consistent with NUREG-1801 except as noted below.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>• Diffuser plate<br><br>BVPS results also include the mechanism Neutron Irradiation Embrittlement for the upper internals assembly.<br><br>Void swelling is not applicable for the upper internals assembly and flux thimble guide tubes because fluence levels are not sufficient to cause this aging mechanism.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.25), PWR Vessel Internals. |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-12 | PWR core support pads, instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains | Crack initiation and growth due to SCC and/or primary water stress corrosion cracking (PWSCC) | Plant specific | Yes, plant specific | Consistent with NUREG-1801 except as noted below.<br><br>BVPS Grouping only includes the core support pads and bottom head penetration tubes. Additionally, the results include the mechanism Fatigue for the core support pads/core guide lugs and penetrations.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.20) Metal Fatigue of Reactor Coolant Pressure Boundary, (Section B.2.1.33), Water Chemistry, and (Section B.2.1.21), Nickel-Alloy Nozzles and Penetrations. |
| 3.1.1-13 | Cast austenitic stainless steel (Cast Austenitic Stainless Steel) reactor coolant system piping | Crack initiation and growth due to SCC | Plant specific | Yes, plant specific | Consistent with NUREG-1801.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.33), Water Chemistry, and (Section B.2.1.32), Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS). |
| 3.1.1-14 | Pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni-alloys | Crack initiation and growth due to PWSCC | Inservice inspection; water chemistry | Yes, AMP for PWSCC of Inconel 182 weld is to be evaluated | Not applicable because these components are not nickel-based alloys at BVPS.<br><br>Further evaluation is not applicable. |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-15 | Westinghouse and B&W baffle former bolts | Crack initiation and growth due to SCC and irradiation-assisted stress corrosion cracking (IASCC) | Plant specific | Yes, plant specific | Consistent with NUREG-1801.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.33), Water Chemistry, and (Section B.2.1.25), PWR Vessel Internals. |
| 3.1.1-16 | Westinghouse and B&W baffle former bolts | Loss of preload due to stress relaxation | Plant specific | Yes, plant specific | Consistent with NUREG-1801.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.25), PWR Vessel Internals. |
| 3.1.1-17 | Steam generator feedwater impingement plate and support | Loss of section thickness due to erosion | Plant specific | Yes, plant specific | Not applicable because the steam generator impingement plate does not exist for BVPS.<br><br>Further evaluation is not applicable. |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-18 | (Alloy 600) Steam generator tubes, repair sleeves, and plugs | Crack initiation and growth due to PWSCC, outside diameter stress corrosion cracking (ODSCC), and/or intergranular attack (IGA); or loss of material due to wastage and pitting corrosion, and fretting and wear; or deformation due to corrosion at tube support plate intersections | Steam generator tubing integrity; water chemistry | Yes, effectiveness of a proposed AMP is to be evaluated | Consistent with NUREG-1801 except as noted below.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>• Steam Generator Anti-Vibration Bars<br><br>For applicable components, IGA is considered a subset of SCC; therefore, BVPS results are consistent even though they do not explicitly call out this aging mechanism.<br><br>Also, BVPS results do not specifically include the aging effect/mechanism "deformation due to corrosion at tube support plate intersections," but this aging effect/mechanism will be managed by the aging management programs for pitting and crevice corrosion.<br><br>Also, BVPS does not use phosphate addition, so these components are not exposed to phosphate chemistry.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.33), Water Chemistry, and (Section B.2.1.29), Steam Generator Tube Integrity. |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-19 | Tube support lattice bars made of carbon steel | Loss of section thickness due to flow-accelerated corrosion (FAC) | Plant specific | Yes, plant specific | Not applicable because this only applies to Combustion Engineering components.<br><br>Further evaluation is not applicable. |
| 3.1.1-20 | Carbon steel tube support plate | Ligament cracking due to corrosion | Plant specific | Yes, effectiveness of a proposed AMP is to be evaluated | Not applicable because FAC was identified as an AERM and will dominate the other listed mechanisms. The Steam Generator Tube Integrity program will manage the listed aging effects.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.29), Steam Generator Tube Integrity. |
| 3.1.1-21 | Steam generator feedwater inlet ring and supports | Loss of material due to flow accelerated corrosion | Combustion Engineering (CE) steam generator feedwater ring inspection | Yes, plant specific | Consistent with NUREG-1801, as follows.<br><br>NUREG-1801 indicates that this line is applicable to CE PWRs. However, the BVPS results also include this aging effect/mechanism for the BVPS Westinghouse steam generators.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.33), Water Chemistry, and (Section B.2.1.29), Steam Generator Tube Integrity.. |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-22 | Reactor vessel closure studs and stud assembly | Crack initiation and growth due to SCC and/or IGSCC | Reactor head closure studs | No | Consistent with NUREG-1801. |
| 3.1.1-23 | Cast Austenitic Stainless Steel pump casing and valve body | Loss of fracture toughness due to thermal aging embrittlement | Inservice inspection | No | Consistent with NUREG-1801, with ASME Section XI Inservice Inspection, Subsection IWB, IWC and IWD program exceptions (see Appendix B, Section B.2.1.2).<br><br>For Chemical and Volume Control System CASS valves, the Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) program is credited vice inservice inspection. |
| 3.1.1-24 | Cast Austenitic Stainless Steel piping | Loss of fracture toughness due to thermal aging embrittlement | Thermal aging embrittlement of Cast Austenitic Stainless Steel | No | Consistent with NUREG-1801 except as noted below.<br><br>Not applicable for the pressurizer because it is not Cast Austenitic Stainless Steel at BVPS. |
| 3.1.1-25 | BWR piping and fittings; steam generator components | Wall thinning due to flow accelerated corrosion | Flow accelerated corrosion | No | Consistent with NUREG-1801 except as noted below.<br><br>For feedwater nozzles and feedwater nozzle thermal sleeves, the Steam Generator Tube Integrity (Section B.2.1.29) is assigned. |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-26 | Reactor coolant pressure boundary (RCPB) valve closure bolting, manway and holding bolting, and closure bolting in high-pressure and high-temperature systems | Loss of material due to wear; loss of preload due to stress relaxation; crack initiation and growth due to cyclic loading and/or SCC | Bolting integrity | No | Consistent with NUREG-1801 except as noted below.<br><br>BVPS results assign the Boric Acid Corrosion program (Section B.2.1.6) vice bolting integrity for cracking of bolting components due to stress corrosion cracking. |
| 3.1.1-27 | BWR Only | | | | |
| 3.1.1-28 | BWR Only | | | | |
| 3.1.1-29 | BWR Only | | | | |
| 3.1.1-30 | BWR Only | | | | |
| 3.1.1-31 | BWR Only | | | | |
| 3.1.1-32 | BWR Only | | | | |
| 3.1.1-33 | BWR Only | | | | |
| 3.1.1-34 | BWR Only | | | | |
| 3.1.1-35 | CRD nozzle | Crack initiation and growth due to PWSCC | Ni-alloy nozzles and penetrations; water chemistry | No | Consistent with NUREG-1801. |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-36 | Reactor vessel nozzles safe ends and CRD housing; reactor coolant system components (except Cast Austenitic Stainless Steel and bolting) | Crack initiation and growth due to cyclic loading, and/or SCC, and PWSCC | Inservice inspection; water chemistry | No | Consistent with NUREG-1801, with ASME Section XI Inservice Inspection, Subsection IWB, IWC and IWD program exceptions (see Appendix B, Section B.2.1.2).<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>▪ CRDM modified vent cap<br>▪ Instrumentation port<br>▪ Head vent<br><br>For Unit 2 reactor vessel inlet and outlet nozzle welds the Nickel-Alloy Nozzles and Penetrations (Section B.2.1-21) is credited rather than inservice inspection.<br><br>For CVCS heat exchangers the Closed-Cycle Cooling Water System (Section B.2.1-8) is credited rather than inservice inspection.<br><br>Regardless of the Component entry in this row, which states "except Cast Austenitic Stainless Steel" certain BVPS components are assigned to NUREG-1801 Volume 2 Items IV.A2.2-b, IV.C2-3-b, IV.C2.4-b, and IV.C2.5-g, which include Cast Austenitic Stainless Steel material. |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-37 | Reactor vessel internals Cast Austenitic Stainless Steel components | Loss of fracture toughness due to thermal aging, neutron irradiation embrittlement, and void swelling | Thermal aging and neutron irradiation embrittlement | No | Consistent with NUREG-1801. |
| 3.1.1-38 | External surfaces of carbon steel components in reactor coolant system pressure boundary | Loss of material due to boric acid corrosion | Boric acid corrosion | No | Consistent with NUREG-1801 except as noted below.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>▪ External carbon steel surfaces<br>▪ Refueling seal ledge<br>▪ Vessel external surface<br>▪ Reactor Plant Sample System stainless steel valves<br><br>Certain Reactor Coolant System valve bolting components include mechanisms crevice corrosion and pitting corrosion. |
| 3.1.1-39 | Steam generator secondary manways and handholds (carbon steel) | Loss of material due to erosion | Inservice inspection | No | Not applicable because BVPS does not have once-through steam generators. |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-40 | Reactor internals, reactor vessel closure studs, and core support pads | Loss of material due to wear | Inservice inspection | No | Consistent with NUREG-1801, with ASME Section XI Inservice Inspection, Subsection IWB, IWC and IWD program exceptions (see Appendix B, Section B.2.1.2).<br><br>For thimbles, aging management program Flux Thimble Tube Examination Program (Section B.2.1.16) is credited vice inservice inspection. |
| 3.1.1-41 | Pressurizer integral support | Crack initiation and growth due to cyclic loading | Inservice inspection | No | Not applicable because the BVPS pressurizers have support skirts, not integral supports. |
| 3.1.1-42 | Upper and lower internals assembly (Westinghouse) | Loss of preload due to stress relaxation | Inservice inspection; loose part and/or neutron noise monitoring | No | Not applicable for the upper or lower internals assemblies because fluence levels are not sufficient to cause this aging mechanism. |
| 3.1.1-43 | Reactor vessel internals in fuel zone region (except Westinghouse and B&W baffle former bolts) | Loss of fracture toughness due to neutron irradiation embrittlement and void swelling | PWR vessel internals; water chemistry | No | Consistent with NUREG-1801.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>• Diffuser plate<br><br>The NUREG-1801 Volume 2 Items referenced in Table 3.1.2-4 include only the PWR vessel internals aging management program, as do the BVPS results for these components. |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-44 | Steam generator upper and lower heads, tubesheets, and primary nozzles and safe ends | Crack initiation and growth due to SCC, PWSCC, and/or IASCC | Inservice inspection; water chemistry | No | Consistent with NUREG-1801, with ASME Section XI Inservice Inspection, Subsection IWB, IWC and IWD program exceptions (see Appendix B, Section B.2.1.2). |
| 3.1.1-45 | Vessel internals (except Westinghouse and B&W baffle former bolts) | Crack initiation and growth due to SCC and IASCC | PWR vessel internals; water chemistry | No | Consistent with NUREG-1801 except as noted below.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>• Diffuser plate<br><br>For clevis insert bolts and control rod guide tube supporting pins, the AMPs are Nickel-Alloy Nozzles and Penetrations (Section B.2.1.21), and Water Chemistry (Section B.2.1.33). |
| 3.1.1-46 | Reactor internals (B&W screws and bolts) | Loss of preload due to stress relaxation | Inservice inspection; loose part monitoring | No | Not applicable because this item only applies to B&W reactor vessel internals. |
| 3.1.1-47 | Reactor vessel closure studs and stud assembly | Loss of material due to wear | Reactor head closure studs | No | Not applicable because the BVPS results do not consider wear due to maintenance to be an AERM. |

**Table 3.1.1 Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.1.1-48 | Reactor internals (Westinghouse upper and lower internal assemblies, CE bolts and tie rods) | Loss of preload due to stress relaxation | Inservice inspection; loose part monitoring | No | Consistent with NUREG-1801 except as noted below.<br><br>The AMP for the lower support column bolts is the PWR Vessel Internals program (Section B.2.1.25). |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Bolting, Potential for Exposure to Leaking Borated Water At Temperatures of 212 deg F or Greater | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.4-d | 3.1.1-01 | A |
| | | | | | | IV.C2.3-d | 3.1.1-01 | A |
| | | | | | | N/A | N/A | S |
| | | | | | Boric Acid Corrosion | IV.C2.4-e | 3.1.1-26 | E |
| | | | | | | IV.D1.1-l | 3.1.1-26 | E |
| | | | | | | IV.C2.3-e | 3.1.1-26 | E |
| | | | | | | IV.C2.5-n | 3.1.1-26 | E |
| | | | | Loss of Material | Boric Acid Corrosion | IV.C2.4-f | 3.1.1-38 | A |
| | | | | | | IV.C2.5-o | 3.1.1-38 | A |
| | | | | | | IV.D1.1-k | 3.1.1-38 | A |
| | | | | | | IV.C2.3-f | 3.1.1-38 | A |
| | | | | Loss of Preload | Bolting Integrity | IV.C2.3-g | 3.1.1-26 | A |
| | | | | | | IV.C2.4-g | 3.1.1-26 | A |
| | | | | | | IV.C2.5-p | 3.1.1-26 | A |
| | | | | | | N/A | N/A | H |
| | | | Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than Or Equal To 212 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | Loss of Material | Bolting Integrity | N/A | N/A | H |
| | | | | Loss of Preload | Bolting Integrity | IV.D1.1-f | 3.1.1-26 | A |
| | | | | | | N/A | N/A | H |
| | | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Bolting, Potential for Exposure to Leaking Borated Water At Temperatures of 212 deg F or Greater | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.4-d | 3.1.1-01 | A |
| | | | | | Boric Acid Corrosion | IV.C2.4-e | 3.1.1-26 | E |
| | | | | Loss of Material | Boric Acid Corrosion | IV.C2.4-f | 3.1.1-38 | R |
| | | | | Loss of Preload | Bolting Integrity | IV.C2.4-g | 3.1.1-26 | A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Element | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| External Surfaces-Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | N/A | N/A | G |
| External Surfaces-Pressurizer | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | IV.C2.5-b | 3.1.1-38 | A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surfaces-Steam Generators | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | IV.D1.1-g | 3.1.1-38 | A |
| External Surfaces-Valves | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Boric Acid Corrosion | N/A | N/A | G |
| Heat Exchanger | Heat Transfer, Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| Orifice | Flow Restriction, Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | One Time Inspection of Small-Bore Piping | IV.C2.1-g | 3.1.1-07 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.1-g | 3.1.1-07 | B |
| | | | | | Water Chemistry | IV.C2.1-g | 3.1.1-07 | A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Orifice (continued) | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | One Time Inspection of Small-Bore Piping | IV.C2.1-g | 3.1.1-07 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.1-g | 3.1.1-07 | B |
| | | | | | Water Chemistry | IV.C2.1-g | 3.1.1-07 | A |
| Piping | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.1-a | 3.1.1-01 | A |
| | | | | | | IV.C2.1-b | 3.1.1-01 | A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Cast Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F (continued) | Crack Initiation and Growth (continued) | Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) | IV.C2.1-e | 3.1.1-13 | A |
| | | | | | Water Chemistry | IV.C2.1-e | 3.1.1-13 | A |
| | | | | Loss of Fracture Toughness | Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) | IV.C2.1-f | 3.1.1-24 | A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Dried Air or Gas | None | N/A | N/A | N/A | N/A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.1-c | 3.1.1-36 | B |
| | | | | | | IV.C2.1-g | 3.1.1-07 | B |
| | | | | | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.1-a | 3.1.1-01 | A |
| | | | | | | IV.C2.1-b | 3.1.1-01 | A |
| | | | | | One-Time Inspection | IV.C2.1-g | 3.1.1-07 | A |
| | | | | | One Time Inspection of Small-Bore Piping | IV.C2.1-g | 3.1.1-07 | A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F (continued) | Crack Initiation and Growth (continued) | Water Chemistry | IV.C2.1-c | 3.1.1-36 | A |
| | | | | | | IV.C2.1-g | 3.1.1-07 | A |
| | | | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pump | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.3-a | 3.1.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.3-b | 3.1.1-36 | B |
| | | | | | Water Chemistry | IV.C2.3-b | 3.1.1-36 | A |
| | | | | Loss of Fracture Toughness | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.3-c | 3.1.1-23 | B |
| Steam Generator – Anti-Vibration Bar | Structural/ Functional Support | Nickel Based Alloy | Steam Generator Secondary Side | Crack Initiation and Growth | Steam Generator Tubing Integrity | IV.D1.2-b | 3.1.1-18 | C |
| | | | | | Water Chemistry | IV.D1.2-b | 3.1.1-18 | C |
| | | | | Loss of Material | Steam Generator Tubing Integrity | IV.D1.2-e | 3.1.1-18 | C |
| | | | | | | IV.D1.2-f | 3.1.1-18 | C |
| | | | | | Water Chemistry | IV.D1.2-e | 3.1.1-18 | C |
| | | | | | | IV.D1.2-f | 3.1.1-18 | C |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steam Generator – Feedwater Nozzle | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.D1.1-b | 3.1.1-01 | A |
| | | | | Loss of Material | Steam Generator Tubing Integrity | IV.D1.1-d | 3.1.1-25 | E |
| | | | | | Water Chemistry | IV.D1.1-d | 3.1.1-25 | A |
| Steam Generator – Feedwater Nozzle Thermal Sleeve | Thermal Shielding | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.D1.1-b | 3.1.1-01 | A |
| | | | | Loss of Material | Steam Generator Tubing Integrity | IV.D1.1-d | 3.1.1-25 | E |
| | | | | | Water Chemistry | IV.D1.1-d | 3.1.1-25 | A |
| Steam Generator – Feedwater Ring | Flow Control, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | Loss of Material | Steam Generator Tubing Integrity | IV.D1.3-a | 3.1.1-21 | A |
| | | | | | Water Chemistry | IV.D1.3-a | 3.1.1-21 | A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steam Generator – Instrument Nozzle | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | M |
| | | | | Loss of Material | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | N/A | N/A | M |
| | | | | | Water Chemistry | N/A | N/A | M |
| Steam Generator – Lower Head | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.D1.1-h | 3.1.1-01 | A |
| Steam Generator – Lower Shell | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.D1.1-b | 3.1.1-01 | A |
| | | | | Loss of Material | Steam Generator Tubing Integrity | N/A | N/A | S |
| | | | | | Water Chemistry | N/A | N/A | S |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steam Generator - Primary Manway | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | IV.D1.1-k | 3.1.1-38 | A |
| Steam Generator - Primary Manway Insert | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | F |
| | | | | | Steam Generator Tubing Integrity | N/A | N/A | F |
| | | | | | Water Chemistry | N/A | N/A | F |
| Steam Generator – Primary Nozzle Safe End | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.D1.1-h | 3.1.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.D1.1-i | 3.1.1-44 | B |
| | | | | | Water Chemistry | IV.D1.1-i | 3.1.1-44 | A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steam Generator - Primary Nozzle | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.D1.1-h | 3.1.1-01 | A |
| Steam Generator - Secondary Hand Hole | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | Q |
| | | | | Loss of Material | Steam Generator Tubing Integrity | N/A | N/A | Q |
| | | | | | Water Chemistry | N/A | N/A | Q |
| Steam Generator – Secondary Manway | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | Q |
| | | | | Loss of Material | Steam Generator Tubing Integrity | N/A | N/A | Q |
| | | | | | Water Chemistry | N/A | N/A | Q |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steam Generator – Steam Outlet Nozzle | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.D1.1-a | 3.1.1-01 | A |
| | | | | Loss of Material | Flow-Accelerated Corrosion | IV.D1.1-d | 3.1.1-25 | A |
| | | | | | Water Chemistry | IV.D1.1-d | 3.1.1-25 | A |
| Steam Generator – Top Head | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.D1.1-a | 3.1.1-01 | A |
| | | | | Loss of Material | Steam Generator Tubing Integrity | N/A | N/A | H |
| | | | | | Water Chemistry | N/A | N/A | H |
| Steam Generator – Transition Cone | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.D1.1-b | 3.1.1-01 | A |
| | | | | Loss of Material | Steam Generator Tubing Integrity | N/A | N/A | S |
| | | | | | Water Chemistry | N/A | N/A | S |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steam Generator – Tube (Secondary Side) | Heat Transfer, Pressure Boundary | Nickel Based Alloy | Steam Generator Secondary Side | Crack Initiation and Growth | Steam Generator Tubing Integrity | IV.D1.2-b | 3.1.1-18 | A |
| | | | | | Water Chemistry | IV.D1.2-b | 3.1.1-18 | A |
| | | | | Loss of Heat Transfer Capability | Steam Generator Tubing Integrity | N/A | N/A | H |
| | | | | Loss of Material | Steam Generator Tubing Integrity | IV.D1.2-e | 3.1.1-18 | A |
| | | | | | | IV.D1.2-f | 3.1.1-18 | A |
| | | | | | Water Chemistry | IV.D1.2-e | 3.1.1-18 | A |
| | | | | | | IV.D1.2-f | 3.1.1-18 | A |
| Steam Generator - Tube Bundle Wrapper | Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | Q |
| | | | | Loss of Material | Steam Generator Tubing Integrity | N/A | N/A | Q |
| | | | | | Water Chemistry | N/A | N/A | Q |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steam Generator - Tube Plugs | Pressure Boundary | Nickel Based Alloy | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | S |
| | | | | | Steam Generator Tubing Integrity | IV.D1.2-i | 3.1.1-18 | A |
| | | | | | Water Chemistry | IV.D1.2-i | 3.1.1-18 | A |
| Steam Generator - Tube Sheet | Pressure Boundary, Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Nickel Based Alloy | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | Q |
| | | | | | Steam Generator Tubing Integrity | N/A | N/A | Q |
| | | | | | Water Chemistry | N/A | N/A | Q |
| Steam Generator - Tube Sheet (Secondary Side) | Pressure Boundary, Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.D1.1-d | 3.1.1-01 | C |
| | | | | Loss of Material | Steam Generator Tubing Integrity | N/A | N/A | Q |
| | | | | | Water Chemistry | N/A | N/A | Q |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steam Generator – Tube Sleeves | Heat Transfer, Pressure Boundary | Nickel Based Alloy | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.D1.2-d | 3.1.1-01 | A |
| | | | | | Steam Generator Tubing Integrity | IV.D1.2-a | 3.1.1-18 | A |
| | | | | | Water Chemistry | IV.D1.2-a | 3.1.1-18 | A |
| Steam Generator – Tube Support Plate | Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | S |
| | | | | Loss of Material | Steam Generator Tubing Integrity | N/A | N/A | H |
| | | | | | Water Chemistry | N/A | N/A | H |
| Steam Generator – Tubes | Heat Transfer, Pressure Boundary | Nickel Based Alloy | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.D1.2-d | 3.1.1-01 | A |
| | | | | | Steam Generator Tubing Integrity | IV.D1.2-a | 3.1.1-18 | A |
| | | | | | Water Chemistry | IV.D1.2-a | 3.1.1-18 | A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Steam Generator - Upper Shell | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.D1.1-b | 3.1.1-01 | A |
| | | | | Loss of Material | Steam Generator Tubing Integrity | N/A | N/A | S |
| | | | | | Water Chemistry | N/A | N/A | S |
| Switch | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| Thermowell | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | One Time Inspection of Small-Bore Piping | IV.C2.1-g | 3.1.1-07 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.1-g | 3.1.1-07 | B |
| | | | | | Water Chemistry | IV.C2.1-g | 3.1.1-07 | A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | Pressure Boundary | Cast Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.4-a | 3.1.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.4-b | 3.1.1-36 | B |
| | | | | | Water Chemistry | IV.C2.4-b | 3.1.1-36 | A |
| | | | | Loss of Fracture Toughness | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.4-c | 3.1.1-23 | B |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.4-a | 3.1.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.4-b | 3.1.1-36 | B |
| | | | | | Water Chemistry | IV.C2.4-b | 3.1.1-36 | A |
| | | | | Loss of Fracture Toughness | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.4-c | 3.1.1-23 | B |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Cast Austenitic Stainless Steel (continued) | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.4-a | 3.1.1-01 | A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F (continued) | Crack Initiation and Growth (continued) | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | N/A | N/A | S |
| | | | | | | IV.C2.4-b | 3.1.1-36 | B |
| | | | | | Water Chemistry | N/A | N/A | S |
| | | | | | | IV.C2.4-b | 3.1.1-36 | A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.4-a | 3.1.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.4-b | 3.1.1-36 | B |
| | | | | | Water Chemistry | IV.C2.4-b | 3.1.1-36 | A |
| | | | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Vessel (Pressurizers) | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | IV.C2.5-o | 3.1.1-38 | A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.5-d | 3.1.1-01 | C |
| | | | | | | IV.C2.5-a | 3.1.1-01 | A |
| | | | | | | IV.C2.5-e | 3.1.1-01 | A |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Vessel (Pressurizers) (continued) | Pressure Boundary (continued) | Nickel-Based Alloys | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.5-f | 3.1.1-01 | A |
| | | | | | Nickel-Alloy Nozzles and Penetrations | N/A | N/A | F |
| | | | | | Water Chemistry | N/A | N/A | F |
| | | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | S |
| | | | | | | IV.C2.5-f | 3.1.1-01 | A |
| | | | | | | IV.C2.5-q | 3.1.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.5-g | 3.1.1-36 | B |
| | | | | | | IV.C2.5-h | 3.1.1-36 | B |
| | | | | | | IV.C2.5-m | 3.1.1-36 | B |
| | | | | | | IV.C2.5-r | 3.1.1-36 | B |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Vessel (Pressurizers) (continued) | Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water, Subject to Thermal Cycling | Crack Initiation and Growth | Water Chemistry | IV.C2.5-g | 3.1.1-36 | A |
| | | | | | | IV.C2.5-h | 3.1.1-36 | A |
| | | | | | | IV.C2.5-m | 3.1.1-36 | A |
| | | | | | | IV.C2.5-r | 3.1.1-36 | A |
| | | | | | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.5-t | 3.1.1-01 | A |
| | | | | Loss of Material | Boric Acid Corrosion | N/A | N/A | H |
| | Thermal Shielding | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.5-f | 3.1.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | N/A | N/A | S |
| | | | | | Water Chemistry | N/A | N/A | S |

**Table 3.1.2-1: Reactor Coolant Systems – Reactor Coolant System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | N/A | N/A | U |
| | | | Treated Water | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Reactor Coolant System, those safety-related buildings and areas are:

Unit 1 Reactor Containment Building
Unit 2 Reactor Containment Building

**Table 3.1.2-2: Reactor Coolant Systems – Reactor Plant Vents and Drains System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | Boric Acid Corrosion | IV.C2.4-e | 3.1.1-26 | E |
| | | | | Loss of Material | Boric Acid Corrosion | IV.C2.4-f | 3.1.1-38 | A |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | IV.C2.2-d | 3.1.1-38 | A |

**Table 3.1.2-2: Reactor Coolant Systems – Reactor Plant Vents and Drains System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | IV.C2.2-h | 3.1.1-07 | A |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | L |
| | | | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.1.2-2: Reactor Coolant Systems – Reactor Plant Vents and Drains System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | Pressure Boundary | Cast Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | G |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | L |
| | | | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Loss of Material | One-Time Inspection | N/A | N/A | N |
| | | | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Water Chemistry | N/A | N/A | M |
| | | | | | One-Time Inspection | N/A | N/A | M |
| | | Wrought Austenitic Stainless Steel | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | G |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | L |
| | | | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | N/A | N/A | U |

**Table 3.1.2-2: Reactor Coolant Systems – Reactor Plant Vents and Drains System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** (continued) | NSR Functional Support (continued) | Any (continued) | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | Treated Water | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Reactor Plant Vents and Drains System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Chemical Addition Building
Unit 1 Fuel Building
Unit 1 Primary Water Storage Building
Unit 1 Reactor Containment Building
Unit 1 Safeguards Building

Unit 2 Auxiliary Building
Unit 2 Decontamination Building
Unit 2 Fuel Building
Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Pipe Tunnels
Unit 2 Reactor Containment Building
Unit 2 Safeguards Building

**Table 3.1.2-3: Reactor Coolant Systems – Reactor Vessel - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Control Rod Drive Assembly Components | Pressure Boundary, Structural/ Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.2-c | 3.1.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.A2.2-b | 3.1.1-36 | B |
| | | | | | Water Chemistry | IV.A2.2-b | 3.1.1-36 | A |
| Neutron Shield Tank | Pressure Boundary, Radiation Shielding, Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | IV.A2.8-b | 3.1.1-38 | A |
| | | | Treated Water, Temperature Less Than 140 deg F | Loss of Material | One-Time Inspection | N/A | N/A | L |

**Table 3.1.2-3: Reactor Coolant Systems – Reactor Vessel - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Vessel-Bottom Head | Pressure Boundary, Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.5-d | 3.1.1-01 | A |
| Vessel-Bottom Head Instrument Tubes | Pressure Boundary, Structural/ Functional Support | Nickel Based Alloy | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.7-a | 3.1.1-12 | R |
| | | | | | Nickel-Alloy Nozzles and Penetrations | IV.A2.7-a | 3.1.1-12 | A |
| | | | | | Water Chemistry | IV.A2.7-a | 3.1.1-12 | A |

**Table 3.1.2-3: Reactor Coolant Systems – Reactor Vessel - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Vessel-Closure Head (External Surface) | Pressure Boundary, Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | IV.A2.1-a | 3.1.1-38 | A |
| Vessel-Closure Head Dome | Pressure Boundary, Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.1-b | 3.1.1-01 | A |
| Vessel-Closure Head Flange | Pressure Boundary, Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.1-b | 3.1.1-01 | C |

**Table 3.1.2-3: Reactor Coolant Systems – Reactor Vessel - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Vessel-Closure Head Vent Pipe | Pressure Boundary | Nickel Based Alloy | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | S |
| | | | | | Nickel-Alloy Nozzles and Penetrations | IV.A2.7-b | 3.1.1-35 | A |
| | | | | | Water Chemistry | IV.A2.7-b | 3.1.1-35 | A |
| Vessel-Closure Stud Assembly | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Bolting, Potential for Exposure to Leaking Borated Water At Temperatures of 212 deg F or Greater | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.1-e | 3.1.1-01 | A |
| | | | | | Reactor Head Closure Studs | IV.A2.1-c | 3.1.1-22 | A |
| | | | | Loss of Material | Boric Acid Corrosion | IV.A2.1-a | 3.1.1-38 | A |

**Table 3.1.2-3: Reactor Coolant Systems – Reactor Vessel - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Vessel-Core Support Lugs | Structural/ Functional Support | Nickel Based Alloy | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.6-a | 3.1.1-12 | R |
| | | | | | Nickel-Alloy Nozzles and Penetrations | IV.A2.6-a | 3.1.1-12 | A |
| | | | | | Water Chemistry | IV.A2.6-a | 3.1.1-12 | A |
| Vessel-CRDM Housings-Tube | Pressure Boundary, Structural/ Functional Support | Nickel Based Alloy | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.2-c | 3.1.1-01 | A |
| | | | | | Nickel-Alloy Nozzles and Penetrations | IV.A2.2-a | 3.1.1-35 | A |
| | | | | | Water Chemistry | IV.A2.2-a | 3.1.1-35 | A |

**Table 3.1.2-3: Reactor Coolant Systems – Reactor Vessel - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Vessel-External Surface | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | IV.A2.5-e | 3.1.1-38 | C |
| Vessel-Inlet and Outlet Nozzles | Pressure Boundary, Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal to 482 deg F and Neutron Fluence Greater Than or Equal to 1E17 n/sq. cm But Less than 5E20 n/sq. cm | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.3-c | 3.1.1-01 | A |
| | | | | Loss of Fracture Toughness | Reactor Vessel Surveillance | IV.A2.3-a | 3.1.1-04 | A |
| | | | | | | IV.A2.3-b | 3.1.1-05 | A |
| Vessel-Inlet and Outlet Nozzle Safe Ends | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.4-a | 3.1.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.A2.4-b | 3.1.1-36 | B |
| | | | | | Water Chemistry | IV.A2.4-b | 3.1.1-36 | A |

**Table 3.1.2-3: Reactor Coolant Systems – Reactor Vessel - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Vessel-Inlet and Outlet Nozzle Welds | Pressure Boundary | Nickel-Based Alloys | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than Or Equal To 1E17 n/sq. cm But Less Than 5E20 n/sq. cm | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.4-a | 3.1.1-01 | A |
| | | | | | Nickel-Alloy Nozzles and Penetrations | IV.A2.4-b | 3.1.1-36 | E |
| | | | | | Water Chemistry | IV.A2.4-b | 3.1.1-36 | E |
| Vessel-Instrumentation Port | Pressure Boundary, Structural/ Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.2-c | 3.1.1-01 | C |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.A2.2-b | 3.1.1-36 | D |
| | | | | | Water Chemistry | IV.A2.2-b | 3.1.1-36 | C |

**Table 3.1.2-3: Reactor Coolant Systems – Reactor Vessel - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Vessel-Latch Housing | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.2-c | 3.1.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.A2.2-b | 3.1.1-36 | B |
| | | | | | Water Chemistry | IV.A2.2-b | 3.1.1-36 | A |
| | | | | Loss of Fracture Toughness | Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) | IV.A2.2-d | 3.1.1-24 | A |
| Vessel-Lower, Intermediate, and Upper (nozzle) Shells | Pressure Boundary, Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal to 482 deg F and Neutron Fluence Greater Than or Equal to 1E17 n/sq. cm But Less than 5E20 n/sq. cm | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.5-d | 3.1.1-01 | A |
| | | | | Loss of Fracture Toughness | Reactor Vessel Surveillance | IV.A2.5-a | 3.1.1-04 | A |
| | | | | | | IV.A2.5-c | 3.1.1-05 | A |

**Table 3.1.2-3: Reactor Coolant Systems – Reactor Vessel - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Vessel-Partial Length CRDM-Motor Tube | Pressure Boundary | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.2-c | 3.1.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.A2.2-b | 3.1.1-36 | B |
| | | | | | Water Chemistry | IV.A2.2-b | 3.1.1-36 | A |
| Vessel-Refueling Seal Ledge | Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | IV.A2.5-e | 3.1.1-38 | C |
| Vessel-Vessel Flange | Pressure Boundary, Structural/ Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.A2.5-d | 3.1.1-01 | A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Baffle Bolts | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region), Plus Preload | Change in Dimensions | PWR Vessel Internals | IV.B2.4-d | 3.1.1-11 | A |
| | | | | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.4-g | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.4-c | 3.1.1-15 | A |
| | | | | | Water Chemistry | IV.B2.4-c | 3.1.1-15 | A |
| | | | | Loss of Fracture Toughness | PWR Vessel Internals | IV.B2.4-f | 3.1.1-06 | A<br>R |
| | | | | Loss of Preload | PWR Vessel Internals | IV.B2.4-h | 3.1.1-16 | A |
| Internals-Clevis Insert | Structural/Functional Support | Nickel Based Alloy | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Relative Motion Between Components | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.5-p | 3.1.1-01 | A |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Clevis Insert (continued) | Structural/Functional Support (continued) | Nickel Based Alloy (continued) | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Relative Motion Between Components (continued) | Crack Initiation and Growth (continued) | Nickel-Alloy Nozzles and Penetrations | N/A | N/A | M |
| | | | | | Water Chemistry | N/A | N/A | M |
| | | | | Loss of Material | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.B2.5-o | 3.1.1-40 | B |
| Internals-Clevis Insert Bolt | Structural/Functional Support | Nickel Based Alloy | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.5-p | 3.1.1-01 | A |
| | | | | | Nickel-Alloy Nozzles and Penetrations | IV.B2.5-e | 3.1.1-45 | E |
| | | | | | Water Chemistry | IV.B2.5-e | 3.1.1-45 | E |
| Internals-Control Rod Guide Tube | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.2-c | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.2-a | 3.1.1-45 | A |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Control Rod Guide Tube (continued) | Structural/Functional Support (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F (continued) | Crack Initiation and Growth (continued) | Water Chemistry | IV.B2.2-a | 3.1.1-45 | A |
| Internals-Control Rod Guide Tube Bolts | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.2-f | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.2-d | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.2-d | 3.1.1-45 | A |
| Internals-Control Rod Guide Tube Support Pins | Structural/Functional Support | Nickel Based Alloy | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.2-f | 3.1.1-01 | A |
| | | | | | Nickel-Alloy Nozzles and Penetrations | IV.B2.2-d | 3.1.1-45 | E |
| | | | | | Water Chemistry | IV.B2.2-d | 3.1.1-45 | E |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Core Baffle and Core Former | Flow Control, Radiation Shieldings, Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region) | Change in Dimensions | PWR Vessel Internals | IV.B2.4-b | 3.1.1-11 | A |
| | | | | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.4-g | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.4-a | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.4-a | 3.1.1-45 | A |
| | | | | Loss of Fracture Toughness | PWR Vessel Internals | IV.B2.4-e | 3.1.1-43 | A |
| Internals-Core Barrel | Flow Control, Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region) | Change in Dimensions | PWR Vessel Internals | IV.B2.3-b | 3.1.1-11 | A |
| | | | | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.3-d | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.3-a | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.3-a | 3.1.1-45 | A |
| | | | | Loss of Fracture Toughness | PWR Vessel Internals | IV.B2.3-c | 3.1.1-43 | A |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Core Support Forging | Flow Control, Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region) | Change in Dimensions | PWR Vessel Internals | IV.B2.5-l | 3.1.1-11 | A |
| | | | | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | S |
| | | | | | PWR Vessel Internals | IV.B2.5-k | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.5-k | 3.1.1-45 | A |
| | | | | Loss of Fracture Toughness | PWR Vessel Internals | IV.B2.5-n | 3.1.1-43 | A |
| Internals-Diffuser Plate (Unit 1 only) | Flow Control, Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region) | Change in Dimensions | PWR Vessel Internals | IV.B2.5-b | 3.1.1-11 | C |
| | | | | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.5-d | 3.1.1-01 | C |
| | | | | | PWR Vessel Internals | IV.B2.5-a | 3.1.1-45 | C |
| | | | | | Water Chemistry | IV.B2.5-a | 3.1.1-45 | C |
| | | | | Loss of Fracture Toughness | PWR Vessel Internals | IV.B2.5-c | 3.1.1-43 | C |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Fuel Alignment Pin (lower assembly) | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region) | Change in Dimensions | PWR Vessel Internals | IV.B2.5-f | 3.1.1-11 | A |
| | | | | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.5-j | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.5-e | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.5-e | 3.1.1-45 | A |
| | | | | Loss of Fracture Toughness | PWR Vessel Internals | IV.B2.5-g | 3.1.1-43 | A |
| Internals-Fuel Alignment Pin (upper assembly) | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region) | Change in Dimensions | PWR Vessel Internals | IV.B2.1-j | 3.1.1-11 | A |
| | | | | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.1-m | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.1-i | 3.1.1-45 | A |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Fuel Alignment Pin (upper assembly) (continued) | Structural/Functional Support (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region) (continued) | Crack Initiation and Growth (continued) | Water Chemistry | IV.B2.1-i | 3.1.1-45 | A |
| | | | | Loss of Fracture Toughness | PWR Vessel Internals | IV.B2.1-j | 3.1.1-11 | A<br>R |
| Internals-Hold Down Spring and Upper Support Assembly | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.1-c | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.1-a | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.1-a | 3.1.1-45 | A |
| Internals-Instrumentation Guide Tubes | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | S |
| | | | | | PWR Vessel Internals | IV.B2.6-a | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.6-a | 3.1.1-45 | A |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Lower Core Plate | Flow Control, Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region) | Change in Dimensions | PWR Vessel Internals | IV.B2.5-b | 3.1.1-11 | A |
| | | | | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.5-d | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.5-a | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.5-a | 3.1.1-45 | A |
| | | | | Loss of Fracture Toughness | PWR Vessel Internals | IV.B2.5-c | 3.1.1-43 | A |
| Internals-Lower Support Column | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region) | Change in Dimensions | PWR Vessel Internals | IV.B2.5-l | 3.1.1-11 | A |
| | | | | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.5-d | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.5-k | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.5-k | 3.1.1-45 | A |
| | | | | Loss of Fracture Toughness | PWR Vessel Internals | IV.B2.5-n | 3.1.1-43 | A |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Lower Support Column Bolts | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region), Plus Preload | Change in Dimensions | PWR Vessel Internals | IV.B2.5-f | 3.1.1-11 | A |
| | | | | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.5-j | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.5-e | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.5-e | 3.1.1-45 | A |
| | | | | Loss of Fracture Toughness | PWR Vessel Internals | IV.B2.5-g | 3.1.1-43 | A |
| | | | | Loss of Preload | PWR Vessel Internals | IV.B2.5-h | 3.1.1-48 | E |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Lower Support Column-Base | Structural/Functional Support | Cast Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region) | Change in Dimensions | PWR Vessel Internals | IV.B2.5-l | 3.1.1-11 | A |
| | | | | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.5-d | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.5-k | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.5-k | 3.1.1-45 | A |
| | | | | Loss of Fracture Toughness | Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) | IV.B2.5-m | 3.1.1-37 | A |
| | | | | | PWR Vessel Internals | IV.B2.5-n | 3.1.1-43 | A |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Radial Support | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Relative Motion Between Components | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.5-p | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.5-a | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.5-a | 3.1.1-45 | A |
| | | | | Loss of Material | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.B2.5-o | 3.1.1-40 | B |
| Internals-Seal Table | Pressure Boundary, Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| Internals-Seal Table Fitting | Pressure Boundary, Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Secondary Support Assembly | Flow Control, Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.5-d | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.5-a | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.5-a | 3.1.1-45 | A |
| Internals-Thermal Shield | Radiation Shielding | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region) | Change in Dimensions | PWR Vessel Internals | IV.B2.3-b | 3.1.1-11 | A |
| | | | | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.3-d | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.3-a | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.3-a | 3.1.1-45 | A |
| | | | | Loss of Fracture Toughness | PWR Vessel Internals | IV.B2.3-c | 3.1.1-43 | A |
| Internals-Thimble Guide Tube | Pressure Boundary, Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | S |
| | | | | | PWR Vessel Internals | IV.B2.6-a | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.6-a | 3.1.1-45 | A |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Upper Core Plate | Flow Control, Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.1-c | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.1-a | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.1-a | 3.1.1-45 | A |
| Internals-Upper Core Plate Alignment Pins | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Relative Motion Between Components | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | S |
| | | | | | PWR Vessel Internals | IV.B2.1-i | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.1-i | 3.1.1-45 | A |
| | | | | Loss of Material | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.B2.1-l | 3.1.1-40 | B |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Upper Core Plate-Flow Mixer | Flow Control, Structural/Functional Support | Cast Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal to 482 deg F and Neutron Fluence Greater Than or Equal to 1E17 n/sq. cm But Less than 5E20 n/sq. cm | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.1-c | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.1-a | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.1-a | 3.1.1-45 | A |
| | | | | | Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) | N/A | N/A | L |
| Internals-Upper Support Column | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.1-h | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.1-e | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.1-e | 3.1.1-45 | A |
| Internals-Upper Support Column Bolts | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | S |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Internals-Upper Support Column Bolts (continued) | Structural/Functional Support (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F (continued) | Crack Initiation and Growth (continued) | PWR Vessel Internals | IV.B2.1-i | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.1-i | 3.1.1-45 | A |
| Internals-Upper Support Column-Base | Structural/Functional Support | Cast Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal to 482 deg F and Neutron Fluence Greater Than or Equal to 1E17 n/sq. cm But Less than 5E20 n/sq. cm | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.B2.1-h | 3.1.1-01 | A |
| | | | | | PWR Vessel Internals | IV.B2.1-e | 3.1.1-45 | A |
| | | | | | Water Chemistry | IV.B2.1-e | 3.1.1-45 | A |
| | | | | Loss of Fracture Toughness | Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) | IV.B2.1-g | 3.1.1-37 | A |

**Table 3.1.2-4: Reactor Coolant Systems – Reactor Vessel Internals - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Thimbles | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F and Neutron Fluence Greater Than or Equal To 5E20 n/sq. cm (RVI beltline region), Relative Motion Between Components | Change in Dimensions | PWR Vessel Internals | N/A | N/A | H |
| | | | | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | | PWR Vessel Internals | N/A | N/A | H |
| | | | | | Water Chemistry | N/A | N/A | H |
| | | | | Loss of Fracture Toughness | PWR Vessel Internals | N/A | N/A | H |
| | | | | Loss of Material | Flux Thimble Tube Examination Program | IV.B2.6-c | 3.1.1-40 | E |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

Definitions of the LRA Notes shown in Tables 3.1.2-1 through 3.1.2-4

A. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 for material, environment, and aging effect, but a different aging management program is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material, and environment combination.

I. Aging effect and/or mechanism 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.

K. Material and environment not in NUREG-1801 for this component and aging effect.

L. Aging effect and environment not in NUREG-1801 for this component and material.

M. Aging effect and material not in NUREG-1801 for this component and environment.

N. Aging effect, material, and environment not in NUREG-1801 for this component.

P. Component and aging effect not in NUREG-1801 for this material and environment.

Q. Component not in NUREG-1801 for this material, environment, and aging effect.

R. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801.

S. AMP and aging mechanism are not consistent with NUREG-1801.

T. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801.

U. Specific material/environment combinations were not determined. Comparison to NUREG-1801 is not possible.

V. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801. AMP takes some exceptions to NUREG-1801 AMP.

(Note “O” was not used to avoid confusion with the number zero)

Plant-Specific Notes

None.

## 3.2 AGING MANAGEMENT OF ENGINEERED SAFETY FEATURES SYSTEMS

### 3.2.1 Introduction

This section provides the results of the aging management review for those components identified in Section 2.3.2, Engineered Safety Features Systems (ESF), as being subject to aging management review. The systems, or portions of systems, which are addressed in this section, are described in the indicated sections.

- Containment Depressurization System (Section 2.3.2.1)
- Residual Heat Removal System (Section 2.3.2.2)
- Safety Injection System (Section 2.3.2.3)

Table 3.2.1, Summary of Aging Management Evaluations in Chapter V of NUREG-1801 for the Engineered Safety Features, provides the summary of the programs evaluated in NUREG-1801 for the Engineered Safety Features component groups that are relied on for license renewal.

This table uses the format described in Section 3.0 above. Note that this table only includes those component groups that are applicable to a PWR.

### 3.2.2 Results

The following tables summarize the results of the aging management review for systems in the ESF systems group. The tables appear after Table 3.2.1, which appears after Section 3.2.3, Conclusion.

Table 3.2.2-1, Engineered Safety Features - Containment Depressurization System - Summary of Aging Management Evaluation

Table 3.2.2-2, Engineered Safety Features - Residual Heat Removal System - Summary of Aging Management Evaluation

Table 3.2.2-3, Engineered Safety Features - Safety Injection System - Summary of Aging Management Evaluation

The materials that specific components are fabricated from, the environments to which components are exposed, the aging effects requiring management, and the aging management programs used to manage these aging effects are provided for each of the above systems in the following subsections of Section 3.2.2.1, Materials, Environments, Aging Effects Requiring Management and Aging Management Programs:

Section 3.2.2.1.1, Containment Depressurization System

Section 3.2.2.1.2, Residual Heat Removal System

Section 3.2.2.1.3, Safety Injection System

### 3.2.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

#### 3.2.2.1.1 Containment Depressurization System

**Materials**

The materials of construction for the Containment Depressurization System components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi, Clad with Stainless Steel
- Cast Austenitic Stainless Steel
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Wrought Austenitic Stainless Steel

**Environments**

The Containment Depressurization System components are exposed to the following environments:

- Air
- Air, Moisture or Wetting, Temperature Less Than 140 deg F
- Air, Potential for Leaking Borated Water
- Demineralized, Untreated Water
- Raw Water, Low Flow
- Treated Water
- Treated Water, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Containment Depressurization System, require management:

- Crack Initiation and Growth
- Loss of Heat Transfer Capability
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Containment Depressurization System components:

- Boric Acid Corrosion
- One-Time Inspection
- Open-Cycle Cooling Water System
- System Monitoring
- Water Chemistry

### 3.2.2.1.2 Residual Heat Removal System

**Materials**

The materials of construction for the Residual Heat Removal System components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Wrought Austenitic Stainless Steel

**Environments**

The Residual Heat Removal System components are exposed to the following environments:

- Air, Potential for Leaking Borated Water
- Bolting, Potential for Exposure to Leaking Borated Water At Temperatures of 212 deg F or Greater
- Treated Water
- Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F.
- Treated Water or Steam, Temperature Greater Than or Equal to 482 deg F
- Treated Water, Temperature Less Than 140 deg F
- Treated Water, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Residual Heat Removal System, require management:

- Crack Initiation and Growth

- Loss of Material
- Loss of Preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the Residual Heat Removal System components:

- ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD
- Bolting Integrity
- Boric Acid Corrosion
- Closed-Cycle Cooling Water System
- Metal Fatigue of Reactor Coolant Pressure Boundary
- System Monitoring
- Water Chemistry

### 3.2.2.1.3 Safety Injection System

**Materials**

The materials of construction for the Safety Injection System components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Wrought Austenitic Stainless Steel

**Environments**

The Safety Injection System components are exposed to the following environments:

- Air
- Air, Potential for Leaking Borated Water
- Dried Air or Gas
- Treated Water
- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F
- Treated Water, Temperature Less Than 140 deg F, Low Flow

- Treated Water, Temperature Greater Than or Equal to 140 deg F But Less Than 212 deg F.

**Aging Effects Requiring Management**

The following aging effects, associated with the Safety Injection System, require management:

- Crack Initiation and Growth
- Loss of Fracture Toughness
- Loss of Heat Transfer Capability
- Loss of Material
- Loss of Preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the Safety Injection System components:

- ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD
- Bolting Integrity
- Boric Acid Corrosion
- Metal Fatigue of Reactor Coolant Pressure Boundary
- One-Time Inspection
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)
- System Monitoring
- Water Chemistry

### 3.2.2.2 Time-Limited Aging Analyses

The time-limited aging analyses (TLAA) identified below are associated with the ESF systems components. The section of the LRA that contains the TLAA review results is indicated in parenthesis.

- ASME Fatigue Analysis (Section 4.3.1)
- Criteria for B31.1 System (Section 4.3.5)
- Environmental Qualification (Section 4.4)
- Leak Before Break (LBB) (Section 4.7.3)
- Motor Operated Valve Fatigue (Section 4.3.6)

### 3.2.3 Conclusion

The ESF systems components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management

programs selected to manage aging effects for the ESF components are identified in the summary tables and Section 3.2.2.1.

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 adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

**Table 3.2.1 Summary of Aging Management Evaluations in Chapter V of NUREG-1801 for Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-01 | Piping, fittings, and valves in emergency core cooling system | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) | Yes, TLAA | Consistent with NUREG-1801.<br><br>Further evaluation is discussed in TLAA Section 4.3, Metal Fatigue Analysis. |
| 3.2.1-02 | BWR Only | | | | |
| 3.2.1-03 | Components in containment spray (PWR only), standby gas treatment system (BWR only), containment isolation, and emergency core cooling systems | Loss of material due to general corrosion | Plant specific | Yes, plant specific | Consistent with NUREG-1801 for piping in the Containment Vacuum and Leakage Monitoring System.<br><br>Not applicable for headers and spray nozzles because at BVPS these components are stainless steel and the aging effect does not apply.<br><br>Not applicable for valves (hand, control and containment isolation) in headers and spray nozzles because at BVPS these components are stainless steel and the aging effect does not apply.<br><br>Further evaluation is documented in Appendix B, One-Time Inspection (Section B.2.1.22). |
| 3.2.1-04 | BWR Only | | | | |

**Table 3.2.1 Summary of Aging Management Evaluations in Chapter V of NUREG-1801 for Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-05 | Components in containment spray (PWR only), standby gas treatment system (BWR only), containment isolation, and emergency core cooling systems | Loss of material due to pitting and crevice corrosion | Plant specific | Yes, plant specific | Not applicable because results for these components at BVPS do not include mechanisms pitting or crevice corrosion. |
| 3.2.1-06 | Containment isolation valves and associated piping | Loss of material due to microbiologically influenced corrosion (MIC) | Plant specific | Yes, plant specific | Not applicable because containment isolation components in these systems were assigned to rows associated with normal system process piping.<br><br>Further evaluation is not applicable. |
| 3.2.1-07 | BWR Only | | | | |
| 3.2.1-08 | High-pressure safety injection (charging) pump miniflow orifice | Loss of material due to erosion | Plant specific | Yes, plant specific | Not applicable because these miniflow orifices at BVPS are stainless steel and not subject to erosion.<br><br>Further evaluation is not applicable. |
| 3.2.1-09 | BWR Only | | | | |
| 3.2.1-10 | External surface of carbon steel components | Loss of material due to general corrosion | Plant specific | Yes, plant specific | Consistent with NUREG-1801.<br><br>Further evaluation is documented in Appendix B, System Monitoring (Section B.2.1.31). |

**Table 3.2.1 Summary of Aging Management Evaluations in Chapter V of NUREG-1801 for Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-11 | Piping and fittings of Cast Austenitic Stainless Steel in emergency core cooling systems | Loss of fracture toughness due to thermal aging embrittlement | Thermal aging embrittlement of Cast Austenitic Stainless Steel | No | Not applicable because for BVPS these components are not Cast Austenitic Stainless Steel. |
| 3.2.1-12 | Components serviced by open-cycle cooling system | Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling | Open-cycle cooling water system | No | Consistent with NUREG-1801.<br><br>The BVPS Recirculation Spray Coolers results are consistent with NUREG-1801 row V.A.6-a, and also include mechanisms crevice corrosion, pitting, and galvanic corrosion. |
| 3.2.1-13 | Components serviced by closed-cycle cooling system | Loss of material due to general, pitting, and crevice corrosion | Closed-cycle cooling water system | No | Consistent with NUREG-1801 except as noted below.<br><br>BVPS results also included the mechanism general corrosion for the residual heat removal (RHR) heat exchangers, the Unit 1 RHR pump seal water coolers, and the Unit 2 RHR integrated seal coolers. |
| 3.2.1-14 | BWR Only | | | | |
| 3.2.1-15 | Pumps, valves, piping and fittings, and tanks in containment spray and emergency core cooling system | Crack initiation and growth due to SCC | Water chemistry | No | Consistent with NUREG-1801. |

**Table 3.2.1 Summary of Aging Management Evaluations in Chapter V of NUREG-1801 for Engineered Safety Features**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.2.1-16 | BWR Only | | | | |
| 3.2.1-17 | Carbon steel components | Loss of material due to boric acid corrosion | Boric acid corrosion | No | Consistent with NUREG-1801 for some components.<br><br>Not applicable for HPSI and LPSI pumps because for BVPS the casings are not carbon steel. |
| 3.2.1-18 | Closure bolting in high-pressure or high-temperature systems | Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC | Bolting integrity | No | Not applicable because bolting in these systems is assigned to other applicable/redundant rows, or BVPS aging management review results details are not consistent with NUREG-1801. |

**Table 3.2.2-1: Engineered Safety Features Systems – Containment Depressurization System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | Boric Acid Corrosion | N/A | N/A | H |
| | | | | Loss of Material | Boric Acid Corrosion | V.A.1-b | 3.2.1-17 | A |
| | | | | | | V.A.3-b | 3.2.1-17 | A |
| | | | | | | V.A.4-b | 3.2.1-17 | A |
| | | | | | | V.A.5-b | 3.2.1-17 | A |
| | | | | | | V.A.6-d | 3.2.1-17 | A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | V.D1.8-b | 3.2.1-17 | A |
| | | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | Boric Acid Corrosion | N/A | N/A | M |
| | | | | Loss of Material | Boric Acid Corrosion | N/A | N/A | F |
| Element | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.2.2-1: Engineered Safety Features Systems – Containment Depressurization System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surface | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | V.E.1-b | 3.2.1-10 | A |
| | | | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | V.E.1-a | 3.2.1-17 | A |
| Heat Exchanger | Heat Transfer, Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | V.A.6-a | 3.2.1-12 | A<br>R |
| | | | | Loss of Heat Transfer Capability | Open-Cycle Cooling Water System | V.A.6-b | 3.2.1-12 | A |
| | | | Demineralized Untreated Water | Loss of Heat Transfer Capability | One-Time Inspection | N/A | N/A | J |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water, Low Flow | Loss of Material | Open-Cycle Cooling Water System | V.A.6-a | 3.2.1-12 | A<br>R |

**Table 3.2.2-1: Engineered Safety Features Systems – Containment Depressurization System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Orifice | Flow Restriction, Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Pipe Fittings | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Piping | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.2.2-1: Engineered Safety Features Systems – Containment Depressurization System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Demineralized Untreated Water | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Pump | Pressure Boundary | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.2.2-1: Engineered Safety Features Systems – Containment Depressurization System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Seal | Pressure Boundary | Wrought Austenitic Stainless Steel | Demineralized Untreated Water | None | N/A | N/A | N/A | N/A |
| Strainer | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Tank | Pressure Boundary | Carbon and Low Alloy Steel with Yield Strength Less than 100 Ksi Clad with Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.2.2-1: Engineered Safety Features Systems – Containment Depressurization System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Tank (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Air, Moisture or Wetting, Temperature Less Than 140 deg F | Loss of Material | One-Time Inspection | N/A | N/A | J |
| | | | Demineralized Untreated Water | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Valve | Pressure Boundary | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water, Temperature Less than 140 deg F, Low Flow | Loss of Material | Water Chemistry | N/A | N/A | M |

**Table 3.2.2-1: Engineered Safety Features Systems – Containment Depressurization System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Demineralized Untreated Water | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | N/A | N/A | U |
| | | | Treated Water | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Containment Depressurization System, those safety-related buildings and areas are:

Unit 1 Chemical Addition Building
Unit 1 Reactor Containment Building
Unit 1 Refueling Water Storage Tank Foundation Mat and Shield Wall

Unit 1 Safeguards Building

Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Pipe Tunnels
Unit 2 Reactor Containment Building
Unit 2 Refueling Water Storage Tank and Chemical Addition Tank Shield Wall
Unit 2 Safeguards Building

**Table 3.2.2-2: Engineered Safety Features Systems – Residual Heat Removal System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Bolting, Potential for Exposure to Leaking Borated Water At Temperatures of 212 deg F or Greater | Crack Initiation and Growth | Boric Acid Corrosion | N/A | N/A | H |
| | | | | | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | Loss of Material | Boric Acid Corrosion | V.D1.1-d | 3.2.1-17 | A |
| | | | | | | V.D1.4-c | 3.2.1-17 | A |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| Element | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | V.D1.1-c | 3.2.1-01 | A |
| | | | | | Water Chemistry | V.D1.1-a | 3.2.1-15 | A |

**Table 3.2.2-2: Engineered Safety Features Systems – Residual Heat Removal System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surface | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | V.D1.4-c | 3.2.1-17 | A |
| | | | | | | V.E.1-a | 3.2.1-17 | A |
| Heat Exchanger | Heat Transfer, Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | | Water Chemistry | N/A | N/A | H |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | V.D1.5-b | 3.2.1-17 | A |
| | | | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Closed-Cycle Cooling Water System | V.D1.5-a | 3.2.1-13 | R |
| | | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | | Water Chemistry | N/A | N/A | H |

**Table 3.2.2-2: Engineered Safety Features Systems – Residual Heat Removal System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Orifice | Flow Restriction, Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | V.D1.1-c | 3.2.1-01 | A |
| | | | | | Water Chemistry | V.D1.1-a | 3.2.1-15 | A |
| | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | V.D1.1-c | 3.2.1-01 | A |
| | | | | | Water Chemistry | V.D1.1-a | 3.2.1-15 | A |
| Piping | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.2-a | 3.1.1-01 | A |
| | | | | | | V.D1.1-c | 3.2.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | Water Chemistry | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | | V.D1.1-a | 3.2.1-15 | A |

**Table 3.2.2-2: Engineered Safety Features Systems – Residual Heat Removal System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.2-a | 3.1.1-01 | A |
| | | | | | | V.D1.1-c | 3.2.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | Water Chemistry | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | | V.D1.1-a | 3.2.1-15 | A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.2.2-2: Engineered Safety Features Systems – Residual Heat Removal System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pump | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | S |
| | | | | | Water Chemistry | V.D1.2-a | 3.2.1-15 | A |
| | | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | S |
| | | | | | Water Chemistry | V.D1.2-a | 3.2.1-15 | A |
| Valve | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.2-a | 3.1.1-01 | A |
| | | | | | | V.D1.4-a | 3.2.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | Water Chemistry | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | | V.D1.4-b | 3.2.1-15 | A |

**Table 3.2.2-2: Engineered Safety Features Systems – Residual Heat Removal System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.2-a | 3.1.1-01 | A |
| | | | | | | V.D1.4-a | 3.2.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | Water Chemistry | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | | V.D1.4-b | 3.2.1-15 | A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.2-a | 3.1.1-01 | A |
| | | | | | | V.D1.4-a | 3.2.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | Water Chemistry | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | | V.D1.4-b | 3.2.1-15 | A |

**Table 3.2.2-2: Engineered Safety Features Systems – Residual Heat Removal System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | N/A | N/A | U |
| | | | Treated Water | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | | | |
| | | | | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Residual Heat Removal System, those safety-related buildings and areas are:

Unit 1 Reactor Containment Building
Unit 1 Safeguards Building

Unit 2 Reactor Containment Building
Unit 2 Safeguards Building

**Table 3.2.2-3: Engineered Safety Features Systems – Safety Injection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Accumulator | Pressure Boundary | Wrought Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | Boric Acid Corrosion | N/A | N/A | H |
| | | | | Loss of Material | Boric Acid Corrosion | V.D1.1-d | 3.2.1-17 | A |
| | | | | | | V.D1.4-c | 3.2.1-17 | A |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| | | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | Boric Acid Corrosion | N/A | N/A | M |
| | | | | Loss of Material | Boric Acid Corrosion | N/A | N/A | F |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| Element | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| External Surface | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | V.D1.4-c | 3.2.1-17 | A |
| | | | | | | V.E.1-a | 3.2.1-17 | A |
| Heat Exchanger | Heat Transfer, Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | Loss of Heat Transfer Capability | One-Time Inspection | N/A | N/A | H |

**Table 3.2.2-3: Engineered Safety Features Systems – Safety Injection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Orifice | Flow Restriction, Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Pipe Fittings | Pressure Boundary | Wrought Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.2-a | 3.1.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | Water Chemistry | IV.C2.2-f | 3.1.1-36 | A |

**Table 3.2.2-3: Engineered Safety Features Systems – Safety Injection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Greater Than or Equal to 140 deg F But Less Than 212 deg F | Crack Initiation and Growth | Water Chemistry | V.D1.1-a | 3.2.1-15 | A |
| Pump | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Seal | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Tank | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.2.2-3: Engineered Safety Features Systems – Safety Injection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Tank (continued) | Pressure Boundary (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi Clad with Stainless Steel (continued) | Treated Water, Temperature Greater Than or Equal to 140 deg F But Less Than 212 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Valve | Flow Control, Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| | Pressure Boundary | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |

**Table 3.2.2-3: Engineered Safety Features Systems – Safety Injection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Cast Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.2-a | 3.1.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | Water Chemistry | IV.C2.2-f | 3.1.1-36 | A |
| | | | | Loss of Fracture Toughness | Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) | N/A | N/A | H |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Greater Than or Equal to 140 deg F But Less Than 212 deg F | Crack Initiation and Growth | Water Chemistry | V.D1.4-b | 3.2.1-15 | A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Dried Air or Gas | None | N/A | N/A | N/A | N/A |

**Table 3.2.2-3: Engineered Safety Features Systems – Safety Injection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | IV.C2.2-a | 3.1.1-01 | A |
| | | | | | | V.D1.4-a | 3.2.1-01 | A |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | Water Chemistry | IV.C2.2-f | 3.1.1-36 | A |
| | | | | | | V.D1.4-b | 3.2.1-15 | A |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Greater Than or Equal to 140 deg F But Less Than 212 deg F | Crack Initiation and Growth | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | Water Chemistry | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | | V.D1.4-b | 3.2.1-15 | A |

**Table 3.2.2-3: Engineered Safety Features Systems – Safety Injection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | N/A | N/A | U |
| | | | Treated Water | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Safety Injection System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Reactor Containment Building
Unit 1 Safeguards Building

Unit 2 Auxiliary Building
Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Reactor Containment Building
Unit 2 Safeguards Building

Definitions of the LRA Notes shown in Tables 3.2.2-1 through 3.2.2-3

A. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 for material, environment, and aging effect, but a different aging management program is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material, and environment combination.

I. Aging effect and/or mechanism 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.

K. Material and environment not in NUREG-1801 for this component and aging effect.

L. Aging effect and environment not in NUREG-1801 for this component and material.

M. Aging effect and material not in NUREG-1801 for this component and environment.

N. Aging effect, material, and environment not in NUREG-1801 for this component.

P. Component and aging effect not in NUREG-1801 for this material and environment.

Q. Component not in NUREG-1801 for this material, environment, and aging effect.

R. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801.

S. AMP and aging mechanism are not consistent with NUREG-1801.

T. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801.

U. Specific material/environment combinations were not determined. Comparison to NUREG-1801 is not possible.

V. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801. AMP takes some exceptions to NUREG-1801 AMP.

(Note “O” was not used to avoid confusion with the number zero)

Plant-Specific Notes

None.

## 3.3 AGING MANAGEMENT OF AUXILIARY SYSTEMS

### 3.3.1 Introduction

This section provides the results of the aging management review for those components identified in Section 2.3.3, Auxiliary Systems, as being subject to aging management review. The systems, or portions of systems, which are addressed in this section, are described in the indicated sections.

- Area Ventilating Systems - Air Conditioning (2.3.3.1)
- Area Ventilation Systems - Auxiliary Building (2.3.3.2)
- Area Ventilation Systems - Control Area (2.3.3.3)
- Area Ventilation Systems - Cooling (2.3.3.4)
- Area Ventilation Systems - Miscellaneous (2.3.3.5)
- Area Ventilation Systems - Reactor Containment Building (2.3.3.6)
- Boron Recovery and Primary Grade Water System (2.3.3.7)
- Building and Yard Drains System (2.3.3.8)
- Building Services Hot Water Heater System (2.3.3.9)
- Chemical and Volume Control System (2.3.3.10)
- Chilled Water System (2.3.3.11)
- Compressed Air System (2.3.3.12)
- Containment System (2.3.3.13)
- Containment Vacuum and Leakage Monitoring System (2.3.3.14)
- Domestic Water System (2.3.3.15)
- Emergency Diesel Generators and Support Systems (2.3.3.16)
- ERF Substation System (2.3.3.17)
- Fire Protection System (2.3.3.18)
- Fuel Pool Cooling and Purification System (2.3.3.19)
- Glycol Heating System (2.3.3.20)
- Liquid Waste Disposal System (2.3.3.21)
- Post Accident Sample System (2.3.3.22)
- Post-DBA Hydrogen Control System (2.3.3.23)
- Primary Component and Neutron Shield Tank Cooling Water System (2.3.3.24)
- Radiation Monitoring System (2.3.3.25)
- Reactor Plant Sample System (2.3.3.26)
- River Water System (2.3.3.27)
- Security (2.3.3.28)
- Service Water System (2.3.3.29)
- Solid Waste Disposal System (2.3.3.30)
- Supplementary Leak Collection and Release System (2.3.3.31)
- Water Treating System (2.3.3.32)

Table 3.3.1, Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for the Auxiliary Systems, provides the summary of the programs evaluated in NUREG-1801 for the Auxiliary Systems component groups that are relied on for license renewal.

This table uses the format described in Section 3.0 above. Note that this table only includes those component groups that are applicable to a PWR.

### 3.3.2 Results

The following tables summarize the results of the aging management review for systems in the Auxiliary Systems group. The tables appear after Table 3.3.1, which appears after Section 3.3.3, Conclusion.

Table 3.3.2-1, Auxiliary Systems – Area Ventilating Systems - Air Conditioning - Summary of Aging Management Evaluation

Table 3.3.2-2, Auxiliary Systems – Area Ventilation Systems - Auxiliary Building - Summary of Aging Management Evaluation

Table 3.3.2-3, Auxiliary Systems – Area Ventilation Systems - Control Area - Summary of Aging Management Evaluation

Table 3.3.2-4, Auxiliary Systems – Area Ventilation Systems - Cooling - Summary of Aging Management Evaluation

Table 3.3.2-5, Auxiliary Systems – Area Ventilation Systems - Miscellaneous - Summary of Aging Management Evaluation

Table 3.3.2-6, Auxiliary Systems – Area Ventilation Systems - Reactor Containment Building - Summary of Aging Management Evaluation

Table 3.3.2-7, Auxiliary Systems – Boron Recovery and Primary Grade Water System - Summary of Aging Management Evaluation

Table 3.3.2-8, Auxiliary Systems –Building and Yard Drains System - Summary of Aging Management Evaluation

Table 3.3.2-9, Auxiliary Systems – Building Services Hot Water Heater System - Summary of Aging Management Evaluation

Table 3.3.2-10, Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation

Table 3.3.2-11, Auxiliary Systems – Chilled Water System - Summary of Aging Management Evaluation

Table 3.3.2-12, Auxiliary Systems – Compressed Air System - Summary of Aging Management Evaluation

Table 3.3.2-13, Auxiliary Systems – Containment System - Summary of Aging Management Evaluation

Table 3.3.2-14, Auxiliary Systems – Containment Vacuum and Leakage Monitoring System - Summary of Aging Management Evaluation

Table 3.3.2-15, Auxiliary Systems – Domestic Water System - Summary of Aging Management Evaluation

Table 3.3.2-16, Auxiliary Systems – Emergency Diesel Generators and Support Systems - Summary of Aging Management Evaluation

Table 3.3.2-17, Auxiliary Systems – ERF Substation System - Summary of Aging Management Evaluation

Table 3.3.2-18, Auxiliary Systems – Fire Protection System - Summary of Aging Management Evaluation

Table 3.3.2-19, Auxiliary Systems – Fuel Pool Cooling and Purification System - Summary of Aging Management Evaluation

Table 3.3.2-20, Auxiliary Systems – Glycol Heating System - Summary of Aging Management Evaluation

Table 3.3.2-21, Auxiliary Systems – Liquid Waste Disposal System - Summary of Aging Management Evaluation

Table 3.3.2-22, Auxiliary Systems – Post Accident Sample System - Summary of Aging Management Evaluation

Table 3.3.2-23, Auxiliary Systems – Post-DBA Hydrogen Control System - Summary of Aging Management Evaluation

Table 3.3.2-24, Auxiliary Systems – Primary Component and Neutron Shield Tank Cooling Water System - Summary of Aging Management Evaluation

Table 3.3.2-25, Auxiliary Systems – Radiation Monitoring System - Summary of Aging Management Evaluation

Table 3.3.2-26, Auxiliary Systems – Reactor Plant Sample System - Summary of Aging Management Evaluation

Table 3.3.2-27, Auxiliary Systems – River Water System - Summary of Aging Management Evaluation

Table 3.3.2-28, Auxiliary Systems – Security - Summary of Aging Management Evaluation

Table 3.3.2-29, Auxiliary Systems – Service Water System - Summary of Aging Management Evaluation

Table 3.3.2-30, Auxiliary Systems – Solid Waste Disposal System - Summary of Aging Management Evaluation

Table 3.3.2-31, Auxiliary Systems – Supplementary Leak Collection and Release System - Summary of Aging Management Evaluation

Table 3.3.2-32, Auxiliary Systems – Water Treating System - Summary of Aging Management Evaluation

The materials that specific components are fabricated from, the environments to which components are exposed, the potential aging effects requiring management, and the aging management programs used to manage these aging effects are provided for each of the above systems in the following subsections of Section 3.3.2.1, Materials, Environments, Aging Effects Requiring Management and Aging Management Programs:

Section 3.3.2.1.1, Area Ventilating Systems - Air Conditioning

Section 3.3.2.1.2, Area Ventilation Systems - Auxiliary Building

Section 3.3.2.1.3, Area Ventilation Systems - Control Area

Section 3.3.2.1.4, Area Ventilation Systems - Cooling

Section 3.3.2.1.5, Area Ventilation Systems - Miscellaneous

Section 3.3.2.1.6, Area Ventilation Systems - Reactor Containment Building

Section 3.3.2.1.7, Boron Recovery and Primary Grade Water System

Section 3.3.2.1.8, Building and Yard Drains System

Section 3.3.2.1.9, Building Services Hot Water Heater System

Section 3.3.2.1.10, Chemical and Volume Control System

Section 3.3.2.1.11, Chilled Water System

Section 3.3.2.1.12, Compressed Air System

Section 3.3.2.1.13, Containment System

Section 3.3.2.1.14, Containment Vacuum and Leakage Monitoring System

Section 3.3.2.1.15, Domestic Water System

Section 3.3.2.1.16, Emergency Diesel Generators and Support Systems

Section 3.3.2.1.17, ERF Substation System

Section 3.3.2.1.18, Fire Protection System

Section 3.3.2.1.19, Fuel Pool Cooling and Purification System

Section 3.3.2.1.20, Glycol Heating System

Section 3.3.2.1.21, Liquid Waste Disposal System

Section 3.3.2.1.22, Post Accident Sample System

Section 3.3.2.1.23, Post-DBA Hydrogen Control System

Section 3.3.2.1.24, Primary Component and Neutron Shield Tank Cooling Water System

Section 3.3.2.1.25, Radiation Monitoring System

Section 3.3.2.1.26, Reactor Plant Sample System

Section 3.3.2.1.27, River Water System

Section 3.3.2.1.28, Security

Section 3.3.2.1.29, Service Water System

Section 3.3.2.1.30, Solid Waste Disposal System

Section 3.3.2.1.31, Supplementary Leak Collection and Release System

Section 3.3.2.1.32, Water Treating System

### 3.3.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

#### 3.3.2.1.1 Area Ventilating Systems - Air Conditioning

**Materials**

The materials of construction for the Area Ventilating Systems - Air Conditioning components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Copper Alloys with Zinc Contents Less Than or Equal to 15%
- Polymers

**Environments**

The Area Ventilating Systems - Air Conditioning components are exposed to the following environments:

- Air
- Treated Water
- Treated Water, Temperature Less Than 140 deg F

**Aging Effects Requiring Management**

The following aging effects, associated with the Area Ventilating Systems - Air Conditioning, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Area Ventilating Systems - Air Conditioning components:

- Bolting Integrity
- Closed-Cycle Cooling Water System
- Periodic Surveillance and Preventive Maintenance
- System Monitoring

### 3.3.2.1.2 Area Ventilation Systems - Auxiliary Building

**Materials**

The materials of construction for the Area Ventilation Systems - Auxiliary Building components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Polymers
- Wrought Austenitic Stainless Steel

**Environments**

The Area Ventilation Systems - Auxiliary Building components are exposed to the following environments:

- Air

**Aging Effects Requiring Management**

The following aging effects, associated with the Area Ventilation Systems - Auxiliary Building, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Area Ventilation Systems - Auxiliary Building components:

- Bolting Integrity
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- System Monitoring

### 3.3.2.1.3 Area Ventilation Systems - Control Area

**Materials**

The materials of construction for the Area Ventilation Systems - Control Area components are:

- Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon)
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Gray Cast Iron
- Polymers
- Wrought Austenitic Stainless Steel

**Environments**

The Area Ventilation Systems - Control Area components are exposed to the following environments:

- Air
- Air, Moisture or Wetting, Temperature Less Than 140 deg F
- Dried Air or Gas
- Raw Water

**Aging Effects Requiring Management**

The following aging effects, Associated with the Area Ventilation Systems - Control Area, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Heat Transfer Capability
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Area Ventilation Systems - Control Area components:

- One-Time Inspection
- Open-Cycle Cooling Water System
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching of Materials
- System Monitoring

#### 3.3.2.1.4 Area Ventilation Systems - Cooling

**Materials**

The materials of construction for the Area Ventilation Systems - Cooling components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Gray Cast Iron
- Polymers
- Wrought Austenitic Stainless Steel

**Environments**

The Area Ventilation Systems - Cooling components are exposed to the following environments:

- Air
- Dried Air or Gas
- Raw Water
- Treated Water

**Aging Effects Requiring Management**

The following aging effects, associated with the Area Ventilation Systems - Cooling, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Heat Transfer Capability
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Area Ventilation Systems - Cooling components:

- Bolting Integrity
- Closed-Cycle Cooling Water System
- One-Time Inspection
- Open-Cycle Cooling Water System
- Periodic Surveillance and Preventive Maintenance
- System Monitoring

### 3.3.2.1.5 Area Ventilation Systems - Miscellaneous

**Materials**

The materials of construction for the Area Ventilation Systems - Miscellaneous components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Polymers

**Environments**

The Area Ventilation Systems - Miscellaneous components are exposed to the following environments:

- Air
- Treated Water

**Aging Effects Requiring Management**

The following aging effects, associated with the Area Ventilation Systems - Miscellaneous, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Area Ventilation Systems - Miscellaneous components:

- Bolting Integrity
- Closed-Cycle Cooling Water System
- Periodic Surveillance and Preventive Maintenance
- System Monitoring

### 3.3.2.1.6 Area Ventilation Systems - Reactor Containment Building

**Materials**

The materials of construction for the Area Ventilation Systems - Reactor Containment Building components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Wrought Austenitic Stainless Steel
- Polymers

**Environments**

The Area Ventilation Systems - Reactor Containment Building components are exposed to the following environments:

- Air
- Treated Water
- Treated Water, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Area Ventilation Systems - Reactor Containment Building, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Area Ventilation Systems - Reactor Containment Building components:

- Bolting Integrity
- Closed-Cycle Cooling Water System
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- System Monitoring

### 3.3.2.1.7 Boron Recovery and Primary Grade Water System

**Materials**

The materials of construction for the Boron Recovery and Primary Grade Water System components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Wrought Austenitic Stainless Steel

**Environments**

The Boron Recovery and Primary Grade Water System components are exposed to the following environments:

- Air, Potential for Leaking Borated Water
- Bolting, Potential for Exposure to Leaking Borated Water At Temperatures of 212 deg F or Greater
- Demineralized Untreated Water
- Treated Water
- Treated Water, Temperature Less Than 140 deg F, Low Flow
- Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Boron Recovery and Primary Grade Water System, require management:

- Crack Initiation and Growth

- Loss of Material
- Loss of Preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the Boron Recovery and Primary Grade Water System components:

- Bolting Integrity
- Boric Acid Corrosion
- Closed-Cycle Cooling Water System
- Metal Fatigue of Reactor Coolant Pressure Boundary
- One-Time Inspection
- System Monitoring
- Water Chemistry

### 3.3.2.1.8 Building and Yard Drains System

**Materials**

The materials of construction for the Building and Yard Drains System components are:

- Specific materials were not determined.

**Environments**

The Building and Yard Drains System components are exposed to the following environments:

- Raw Water

**Aging Effects Requiring Management**

The following aging effects, associated with the Building and Yard Drains System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Building and Yard Drains System components:

- One-Time Inspection
- System Monitoring

#### 3.3.2.1.9 Building Services Hot Water Heater System

**Materials**

The materials of construction for the Building Services Hot Water Heater System components are:

- Specific materials were not determined.

**Environments**

The Building Services Hot Water Heater System components are exposed to the following environments:

- Demineralized, Untreated Water

**Aging Effects Requiring Management**

The following aging effects, associated with the Building Services Hot Water Heater System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Building Services Hot Water Heater System components:

- One-Time Inspection
- System Monitoring

#### 3.3.2.1.10 Chemical and Volume Control System

**Materials**

The materials of construction for the Chemical and Volume Control System components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Glass
- Gray Cast Iron
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Wrought Austenitic Stainless Steel

**Environments**

The Chemical and Volume Control System components are exposed to the following environments:

- Air, Potential for Leaking Borated Water
- Bolting, Potential for Exposure to Leaking Borated water At Temperatures of 212 deg F or Greater
- Dried Air or Gas
- Lubricating Oil
- Raw Water
- Treated Water
- Treated Water, Temperature Less Than 140 deg F
- Treated Water, Temperature Less Than 140 deg F, Low Flow
- Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F
- Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F, Low Flow
- Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F

**Aging Effects Requiring Management**

The following aging effects, associated with the Chemical and Volume Control System, require management:

- Crack Initiation and Growth
- Loss of Fracture Toughness
- Loss of Heat Transfer Capability
- Loss of Material
- Loss of Preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the Chemical and Volume Control System components:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD
- Bolting Integrity
- Boric Acid Corrosion
- Closed-Cycle Cooling Water System
- Metal Fatigue of Reactor Coolant Pressure Boundary
- One-Time Inspection
- One Time Inspection of Small-Bore Piping
- Open-Cycle Cooling Water System
- System Monitoring
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel
- Water Chemistry

### 3.3.2.1.11 Chilled Water System

**Materials**

The materials of construction for the Chilled Water System components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Wrought Austenitic Stainless Steel

**Environments**

The Chilled Water System components are exposed to the following environments:

- Air
- Treated Water
- Treated Water, Temperature Less Than 140 deg F
- Treated Water, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Chilled Water System, require management:

- Loss of Material
- Crack Initiation and Growth

**Aging Management Programs**

The following aging management programs manage the aging effects for the Chilled Water System components:

- Closed-Cycle Cooling Water System
- One-Time Inspection
- System Monitoring

### 3.3.2.1.12 Compressed Air System

**Materials**

The materials of construction for the Compressed Air System components are:

- Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon)
- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Gray Cast Iron
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Wrought Austenitic Stainless Steel
- Zinc

**Environments**

The Compressed Air System components are exposed to the following environments:

- Air
- Dried Air or Gas

**Aging Effects Requiring Management**

The following aging effects, associated with the Compressed Air System, require management:

- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Compressed Air System components:

- Bolting Integrity
- One-Time Inspection
- System Monitoring

### 3.3.2.1.13 Containment System

**Materials**

The materials of construction for the Containment System components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Copper Alloys with Zinc Contents Less Than or Equial To 15%
- Wrought Austenitic Stainless Steel

**Environments**

The Containment System components are exposed to the following environments:

- Air

**Aging Effects Requiring Management**

The following aging effects, associated with the Containment System, require management:

- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Containment System components:

- One-Time Inspection
- System Monitoring

### 3.3.2.1.14 Containment Vacuum and Leakage Monitoring System

**Materials**

The materials of construction for the Containment Vacuum and Leakage Monitoring System components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Wrought Austenitic Stainless Steel

**Environments**

The Containment Vacuum and Leakage Monitoring System components are exposed to the following environments:

- Air
- Air, Moisture or Wetting, Temperature Less Than 140 deg F
- Treated Water

**Aging Effects Requiring Management**

The following aging effects, associated with the Containment Vacuum and Leakage Monitoring System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Containment Vacuum and Leakage Monitoring System components:

- One-Time Inspection
- System Monitoring
- Water Chemistry

### 3.3.2.1.15 Domestic Water System

**Materials**

The materials of construction for the Domestic Water System components are:

- Specific materials were not determined.

**Environments**

The Domestic Water System components are exposed to the following environments:

- Raw Water

**Aging Effects Requiring Management**

The following aging effects, associated with the Domestic Water System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Domestic Water System components:

- One-Time Inspection
- System Monitoring

### 3.3.2.1.16 Emergency Diesel Generators and Support Systems

**Materials**

The materials of construction for the Emergency Diesel Generators and Support Systems components are:

- Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon)
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Glass
- Gray Cast Iron
- Polymers
- Wrought Austenitic Stainless Steel

**Environments**

The Emergency Diesel Generators and Support Systems components are exposed to the following environments:

- Air
- Dried Air or Gas
- Exhaust
- Fuel Oil
- Fuel Oil Without Water Contamination
- Lubricating Oil
- Raw Water, Low Flow
- Soil, Above the Water Table
- Treated Water, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Emergency Diesel Generators and Support Systems, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Heat Transfer Capability
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Emergency Diesel Generators and Support Systems components:

- Buried Piping and Tanks Inspection
- Closed-Cycle Cooling Water System
- Fuel Oil Chemistry Program
- One-Time Inspection
- Open-Cycle Cooling Water System
- Periodic Surveillance and Preventive Maintenance
- Selective Leaching of Materials
- System Monitoring

### 3.3.2.1.17 ERF Substation System

**Materials**

The materials of construction for the ERF Substation System components are:

- Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon)
- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Strengths Less Than 100 ksi
- Copper Alloys with Zinc Contents Greater Than 15% AND Aluminum Bronze
- Fiberglass
- Plastic Pipe
- Polymers
- Wrought Austenitic Stainless Steel

**Environments**

The ERF Substation System components are exposed to the following environments:

- Air
- Fuel Oil
- Fuel Oil Without Water Contamination
- Soil, Above the Water Table
- Treated Water, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the ERF Substation System, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Heat Transfer Capability
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the ERF Substation System components:

- Bolting Integrity
- Buried Piping and Tanks Inspection
- Closed-Cycle Cooling Water System
- Fuel Oil Chemistry Program
- Periodic Surveillance and Preventive Maintenance
- System Monitoring

#### 3.3.2.1.18 Fire Protection System

**Materials**

The materials of construction for the Fire Protection System components are:

- Alluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon)
- Brass
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Cast Bronz
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Glass
- Gray Cast Iron
- Polymer
- Wrought Austenitic Stainless Steel

**Environments**

The Fire Protection System components are exposed to the following environments:

- Air
- Dried Air or Gas
- Fuel Oil
- Fuel Oil Without Water Contamination
- Lubricating Oil
- Lubricating Oil With Contamination
- Raw Water
- Raw Water, Low Flow
- Soil, Above the Water Table

**Aging Effects Requiring Management**

The following aging effects, associated with the Fire Protection System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Fire Protection System components:

- Buried Piping and Tanks Inspection
- Fire Protection
- Fire Water System
- Fuel Oil Chemistry
- One-Time Inspection
- Selective Leaching of Materials
- System Monitoring

### 3.3.2.1.19 Fuel Pool Cooling and Purification System

**Materials**

The materials of construction for the Fuel Pool Cooling and Purification System components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Wrought Austenitic Stainless Steel

**Environments**

The Fuel Pool Cooling and Purification System components are exposed to the following environments:

- Air, Potential for Leaking Borated Water
- Treated Water
- Treated Water, Temperature Less Than 140 deg F
- Treated Water, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Fuel Pool Cooling and Purification System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Fuel Pool Cooling and Purification System components:

- Boric Acid Corrosion
- Closed-Cycle Cooling Water System
- System Monitoring
- Water Chemistry

### 3.3.2.1.20 Glycol Heating System

**Materials**

The materials of construction for the Glycol Heating System components are:

- Specified materials were not determined.

**Environments**

The Glycol Heating System components are exposed to the following environments:

- Treated Water

**Aging Effects Requiring Management**

The following aging effects, associated with the Glycol Heating System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Glycol Heating System components:

- System Monitoring

### 3.3.2.1.21 Liquid Waste Disposal System

**Materials**

The materials of construction for the Liquid Waste Disposal System components are:

- Specific materials were not determined.

**Environments**

The Liquid Waste Disposal System components are exposed to the following environments:

- Raw Water

**Aging Effects Requiring Management**

The following aging effects, associated with the Liquid Waste Disposal System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Liquid Waste Disposal System components:

- One-Time Inspection
- System Monitoring

### 3.3.2.1.22 Post Accident Sample System

**Materials**

The materials of construction for the Post Accident Sample System components are:

- Wrought Austenitic Stainless Steel

**Environments**

The Post Accident Sample System components are exposed to the following environments:

- Air
- Treated Water
- Treated Wsater, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Post Accident Sample System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Post Accident Sample System components:

- System Monitoring
- Water Chemistry

### 3.3.2.1.23 Post-DBA Hydrogen Control System

**Materials**

The materials of construction for the Post-DBA Hydrogen Control System components are:

- Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon)
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Gray Cast Iron
- Wrought Austenitic Stainless Steel

**Environments**

The Post-DBA Hydrogen Control System components are exposed to the following environments:

- Air

**Aging Effects Requiring Management**

The following aging effects, associated with the Post-DBA Hydrogen Control System, require management:

- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Post-DBA Hydrogen Control System components:

- One-Time Inspection
- System Monitoring

### 3.3.2.1.24 Primary Component and Neutron Shield Tank Cooling Water System

**Materials**

The materials of construction for the Primary Component and Neutron Shield Tank Cooling Water System components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Gray Cast Iron
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Wrought Austenitic Stainless Steel

**Environments**

The Primary Component and Neutron Shield Tank Cooling Water System components are exposed to the following environments:

- Air

- Lubricating Oil
- Raw Water
- Treated Water
- Treated Water, Temperature Less Than 140 deg F
- Treated Water, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Primary Component and Neutron Shield Tank Cooling Water System, require management:

- Crack Initiation and Growth
- Loss of Heat Transfer Capability
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Primary Component and Neutron Shield Tank Cooling Water System components:

- Closed-Cycle Cooling Water System
- One-Time Inspection
- Open-Cycle Cooling Water System
- Selective Leaching of Materials
- System Monitoring

### 3.3.2.1.25 Radiation Monitoring System

**Materials**

The materials of construction for the Radiation Monitoring System components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Less Than Or Equal To 15%
- Wrought Austenitic Stainless Steel

**Environments**

The Radiation Monitoring System components are exposed to the following environments:

- Air

- Raw Water, Low Flow
- Treated Water
- Treated Water, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Radiation Monitoring System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Radiation Monitoring System components:

- One-Time Inspection
- Open-Cycle Cooling Water System
- System Monitoring
- Water Chemistry

### 3.3.2.1.26 Reactor Plant Sample System

**Materials**

The materials of construction for the Reactor Plant Sample System components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Wrought Austenitic Stainless Steel

**Environments**

The Reactor Plant Sample System components are exposed to the following environments:

- Air, Potential for Leaking Borated Water
- Treated Water
- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow
- Treated Water, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Reactor Plant Sample System, require management:

- Crack Initiation
- Loss of Material
- Loss of Preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the Reactor Plant Sample System components:

- Bolting Integrity
- Boric Acid Corrosion
- One-Time Inspection
- System Monitoring
- Water Chemistry

### 3.3.2.1.27 River Water System

**Materials**

The materials of construction for the River Water System components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Copper Alloys with Zinc Contents Less Than Or Equal To 15%
- Gray Cast Iron
- Wrought Austenitic Stainless Steel

**Environments**

The River Water System components are exposed to the following environments:

- Air
- Dried Air or Gas
- Raw Water
- Raw Water, Low Flow

- Soil, Above the Water Table

**Aging Effects Requiring Management**

The following aging effects, associated with the River Water System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the River Water System components:

- Buried Piping and Tanks Inspection
- One-Time Inspection
- Open-Cycle Cooling Water System
- Selective Leaching of Materials
- System Monitoring

### 3.3.2.1.28 Security

**Materials**

The materials of construction for the Security components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Copper Alloys with Zinc Contents Less Than Or Equal To 15%
- Gray Cast Iron
- Plastic Pipe
- Polymers

**Environments**

The Security components are exposed to the following environments:

- Air
- Fuel Oil
- Fuel Oil Without Water Contamination
- Soil, Above the Water Table

**Aging Effects Requiring Management**

The following aging effects, associated with the Security, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Security System components:

- Buried Piping and Tanks Inspection
- Fuel Oil Chemistry Program
- System Monitoring

### 3.3.2.1.29 Service Water System

**Materials**

The materials of construction for the Service Water System components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Copper Alloys with Zinc Contents Less Than Or Equal To 15%
- Glass
- Nickel-Based Alloys
- Wrought Austenitic Stainless Steel

**Environments**

The Service Water System components are exposed to the following environments:

- Air
- Raw Water
- Raw Water, Low Flow
- Soil, Above the Water Table

**Aging Effects Requiring Management**

The following aging effects, associated with the Service Water System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Service Water System components:

- Buried Piping and Tanks Inspection
- One-Time Inspection
- Open-Cycle Cooling Water System
- Selective Leaching of Materials
- System Monitoring

### 3.3.2.1.30 Solid Waste Disposal System

**Materials**

The materials of construction for the Solid Waste Disposal System components are:

- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Less Than Or Equal To 15%
- Wrought Austenitic Stainless Steel

**Environments**

The Solid Waste Disposal System components are exposed to the following environments:

- Air, Potential for Leaking Borated Water
- Demineralized Untreated Water
- Treated Water, Temperature Less Than 140 deg F
- Treated Water, Temperature Less Than 140 deg F, Low Flow
- Raw Water
- Raw Water, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Solid Waste Disposal System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Solid Waste Disposal System components:

- One-Time Inspection
- System Monitoring
- Water Chemistry

### 3.3.2.1.31 Supplementary Leak Collection and Release System

**Materials**

The materials of construction for the Supplementary Leak Collection and Release System components are:

- Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon)
- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Copper Alloys with Zinc Contents Less Than Or Equal To 15%
- Polymers
- Wrought Austenitic Stainless Steel

**Environments**

The Supplementary Leak Collection and Release System components are exposed to the following environments:

- Air
- Air, Moisture or Wetting, Temperature Less Than 140 deg F
- Dried Air or Gas

**Aging Effects Requiring Management**

The following aging effects, associated with the Supplementary Leak Collection and Release System, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Supplementary Leak Collection and Release System components:

- Bolting Integrity
- One-Time Inspection
- Periodic Surveillance and Preventive Maintenance
- System Monitoring

### 3.3.2.1.32 Water Treating System

**Materials**

The materials of construction for the Water Treating System components are:

- Specific materials were not determined.

**Environments**

The Water Treating System components are exposed to the following environments:

- Demineralized Untreated Water, Low Flow
- Raw Water

**Aging Effects Requiring Management**

The following aging effects, associated with the Water Treating System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Water Treating System components:

- One-Time Inspection
- System Monitoring

### 3.3.2.2 Time-Limited Aging Analyses

The time-limited aging analyses (TLAA) identified below are associated with the Auxiliary systems components. The section of the LRA that contains the TLAA review results is indicated in parenthesis.

- Criteria for B31.1 Systems (Section 4.3.5)

### 3.3.3 Conclusion

The Auxiliary Systems components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Auxiliary Systems components are identified in the summary tables and Section 3.2.2.1.

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 Systems components will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

**Table 3.3.1 Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-01 | Components in spent fuel pool cooling and cleanup | Loss of material due to general, pitting, and crevice corrosion | Water chemistry and one-time inspection | Yes, detection of aging effects is to be further evaluated | Not applicable because these components are stainless steel at BVPS, vice carbon steel with a lining. Further evaluation is not applicable. |
| 3.3.1-02 | Linings in spent fuel pool cooling and cleanup system; seals and collars in ventilation systems | Hardening, cracking and loss of strength due to elastomer degradation; loss of material due to wear | Plant specific | Yes, plant specific | Consistent with NUREG-1801.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>▪ Area Ventilation Systems-Control Area system filters.<br><br>Further evaluation is provided in Section B.2.1.24, Periodic Surveillance and Preventive Maintenance, and Section B.2.1.31, System Monitoring. |
| 3.3.1-03 | Components in load handling, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (older BWR) | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) | Yes, TLAA | Consistent with NUREG-1801.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>▪ Boron Recovery and Primary Grade Water System, heat exchanger, orifice, piping and valve |

**Table 3.3.1 Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| | | | | | components credited with Metal Fatigue of Reactor Coolant Pressure Boundary.<br><br>Further evaluation is discussed in TLAA Section 4.3, Metal Fatigue Analysis. |
| 3.3.1-04 | Heat exchangers in reactor water cleanup system (BWR); high pressure pumps in chemical and volume control system (PWR) | Crack initiation and growth due to SCC or cracking | Plant specific | Yes, plant specific | Not applicable because at BVPS high pressure pumps have no AERMs and the bolting is of material "Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels. |
| 3.3.1-05 | Components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems; external surfaces of carbon steel components | Loss of material due to general, pitting, and crevice corrosion, and MIC | Plant specific | Yes, plant specific | Consistent with NUREG-1801 except as noted below.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>• Emergency Diesel Generator System strainers.<br>• Area Ventilation System – Control Area carbon steel piping and valves.<br>• Area Ventilation System – Cooling carbon steel heat |

**Table 3.3.1 Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| | | | | | exchangers.<br>Further evaluation is documented in Appendix B, Bolting Integrity (Section B.2.1.5), One-Time Inspection (Section B.2.1.22), Periodic Surveillance and Preventive Maintenance (Section B.2.1.24), and System Monitoring (Section B.2.1.31). |
| 3.3.1-06 | Components in reactor coolant pump oil collect system of fire protection | Loss of material due to galvanic, general, pitting, and crevice corrosion | One-time inspection | Yes, detection of aging effects is to be further evaluated | Consistent with NUREG-1801.<br><br>Further evaluation is documented in Appendix B, One-Time Inspection (Section B.2.1.22). |
| 3.3.1-07 | Diesel fuel oil tanks in diesel fuel oil system and emergency diesel generator system | Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling | Fuel oil chemistry and one-time inspection | Yes, detection of aging effects is to be further evaluated | Consistent with NUREG-1801, with Fuel Oil Chemistry Program exceptions (see Appendix B, Section B.2.1.17) and except as noted below.<br><br>BVPS results for fuel oil tanks also include a galvanic corrosion mechanism.<br><br>Further evaluation is documented in Appendix B, Fuel Oil Chemistry Program (Section B.2.1.17). The Fuel Oil Chemistry Program provides for detection of aging effects. |

**Table 3.3.1 Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-08 | BWR only | | | | |
| 3.3.1-09 | Heat exchangers in chemical and volume control system | Crack initiation and growth due to SCC and cyclic loading | Water chemistry and a plant-specific verification program | Yes, plant specific | Consistent with NUREG-1801 except as noted below.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>▪ Boron Recovery and Primary Grade Water System stainless steel heat exchanger components.<br><br>Further evaluation is documented in Appendix B, One-Time Inspection (Section B.2.1.22). |
| 3.3.1-10 | Neutron absorbing sheets in spent fuel storage racks | Reduction of neutron absorbing capacity and loss of material due to general corrosion (Boral, boron steel) | Plant specific | Yes, plant specific | Not Applicable.<br><br>The BVPS Unit 1 results assign neutron absorbing sheets as Boral in Treated Water, Less Than 140 deg F, with no aging affects (see Table 3.5.2-3, component type Boral in Treated Water, Less Than 140 deg F). |
| 3.3.1-11 | New fuel rack assembly | Loss of material due to general, pitting, and crevice corrosion | Structures monitoring | No | Not Applicable.<br><br>The BVPS New Fuel Racks are Wrought Austenitic Stainless Steel in Air, with no identified aging affects (see Table 3.5.2-12, |

**Table 3.3.1 Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| | | | | | component type Structural Steel in Air). |
| 3.3.1-12 | Neutron absorbing sheets in spent fuel storage racks | Reduction of neutron absorbing capacity due to Boraflex degradation | Boraflex monitoring | No | Not applicable because Boraflex neutron absorbing sheets are not credited at BVPS for maintaining subcriticality. |
| 3.3.1-13 | Spent fuel storage racks and valves in spent fuel pool cooling and cleanup | Crack initiation and growth due to stress corrosion cracking | Water chemistry | No | Not applicable.<br><br>The BVPS results assign Spent Fuel Racks as Wrought Austenitic Stainless Steel in Treated Water, Temperature Less Than 140 deg F, with no aging affects (see Table 3.5.2-3 and 3.5.2-11, component type Structural Steel in Treated Water, Less Than 140 deg F). |
| 3.3.1-14 | Closure bolting and external surfaces of carbon steel and low-alloy steel components | Loss of material due to boric acid corrosion | Boric acid corrosion | No | Consistent with NUREG-1801. |
| 3.3.1-15 | Components in or serviced by closed-cycle cooling water system | Loss of material due to general, pitting, and crevice corrosion, and MIC | Closed-cycle cooling water system | No | Consistent with NUREG-1801 except as noted below.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>• Certain CVCS heat exchanger components |

**Table 3.3.1 Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| | | | | | • Certain emergency diesel system heaters, heat exchanger components, pumps, tanks, and valves<br>• Certain ERF Substation heat exchanger components and valves<br><br>Certain CVCS heat exchanger components also include mechanism general corrosion even though the associated individual NUREG-1801 Volume 2 row does not. |
| 3.3.1-16 | Cranes including bridge and trolleys and rail system in load handling system | Loss of material due to general corrosion and wear | Overhead heavy load and light load handling systems | No | Consistent with NUREG-1801. |
| 3.3.1-17 | Components in or serviced by open-cycle cooling water systems | Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling; buildup of deposit due to biofouling | Open-cycle cooling water system | No | Consistent with NUREG-1801 except as noted below.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>• Certain Radiation Monitoring System monitors, panel-cabinets, |

**Table 3.3.1 Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| | | | | | • piping, pumps, and valves<br>• River Water System strainer media<br><br>Several River Water System and Service Water System components also include an erosion mechanism and include a galvanic corrosion mechanism even though the associated individual NUREG-1801 Volume 2 row does not.<br><br>For the Primary Plant Component Cooling Water Heat Exchanger Shell Side, the Closed-Cycle Cooling Water (Section B.2.1.8) is credited vice Open-Cycle Cooling Water Program.. |
| 3.3.1-18 | Buried piping and fittings | Loss of material due to general, pitting, and crevice corrosion, and MIC | Buried piping and tanks surveillance<br><br>or<br><br>Buried piping and tanks inspection | No<br><br>Yes, detection of aging effects and operating experience are to be further evaluated | Consistent with NUREG-1801 except as noted below.<br><br>River Water System and Service Water System external surfaces also include a galvanic corrosion mechanism.<br><br>Further evaluation is documented in Appendix B, Buried Piping and Tank Inspection (Section B.2.1.7). |

**Table 3.3.1 Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.3.1-19 | Components in compressed air system | Loss of material due to general and pitting corrosion | Compressed air monitoring | No | Consistent with NUREG-1801 except as noted below.<br><br>Compressed Air System carbon steel filters, piping, tanks, and valves in an air environment are assigned One-Time Inspection (Section B.2.1-22) vice compressed air monitoring. |
| 3.3.1-20 | Components (doors and barrier penetra-tion seals) and concrete structures in fire protection | Loss of material due to wear; hardening and shrinkage due to weathering | Fire protection | No | Consistent with NUREG-1801, with Fire Protection exceptions. See Appendix B, Section B.2.1.13. |
| 3.3.1-21 | Components in water-based fire protection | Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling | Fire water system | No | Consistent with NUREG-1801 except as noted below.<br><br>The following BVPS components are consistent with ,but not addressed by NUREG-1801:<br>• Unit 1 Fire Protection Hydropnuematic Tank |
| 3.3.1-22 | Components in diesel fire system | Loss of material due to galvanic, general, pitting, and crevice corrosion | Fire protection and fuel oil chemistry | No | Consistent with NUREG-1801, with Fire Protection exceptions (See Appendix B, Section B.2.1.13), and as noted below.<br><br>The following BVPS components are consistent with ,but not |

**Table 3.3.1 Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| | | | | | addressed by NUREG-1801:<br>• Diesel Fire Water Pump Fuel Oil Storage Tank |
| 3.3.1-23 | Tanks in diesel fuel oil system | Loss of material due to general, pitting, and crevice corrosion | Aboveground carbon steel tanks | No | Not applicable because these external surfaces are consistent with NUREG-1801 VII.I.1-b (row 3.3.1-05). |
| 3.3.1-24 | Closure bolting | Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and SCC | Bolting integrity | No | Consistent with NUREG-1801, with Bolting Integrity exceptions. See Appendix B, Section B.2.1.5. |
| 3.3.1-25 | BWR only | | | | |
| 3.3.1-26 | BWR only | | | | |
| 3.3.1-27 | BWR only | | | | |
| 3.3.1-28 | BWR only | | | | |
| 3.3.1-29 | Components (aluminum bronze, brass, cast iron, cast steel) in open-cycle and closed-cycle cooling water systems, and ultimate heat sink | Loss of material due to selective leaching | Selective leaching of materials | No | Consistent with NUREG-1801, with Selective Leaching of Materials exceptions. See Appendix B, Section B.2.1.22, One-Time Inspection. |
| 3.3.1-30 | Fire barriers, walls, ceilings, and floors in fire protection | Concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction | Fire protection and structures monitoring | No | Consistent with NUREG-1801, with Fire Protection exceptions. See Appendix B, Section B.2.1.13.<br><br>Consistent with, but not addressed |

**Table 3.3.1 Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| | | with aggregates; loss of material due to corrosion of embedded steel | | | in, NUREG-1801 for concrete in air in the Unit 2 Control Building, the Unit 2 Safeguards Building and Essential Yard Structures. |

**Table 3.3.2-1: Auxiliary Systems – Area Ventilating Systems - Air Conditioning - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Bolting Integrity | VII.F2.1-a | 3.3.1-05 | B |
| Collar | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| | | | | Hardening and Shrinkage | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| | | | | Loss of Strength | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| Damper Housing | Fire Barrier, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |

**Table 3.3.2-1: Auxiliary Systems – Area Ventilating Systems - Air Conditioning - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Duct | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| Fan | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |
| Filter | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.4-a | 3.3.1-05 | A |

**Table 3.3.2-1: Auxiliary Systems – Area Ventilating Systems - Air Conditioning - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger | Pressure Boundary | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Air | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |
| Seal | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | Periodic Surveillance and Preventive Maintenance | VII.F2.4-b | 3.3.1-02 | A |
| | | | | Hardening and Shrinkage | Periodic Surveillance and Preventive Maintenance | VII.F2.4-b | 3.3.1-02 | A |

**Table 3.3.2-1: Auxiliary Systems – Area Ventilating Systems - Air Conditioning - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Seal (continued) | Pressure Boundary (continued) | Polymers (continued) | Air (continued) | Loss of Strength | Periodic Surveillance and Preventive Maintenance | VII.F2.4-b | 3.3.1-02 | A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Crack Initiation and Growth | Closed-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | Closed-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Area Ventilating Systems-Air Conditioning, those safety-related buildings and areas are:

Unit 1 Service Building

**Table 3.3.2-2: Auxiliary Systems – Area Ventilation Systems - Auxiliary Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Bolting Integrity | VII.F2.1-a | 3.3.1-05 | B |
| Collar | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| | | | | Hardening and Shrinkage | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| | | | | Loss of Strength | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| Damper Housing | Fire Barrier, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |
| Duct | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |

**Table 3.3.2-2: Auxiliary Systems – Area Ventilation Systems - Auxiliary Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Element | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.F2.1-a | 3.3.1-05 | A |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| Fan | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |
| Pipe Fittings | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-2: Auxiliary Systems – Area Ventilation Systems - Auxiliary Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Valve | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.3.2-3: Auxiliary Systems – Area Ventilation Systems - Control Area - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Air Dryer | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Moisture or Wetting, Temperature Less Than 140 deg F | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F1.1-a | 3.3.1-05 | A |
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Bolting Integrity | VII.F1.1-a | 3.3.1-05 | B |
| Collar | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | System Monitoring | VII.F1.1-b | 3.3.1-02 | A |
| | | | | Hardening and Shrinkage | System Monitoring | VII.F1.1-b | 3.3.1-02 | A |
| | | | | Loss of Strength | System Monitoring | VII.F1.1-b | 3.3.1-02 | A |
| Conditioner | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.F1.1-a | 3.3.1-05 | A |

**Table 3.3.2-3: Auxiliary Systems – Area Ventilation Systems - Control Area - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Damper Housing | Fire Barrier, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F1.1-a | 3.3.1-05 | A |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F1.1-a | 3.3.1-05 | A |
| Duct | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F1.1-a | 3.3.1-05 | A |
| Element | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.F1.1-a | 3.3.1-05 | A |

**Table 3.3.2-3: Auxiliary Systems – Area Ventilation Systems - Control Area - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| | | Gray Cast Iron | Air | Loss of Material | System Monitoring | N/A | N/A | F |
| Fan | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F1.1-a | 3.3.1-05 | A |
| Filter | Filtration, Pressure Boundary | Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon) | Air | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F1.4-a | 3.3.1-05 | A |
| | | | | | One-Time Inspection | VII.F1.4-a | 3.3.1-05 | A |

**Table 3.3.2-3: Auxiliary Systems – Area Ventilation Systems - Control Area - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Filter (continued) | Filtration, Pressure Boundary (continued) | Polymers | Air | Crack Initiation and Growth | Periodic Surveillance and Preventive Maintenance | VII.F1.4-b | 3.3.1-02 | C |
| | | | | Hardening and Shrinkage | Periodic Surveillance and Preventive Maintenance | VII.F1.4-b | 3.3.1-02 | C |
| | | | | Loss of Strength | Periodic Surveillance and Preventive Maintenance | VII.F1.4-b | 3.3.1-02 | C |
| Heat Exchanger | Heat Transfer, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Heat Transfer Capability | Open-Cycle Cooling Water System | N/A | N/A | J |
| | | | | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | J |

**Table 3.3.2-3: Auxiliary Systems – Area Ventilation Systems - Control Area - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Heat Transfer, Pressure Boundary (continued) | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Air | Loss of Heat Transfer Capability | Periodic Surveillance and Preventive Maintenance | N/A | N/A | H |
| | | | Raw Water | Loss of Heat Transfer Capability | Open-Cycle Cooling Water System | N/A | N/A | J |
| | | | | | | | | L |
| | | | | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | J |
| | | | | | | VII.C2.1-a | 3.3.1-17 | C |
| | | | | | | | | T |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F1.1-a | 3.3.1-05 | A |
| | | | | | One-Time Inspection | VII.F1.1-a | 3.3.1-05 | A |
| | | | Raw Water | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | J |

**Table 3.3.2-3: Auxiliary Systems – Area Ventilation Systems - Control Area - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Pressure Boundary (continued) | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Raw Water | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | G |
| | | Gray Cast Iron | Raw Water | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | F |
| | | | | | Selective Leaching of Materials | N/A | N/A | F |
| Heater | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.F1.1-a | 3.3.1-05 | A |
| Pipe Fittings | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-3: Auxiliary Systems – Area Ventilation Systems - Control Area - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.F1.1-a | 3.3.1-05 | C |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Seal | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | Periodic Surveillance and Preventive Maintenance | VII.F1.1-b | 3.3.1-02 | A |
| | | | | | | VII.F1.4-b | 3.3.1-02 | A |
| | | | | Hardening and Shrinkage | Periodic Surveillance and Preventive Maintenance | VII.F1.1-b | 3.3.1-02 | A |
| | | | | | | VII.F1.4-b | 3.3.1-02 | A |

**Table 3.3.2-3: Auxiliary Systems – Area Ventilation Systems - Control Area - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Seal (continued) | Pressure Boundary (continued) | Polymers (continued) | Air (continued) | Loss of Strength | Periodic Surveillance and Preventive Maintenance | VII.F1.1-b | 3.3.1-02 | A |
| | | | | | | VII.F1.4-b | 3.3.1-02 | A |
| Separator | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Moisture or Wetting, Temperature Less Than 140 deg F | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F1.1-a | 3.3.1-05 | A |
| Tank | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Air | Loss of Material | One-Time Inspection | VII.F1.1-a | 3.3.1-05 | C |

**Table 3.3.2-3: Auxiliary Systems – Area Ventilation Systems - Control Area - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | Pressure Boundary | Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon) | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F1.1-a | 3.3.1-05 | C |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-3: Auxiliary Systems – Area Ventilation Systems - Control Area - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.3.2-4: Auxiliary Systems – Area Ventilation Systems - Cooling - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Bolting Integrity | VII.F2.1-a | 3.3.1-05 | B |
| Collar | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| | | | | Hardening and Shrinkage | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| | | | | Loss of Strength | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| Damper Housing | Fire Barrier, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |

**Table 3.3.2-4: Auxiliary Systems – Area Ventilation Systems - Cooling - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Duct | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| | | Gray Cast Iron | Air | Loss of Material | System Monitoring | N/A | N/A | F |
| Fan | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |
| Filter | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.4-a | 3.3.1-05 | A |

**Table 3.3.2-4: Auxiliary Systems – Area Ventilation Systems - Cooling - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger | Heat Transfer, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | C |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Air | Loss of Heat Transfer Capability | Periodic Surveillance and Preventive Maintenance | N/A | N/A | H |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Raw Water | Loss of Heat Transfer Capability | Open-Cycle Cooling Water System | N/A | N/A | L |
| | | | | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | G |
| | | Gray Cast Iron | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | N |
| | | | | Loss of Heat Transfer Capability | Open-Cycle Cooling Water System | N/A | N/A | N |
| | | | | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | K |
| | | | Air | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-4: Auxiliary Systems – Area Ventilation Systems - Cooling - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | C |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| Seal | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | Periodic Surveillance and Preventive Maintenance | VII.F2.1-b | 3.3.1-02 | A |
| | | | | | | VII.F2.4-b | 3.3.1-02 | A |
| | | | | Hardening and Shrinkage | Periodic Surveillance and Preventive Maintenance | VII.F2.1-b | 3.3.1-02 | A |
| | | | | | | VII.F2.4-b | 3.3.1-02 | A |
| | | | | Loss of Strength | Periodic Surveillance and Preventive Maintenance | VII.F2.1-b | 3.3.1-02 | A |
| | | | | | | VII.F2.4-b | 3.3.1-02 | A |

**Table 3.3.2-4: Auxiliary Systems – Area Ventilation Systems - Cooling - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | Pressure Boundary | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Loss of Material | Closed-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Crack Initiation and Growth | Closed-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Area Ventilation Systems-Cooling, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Safeguards Building

Unit 2 Fuel Building
Unit 2 Main Steam Valve and Cable Vault Area

**Table 3.3.2-5: Auxiliary Systems – Area Ventilation Systems - Miscellaneous - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Bolting Integrity | VII.F2.1-a | 3.3.1-05 | B |
| Collar | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| | | | | Hardening and Shrinkage | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| | | | | Loss of Strength | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| Damper Housing | Fire Barrier, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |

**Table 3.3.2-5: Auxiliary Systems – Area Ventilation Systems - Miscellaneous - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Duct | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| Fan | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.1-a | 3.3.1-05 | A |
| Filter | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F2.4-a | 3.3.1-05 | A |

**Table 3.3.2-5: Auxiliary Systems – Area Ventilation Systems - Miscellaneous - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Seal | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | Periodic Surveillance and Preventive Maintenance | VII.F2.4-b | 3.3.1-02 | A |
| | | | | Hardening and Shrinkage | Periodic Surveillance and Preventive Maintenance | VII.F2.4-b | 3.3.1-02 | A |
| | | | | Loss of Strength | Periodic Surveillance and Preventive Maintenance | VII.F2.4-b | 3.3.1-02 | A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Crack Initiation and Growth | Closed-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | Closed-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Area Ventilation Systems - Miscellaneous, those safety-related buildings and areas are:

Unit 1 Service Building

**Table 3.3.2-6: Auxiliary Systems – Area Ventilation Systems - Reactor Containment Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Bolting Integrity | VII.F3.1-a | 3.3.1-05 | B |
| Collar | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | System Monitoring | VII.F3.1-b | 3.3.1-02 | A |
| | | | | Hardening and Shrinkage | System Monitoring | VII.F3.1-b | 3.3.1-02 | A |
| | | | | Loss of Strength | System Monitoring | VII.F3.1-b | 3.3.1-02 | A |
| Damper Housing | Fire Barrier, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F3.1-a | 3.3.1-05 | A |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F3.1-a | 3.3.1-05 | A |
| Duct | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F3.1-a | 3.3.1-05 | A |

**Table 3.3.2-6: Auxiliary Systems – Area Ventilation Systems - Reactor Containment Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| Fan | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F3.1-a | 3.3.1-05 | A |
| Heat Exchanger | Pressure Boundary | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Air | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.F3.1-a | 3.3.1-05 | A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | VII.F3.3-a | 3.3.1-15 | C |

**Table 3.3.2-6: Auxiliary Systems – Area Ventilation Systems - Reactor Containment Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pipe Fittings | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Valve | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | | | | Periodic Surveillance and Preventive Maintenance | N/A | N/A | G |

**Table 3.3.2-6: Auxiliary Systems – Area Ventilation Systems - Reactor Containment Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Crack Initiation and Growth | Closed-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | Closed-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Area Ventilation Systems-Reactor Containment Building, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Reactor Containment Building

**Table 3.3.2-7: Auxiliary Systems – Boron Recovery and Primary Grade Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Bolting, Potential for Exposure to Leaking Borated Water At Temperatures of 212 deg F or Greater | Crack Initiation and Growth | Boric Acid Corrosion | N/A | N/A | F |
| | | | | | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | F |
| | | | | Loss of Material | Boric Acid Corrosion | N/A | N/A | F |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | VII.I.1-a | 3.3.1-14 | A |
| Heat Exchanger | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.8-a | 3.3.1-03 | C |

**Table 3.3.2-7: Auxiliary Systems – Boron Recovery and Primary Grade Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Pressure Boundary (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi (continued) | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F, Low Flow (continued) | Loss of Material | Water Chemistry | N/A | N/A | G |
| | | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.8-a | 3.3.1-03 | C |
| | | | | | Water Chemistry | VII.E1.8-b | 3.3.1-09 | C |
| | | | | | One-Time Inspection | VII.E1.8-b | 3.3.1-09 | C |

**Table 3.3.2-7: Auxiliary Systems – Boron Recovery and Primary Grade Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Orifice | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.1-a | 3.3.1-03 | C |
| | | | | | Water Chemistry | N/A | N/A | Q |
| Piping | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.3.2-7: Auxiliary Systems – Boron Recovery and Primary Grade Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.1-a | 3.3.1-03 | C |
| | | | | | Water Chemistry | N/A | N/A | Q |
| Valve | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.3-a | 3.3.1-03 | C |
| | | | | | Water Chemistry | N/A | N/A | Q |

**Table 3.3.2-7: Auxiliary Systems – Boron Recovery and Primary Grade Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.3-a | 3.3.1-03 | C |
| | | | | | Water Chemistry | N/A | N/A | Q |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

**Table 3.3.2-7: Auxiliary Systems – Boron Recovery and Primary Grade Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** (continued) | NSR Functional Support (continued) | Any (continued) | Treated Water (continued) | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | N/A | N/A | U |
| | | | Demineralized Untreated Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Boron Recovery and Primary Grade Water System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Fuel Building
Unit 1 PWST
Unit 1 Safeguards Building

Unit 2 Auxiliary Building
Unit 2 Fuel Building
Unit 2 Main Steam Valve and Cable Vault Area

**Table 3.3.2-8: Auxiliary Systems – Building and Yard Drains System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Building and Yard Drains System, those safety-related buildings and areas are:

Unit 1 Intake Structure
Unit 1 Safeguards Building
Unit 1 Service Building

Unit 2 Auxiliary Building
Unit 2 Control Building
Unit 2 Cable Tunnel
Unit 2 Diesel Generator Building
Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Pipe Tunnels
Unit 2 Service Building
Unit 2 Service Water Valve Pits

**Table 3.3.2-9: Auxiliary Systems – Building Services Hot Water Heater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Demineralized Untreated Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Building Services Hot Water Heater System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Fuel Building
Unit 1 Pipe Tunnels
Unit 1 Safeguards Building
Unit 1 Service Building

Unit 2 Auxiliary Building
Unit 2 Control Building
Unit 2 Decontamination Building
Unit 2 Fuel Building
Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Service Building

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | Boric Acid Corrosion | N/A | N/A | H |
| | | | | Loss of Material | Boric Acid Corrosion | VII.E1.10-a | 3.3.1-14 | A |
| | | | | | | VII.E1.6-a | 3.3.1-14 | A |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| | | | Bolting, Potential for Exposure to Leaking Borated Water At Temperatures of 212 deg F or Greater | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | | Boric Acid Corrosion | N/A | N/A | H |
| | | | | Loss of Material | Boric Acid Corrosion | VII.E1.2-a | 3.3.1-14 | A |
| | | | | | | VII.E1.4-a | 3.3.1-14 | A |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| | | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | Boric Acid Corrosion | N/A | N/A | F |
| | | | | | | N/A | N/A | M |
| | | | | Loss of Material | Boric Acid Corrosion | N/A | N/A | F |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting (continued) | Pressure Boundary (continued) | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels (continued) | Bolting, Potential for Exposure to Leaking Borated Water At Temperatures of 212 deg F or Greater | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | F |
| | | | | | | N/A | N/A | G |
| | | | | | | N/A | N/A | K |
| | | | | | | N/A | N/A | M |
| | | | | | Boric Acid Corrosion | N/A | N/A | F |
| | | | | | | N/A | N/A | L |
| | | | | | | N/A | N/A | M |
| | | | | Loss of Material | Boric Acid Corrosion | N/A | N/A | F |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| Demineralizer | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Element | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.1-a | 3.3.1-03 | A |
| | | | | | Water Chemistry | N/A | N/A | S |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | VII.I.1-a | 3.3.1-14 | A |
| | | Gray Cast Iron | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | N/A | N/A | F |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Filter | Filtration, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | Gray Cast Iron | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| Heat Exchanger | Heat Transfer, Pressure Boundary | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | | Raw Water | Loss of Heat Transfer Capability | Open-Cycle Cooling Water System | N/A | N/A | J<br>P |
| | | | | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | J |
| | | | | | | VII.C1.2-a | 3.3.1-17 | C<br>T |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Heat Transfer, Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Heat Transfer Capability | Water Chemistry | N/A | N/A | H |
| | | | | | Closed-Cycle Cooling Water System | N/A | N/A | H |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.8-a | 3.3.1-03 | A |
| | | | | | | VII.E1.7-a | 3.3.1-03 | A |
| | | | | | Water Chemistry | VII.E1.8-b | 3.3.1-09 | A |
| | | | | | | VII.E1.7-c | 3.3.1-09 | A |
| | | | | | One-Time Inspection | VII.E1.8-b | 3.3.1-09 | A |
| | | | | | | VII.E1.7-c | 3.3.1-09 | A |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.7-a | 3.3.1-03 | A |
| | | | | | Water Chemistry | VII.E1.7-c | 3.3.1-09 | A |
| | | | | | One-Time Inspection | VII.E1.7-c | 3.3.1-09 | A |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less than 100 ksi | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Water Chemistry | N/A | N/A | Q |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | N/A | N/A | Q |
| | | | | | | VII.E1.8-c | 3.3.1-15 | C |
| | | | | | | | | R |
| | | Cast Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | C |
| | | | | | | | | T |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.7-a | 3.3.1-03 | A |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Pressure Boundary (continued) | Cast Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F (continued) | Crack Initiation and Growth (continued) | Water Chemistry | VII.E1.7-c | 3.3.1-09 | A |
| | | | | | One-Time Inspection | VII.E1.7-c | 3.3.1-09 | A |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.7-a | 3.3.1-03 | A |
| | | | | | Water Chemistry | VII.E1.7-c | 3.3.1-09 | A |
| | | | | | One-Time Inspection | VII.E1.7-c | 3.3.1-09 | A |
| | | | | Loss of Fracture Toughness | Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) | N/A | N/A | H |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.7-a | 3.3.1-03 | A |
| | | | | | | VII.E1.8-a | 3.3.1-03 | A |
| | | | | | Water Chemistry | VII.E1.7-c | 3.3.1-09 | A |
| | | | | | | VII.E1.8-b | 3.3.1-09 | A<br>E |
| | | | | | One-Time Inspection | VII.E1.7-c | 3.3.1-09 | A |
| | | | | | | VII.E1.8-b | 3.3.1-09 | A |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.7-a | 3.3.1-03 | A |
| | | | | | Water Chemistry | VII.E1.7-c | 3.3.1-09 | A |
| | | | | | One-Time Inspection | VII.E1.7-c | 3.3.1-09 | A |
| | | | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Indicator | Pressure Boundary | Glass | Lubricating Oil | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Miscellaneous Mechanical Equipment (HHSI Charging Pump Increasing Gear Unit) | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| Orifice | Flow Restriction, Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.1-a | 3.3.1-03 | A |
| | | | | | Water Chemistry | N/A | N/A | S |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Orifice (continued) | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Pipe Fittings | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| | | | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pipe Fittings (continued) | Pressure Boundary (continued) | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Lubricting Oil | None | N/A | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal to 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | N/A |
| | | | | | | VII.E1.1-a | 3.3.1-03 | A |
| | | | | | Water Chemistry | N/A | N/A | S |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.1-a | 3.3.1-03 | A |
| | | | | | | N/A | N/A | S |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | One Time Inspection of Small-Bore Piping | N/A | N/A | S |
| | | | | | | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | Water Chemistry | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | | N/A | N/A | S |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.1-a | 3.3.1-03 | A |
| | | | | | | N/A | N/A | S |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | One Time Inspection of Small-Bore Piping | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | | N/A | N/A | S |
| | | | | | Water Chemistry | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | | N/A | N/A | S |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pump | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | Gray Cast Iron | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Strainer | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Tank | Pressure Boundary | Wrought Austenitic Stainless Steel | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | Cast Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.3-a | 3.3.1-03 | A |
| | | | | | | N/A | N/A | S |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | One-Time Inspection | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | Water Chemistry | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | | N/A | N/A | S |
| | | | | Loss of Fracture Toughness | Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) | IV.C2.4-c | 3.1.1-23 | E |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Cast Austenitic Stainless Steel (continued) | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.3-a | 3.3.1-03 | A |
| | | | | | | N/A | N/A | S |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | One-Time Inspection | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | Water Chemistry | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | | N/A | N/A | S |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Cast Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.3-a | 3.3.1-03 | A |
| | | | | | | N/A | N/A | S |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | One-Time Inspection | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | Water Chemistry | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | | N/A | N/A | S |
| | | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Lubricating Oil | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.3-a | 3.3.1-03 | A |
| | | | | | | N/A | N/A | S |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | One-Time Inspection | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | Water Chemistry | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | | N/A | N/A | S |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.3-a | 3.3.1-03 | A |
| | | | | | | N/A | N/A | S |
| | | | | | Water Chemistry | N/A | N/A | S |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.3-a | 3.3.1-03 | A |
| | | | | | | N/A | N/A | S |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | One-Time Inspection | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | Water Chemistry | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | | N/A | N/A | S |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VII.E1.3-a | 3.3.1-03 | A |
| | | | | | | N/A | N/A | S |
| | | | | | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | One-Time Inspection | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | Water Chemistry | IV.C2.2-h | 3.1.1-07 | A |
| | | | | | | N/A | N/A | S |

**Table 3.3.2-10: Auxiliary Systems – Chemical and Volume Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | N/A | N/A | U |
| | | | Treated Water | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Chemical and Volume Control System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Reactor Containment Building

Unit 2 Auxiliary Building
Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Reactor Containment Building
Unit 2 Refueling Water Storage Tank
Unit 2 Pipe Tunnel

**Table 3.3.2-11: Auxiliary Systems – Chilled Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Closed-Cycle Cooling Water System | VII.C2.1-a | 3.3.1-15 | A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| Valve | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |

**Table 3.3.2-11: Auxiliary Systems – Chilled Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi (continued) | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | VII.C2.2-a | 3.3.1-15 | A |
| | | | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Closed-Cycle Cooling Water System | VII.C2.2-a | 3.3.1-15 | A |
| | | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Crack Initiation and Growth | Closed-Cycle Cooling Water System | N/A | N/A | U |

**Table 3.3.2-11: Auxiliary Systems – Chilled Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** (continued) | NSR Functional Support (continued) | Any (continued) | Treated Water (continued) | Crack Initiation and Growth (continued) | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | Closed-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Chilled Water System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Pipe Tunnels
Unit 1 Reactor Containment Building
Unit 1 Service Building
Unit 1 Safeguards Building
Unit 2 Auxiliary Building
Unit 2 Fuel Building
Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Pipe Tunnels
Unit 2 Reactor Containment Building
Unit 2 Safeguards Building

**Table 3.3.2-12: Auxiliary Systems – Compressed Air System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Air Dryer | NSR Functional Support | Wrought Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Bolting Integrity | VII.D.1-a | 3.3.1-19 | E |
| | | | | | | VII.D.2-a | 3.3.1-19 | E |
| | | | | | | VII.D.3-a | 3.3.1-19 | E |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Bolting Integrity | VII.D.1-a | 3.3.1-19 | E |
| | | | | | | VII.D.2-a | 3.3.1-19 | E |
| | | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Air | None | N/A | N/A | N/A | N/A |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| | | Gray Cast Iron | Air | Loss of Material | System Monitoring | N/A | N/A | F |

**Table 3.3.2-12: Auxiliary Systems – Compressed Air System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Filter | NSR Functional Support | Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon) | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.D.5-a | 3.3.1-19 | E |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| Pipe Fittings | Pressure Boundary | Wrought Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-12: Auxiliary Systems – Compressed Air System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | NSR Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.D.1-a | 3.3.1-19 | E |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.D.1-a | 3.3.1-19 | E |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-12: Auxiliary Systems – Compressed Air System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Tank | NSR Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.D.3-a | 3.3.1-19 | E |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | Pressure Boundary | Wrought Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| Valve | NSR Functional Support | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-12: Auxiliary Systems – Compressed Air System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | NSR Functional Support (continued) | Cast Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Gray Cast Iron | Air | Loss of Material | One-Time Inspection | N/A | N/A | F |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | Pressure Boundary | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.D.2-a | 3.3.1-19 | E |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-12: Auxiliary Systems – Compressed Air System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Zinc | Air | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Dried Air or Gas | None | N/A | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.3.2-13: Auxiliary Systems – Containment System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | V.C.1-a | 3.2.1-03 | A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Air | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Valve | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | V.C.1-a | 3.2.1-03 | A |
| | | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-13: Auxiliary Systems – Containment System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Air | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.3.2-14: Auxiliary Systems - Containment Vacuum and Leakage Monitoring System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| Orifice | Flow Restriction, Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Piping | Pressure Boundary | Copper Alloys with Zinc Contents Less Than or Equal to 15% | Air | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Separator | Pressure Boundary | Wrought Austenitic Stainless Steel | Air, Moisture or Wetting, Temperature Less Than 140 deg F | Loss of Material | One-Time Inspection | N/A | N/A | J |

**Table 3.3.2-14: Auxiliary Systems - Containment Vacuum and Leakage Monitoring System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.
** For the Containment Vacuum and Leakage Monitoring System, those safety-related buildings and areas are:
Unit 1 Safeguards Building

Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Pipe Tunnels

**Table 3.3.2-15: Auxiliary Systems - Domestic Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Domestic Water System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Service Building

Unit 2 Auxiliary Building
Unit 2 Control Building
Unit 2 Cable Tunnel
Unit 2 Decontamination Building
Unit 2 Fuel Building
Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Service Building

**Table 3.3.2-16: Auxiliary Systems – Emergency Diesel Generators and Support Systems - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| | | Gray Cast Iron | Air | Loss of Material | System Monitoring | N/A | N/A | F |
| Filter | Filtration, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.H2.3-a | 3.3.1-05 | A |
| | | | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| Heat Exchanger | Heat Transfer, Pressure Boundary | Wrought Austenitic Stainless Steel | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | J |
| | | | | Loss of Heat Transfer Capability | Open-Cycle Cooling Water System | N/A | N/A | J |
| | | | | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | J |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| | | | | Loss of Heat Transfer Capability | Closed-Cycle Cooling Water System | N/A | N/A | J |

**Table 3.3.2-16: Auxiliary Systems – Emergency Diesel Generators and Support Systems - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | VII.H2.1-a | 3.3.1-15 | C |
| | | | Raw Water, Low Flow | Loss of Material | Open-Cycle Cooling Water System | VII.H2.1-b | 3.3.1-17 | C |
| | | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Raw Water, Low Flow | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | J |
| | | | | | Selective Leaching of Materials | N/A | N/A | J |
| | | Gray Cast Iron | Raw Water, Low Flow | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | J |
| | | | | | Selective Leaching of Materials | N/A | N/A | J |
| Indicator | Pressure Boundary | Glass | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-16: Auxiliary Systems – Emergency Diesel Generators and Support Systems - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Orifice | Flow Restriction, Pressure Boundary | Wrought Austenitic Stainless Steel | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| Pipe Fittings | Fire Barrier | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.H1.1-a | 3.3.1-05 | A |
| | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| | | Polymer | Treated Water, Temperature Less Than 140 deg F, Low Flow | Crack Initiation and Growth | Closed-Cycle Cooling Water System | N/A | N/A | M |
| | | | | Hardening and Shrinkage | Closed-Cycle Cooling Water System | N/A | N/A | M |

**Table 3.3.2-16: Auxiliary Systems – Emergency Diesel Generators and Support Systems - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pipe Fittings (continued) | Pressure Boundary (continued) | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.H2.3-a | 3.3.1-05 | A |
| | | | Exhaust | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.H2.4-a | 3.3.1-05 | A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | VII.H2.1-a | 3.3.1-15 | A |

**Table 3.3.2-16: Auxiliary Systems – Emergency Diesel Generators and Support Systems - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure Boundary | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.H2.2-a | 3.3.1-05 | A |
| | | | | | | VII.H2.3-a | 3.3.1-05 | A |
| | | | | | | VII.H1.1-a | 3.3.1-05 | A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Exhaust | Loss of Material | Periodic Surveillance and Preventive Maintenance | VII.H2.4-a | 3.3.1-05 | A |
| | | | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| | | | Soil, Above the Water Table | Loss of Material | Buried Piping and Tanks Inspection | VII.H1.1-b | 3.3.1-18 | A |

**Table 3.3.2-16: Auxiliary Systems – Emergency Diesel Generators and Support Systems - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi (continued) | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | VII.H2.1-a | 3.3.1-15 | A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Pump | Pressure Boundary | Cast Austenitic Stainless Steel | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-16: Auxiliary Systems – Emergency Diesel Generators and Support Systems - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pump (continued) | Pressure Boundary (continued) | Gray Cast Iron | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| Strainer | Filtration, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-16: Auxiliary Systems – Emergency Diesel Generators and Support Systems - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Tank | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.H2.2-a | 3.3.1-05 | A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Fuel Oil | Loss of Material | Fuel Oil Chemistry Program | VII.H1.4-a | 3.3.1-07 | B |
| | | | | | | | | V |
| | | | | | | VII.H2.5-a | 3.3.1-07 | B |
| | | | | | | | | V |
| | | | Soil, Above the Water Table | Loss of Material | Buried Piping and Tanks Inspection | N/A | N/A | G |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | VII.H2.1-a | 3.3.1-15 | C |

**Table 3.3.2-16: Auxiliary Systems – Emergency Diesel Generators and Support Systems - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | Pressure Boundary | Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon) | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.H1.2-a | 3.3.1-05 | A |
| | | | | | | VII.H2.2-a | 3.3.1-05 | A |
| | | | | | | VII.H2.3-a | 3.3.1-05 | A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | VII.H2.1-a | 3.3.1-15 | C |
| | | Cast Austenitic Stainless Steel | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-16: Auxiliary Systems – Emergency Diesel Generators and Support Systems - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Gray Cast Iron | Air | Loss of Material | One-Time Inspection | N/A | N/A | F |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | N/A | N/A | F |
| | | | | | Selective Leaching of Materials | N/A | N/A | F |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.3.2-17: Auxiliary Systems – ERF Substation System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Bolting Integrity | VII.I.2-a | 3.3.1-24 | B |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.H1.1-a | 3.3.1-05 | A |
| | | | Soil, Above the Water Table | Loss of Material | Buried Piping and Tanks Inspection | VII.H1.1-b | 3.3.1-18 | A |
| | | Plastic Pipe | Air | Crack Initiation and Growth | System Monitoring | N/A | N/A | M |
| | | | | Hardening and Shrinkage | System Monitoring | N/A | N/A | M |
| | | | | Loss of Strength | System Monitoring | N/A | N/A | M |
| | | | Soil, Above the Water Table | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-17: Auxiliary Systems – ERF Substation System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger | Heat Transfer, Pressure Boundary | Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon) | Air | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Air | Loss of Heat Transfer Capability | Periodic Surveillance and Preventive Maintenance | N/A | N/A | N |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Heat Transfer Capability | Closed-Cycle Cooling Water System | N/A | N/A | M |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | VII.H2.1-a | 3.3.1-15 | C |
| Orifice | Flow Restriction, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-17: Auxiliary Systems – ERF Substation System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pipe Fittings | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | VII.H2.1-a | 3.3.1-15 | A |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | VII.H2.1-a | 3.3.1-15 | A |
| | | Polymers | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| Pump | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-17: Auxiliary Systems – ERF Substation System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Tank | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Fuel Oil | Loss of Material | Fuel Oil Chemistry Program | VII.H1.4-a | 3.3.1-07 | B<br>V |
| | | Fiberglass | Fuel Oil | None | N/A | N/A | N/A | N/A |
| | | | Air | Crack Initiation and Growth | System Monitoring | N/A | N/A | M |
| | | | | Loss of Strength | System Monitoring | N/A | N/A | M |
| Valve | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.3.2-18: Auxiliary Systems – Fire Protection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surfaces | NSR Functional Support, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| | NSR Functional Support | Gray Cast Iron | Air | Loss of Material | System Monitoring | N/A | N/A | F |
| | | | Soil, Above the Water Table | Loss of Material | Buried Piping and Tanks Inspection | N/A | N/A | F |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Mallable Cast Iron with Yield Strengths Less Than 100 ksi | Soil, Above the Water Table | Loss of Material | Buried Piping and Tanks Inspection | N/A | N/A | G |
| Indicator | NSR Functional Support | Glass | Raw Water, Low Flow | None | N/A | N/A | N/A | N/A |
| Nozzle | NSR Functional Support | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Air | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-18: Auxiliary Systems – Fire Protection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Orifice | NSR Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-a | 3.3.1-21 | A |
| Pipe Fittings | Fire Barrier | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | NSR Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Fire Water System | N/A | N/A | G |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-a | 3.3.1-21 | A |
| | | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Air | None | N/A | N/A | N/A | N/A |
| | | Polymer | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Lubricating Oil With Contamination | Loss of Material | One-Time Inspection | N/A | N/A | F |

**Table 3.3.2-18: Auxiliary Systems – Fire Protection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | NSR Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Materials | Fire Water System | N/A | N/A | G |
| | | | | | One-Time Inspection | N/A | N/A | G |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-a | 3.3.1-21 | A |
| | | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Loss of Material | Fire Water System | N/A | N/A | F |
| | | Gray Cast Iron | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-a | 3.3.1-21 | A |
| | | | | | Selective Leaching of Materials | N/A | N/A | S |
| | | Polymer | Dried Air or Gas | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-18: Auxiliary Systems – Fire Protection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | NSR Functional Support (continued) | Wrought Austenitic Stainless Steel | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Fire Water System | N/A | N/A | G |
| Pump | NSR Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-b | 3.3.1-21 | A |
| | | Gray Cast Iron | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-b | 3.3.1-21 | A |
| | | | | | Selective Leaching of Materials | N/A | N/A | S |

**Table 3.3.2-18: Auxiliary Systems – Fire Protection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Strainer | NSR Functional Support | Gray Cast Iron | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-b | 3.3.1-21 | A |
| | | | | | Selective Leaching of Materials | N/A | N/A | S |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-b | 3.3.1-21 | A |
| | | Copper Alloys with Zinc Contents Less Than or Equal to 15% | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| Tank | Fire Barrier | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Lubricating Oil With Contamination | Loss of Material | One-Time Inspection | VII.G.7-a | 3.3.1-06 | A |
| | NSR Functional Support | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Air | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-18: Auxiliary Systems – Fire Protection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Tank (continued) | NSR Functional Support (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Fuel Oil | Loss of Material | Fuel Oil Chemistry Program | VII.G.8-a | 3.3.1-22 | D |
| | | | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-b | 3.3.1-21 | C |
| | | Gray Cast Iron | Air | Loss of Material | Fire Water System | N/A | N/A | G |
| Valve | Fire Barrier | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Lubricating Oil With Contamination | Loss of Material | One-Time Inspection | VII.G.7-b | 3.3.1-06 | A |
| | | | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | NSR Functional Support | Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon) | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-b | 3.3.1-21 | A |
| | | | Air | Loss of Material | Fire Protection | N/A | N/A | G |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-18: Auxiliary Systems – Fire Protection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | NSR Functional Support (continued) | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-b | 3.3.1-21 | A |
| | | | | | Selective Leaching of Materials | N/A | N/A | S |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-b | 3.3.1-21 | A |
| | | Gray Cast Iron | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-b | 3.3.1-21 | A |
| | | | | | Selective Leaching of Materials | N/A | N/A | S |
| | | | Air | Loss of Material | Fire Water System | N/A | N/A | G |

**Table 3.3.2-18: Auxiliary Systems – Fire Protection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | NSR Functional Support (continued) | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | VII.G.6-b | 3.3.1-21 | A |
| | | | | Loss of Material | Fire Water System | VII.G.6-b | 3.3.1-21 | A |
| | Pressure Boundary | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water, Low Flow | Loss of Material | Fire Water System | VII.G.6-b | 3.3.1-21 | A |
| | | | Air | Loss of Material | Fire Water System | N/A | N/A | G |

**Table 3.3.2-18: Auxiliary Systems – Fire Protection System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Raw Water | Crack Initiation and Growth | Fire Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | Fire Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Fire Protection System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Fuel Building
Unit 1 Intake Structure
Unit 1 Pipe Tunnels
Unit 1 Reactor Containment Building,
Unit 1 Safeguards Building
Unit 1 Service Building

Unit 2 Auxiliary Building
Unit 2 Control Building
Unit 2 Cable Tunnel
Unit 2 Decontamination Building
Unit 2 Diesel Generator Building
Unit 2 Fuel Building
Unit 2 Main Steam and Cable Vault Area
Unit 2 Pipe Tunnels
Unit 2 Reactor Containment Building
Unit 2 Service Building
Unit 2 Safeguards Building

**Table 3.3.2-19: Auxiliary Systems – Fuel Pool Cooling and Purification System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | Boric Acid Corrosion | N/A | N/A | H |
| | | | | Loss of Material | Boric Acid Corrosion | VII.A3.6-a | 3.3.1-14 | A |
| | | | | | | VII.A3.4-b | 3.3.1-14 | A |
| | | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | Boric Acid Corrosion | N/A | N/A | M |
| | | | | Loss of Material | Boric Acid Corrosion | N/A | N/A | F |
| | | Wrought Austenitic Stainless Steel | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | Boric Acid Corrosion | N/A | N/A | M |
| | | | | Loss of Material | Boric Acid Corrosion | N/A | N/A | F |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | VII.I.1-a | 3.3.1-14 | A |

**Table 3.3.2-19: Auxiliary Systems – Fuel Pool Cooling and Purification System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger | Heat Transfer, Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| | | | | | Water Chemistry | N/A | N/A | N/A |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | VII.A3.4-b | 3.3.1-14 | A |
| | | | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Closed-Cycle Cooling Water System | VII.A3.4-a | 3.3.1-15 | A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| Orifice | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.3.2-19: Auxiliary Systems – Fuel Pool Cooling and Purification System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pipe Fittings | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| Piping | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Pump | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |
| Valve | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-19: Auxiliary Systems – Fuel Pool Cooling and Purification System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | N/A | N/A | U |
| | | | Treated Water | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Fuel Pool Cooling and Purification System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Fuel Building

Unit 1 Reactor Containment Building
Unit 1 Refueling Water Storage Tank Foundation Mat and Shield Wall
Unit 1 Safeguards Building

Unit 2 Auxiliary Building
Unit 2 Decontamination Building
Unit 2 Fuel Building
Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Pipe Tunnels
Unit 2 Reactor Containment Building
Unit 2 Refueling Water Storage Tank and Chemical Addition Tank Shield Wall

**Table 3.3.2-20: Auxiliary Systems – Glycol Heating System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.
** For the Glycol Heating System, those safety-related buildings and areas are:
Unit 1 Auxiliary Building
Unit 1 Service Building

**Table 3.3.2-21: Auxiliary Systems – Liquid Waste Disposal System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Liquid Waste Disposal System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Fuel Building
Unit 1 Safeguards Building
Unit 1 Service Building

Unit 2 Auxiliary Building
Unit 2 Pipe Tunnels

**Table 3.3.2-22: Auxiliary Systems – Post Accident Sample System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Valve | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Post Accident Sample System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Reactor Containment Building
Unit 1 Safeguards Building

Unit 2 Auxiliary Building
Unit 2 Reactor Containment Building

**Table 3.3.2-23: Auxiliary Systems – Post-DBA Hydrogen Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Compressor | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | J |
| Damper Housing | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | J |
| Duct | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | J |
| Element | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| | | Gray Cast Iron | Air | Loss of Material | System Monitoring | N/A | N/A | F |

**Table 3.3.2-23: Auxiliary Systems – Post-DBA Hydrogen Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Fan | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | J |
| | | Gray Cast Iron | Air | Loss of Material | One-Time Inspection | N/A | N/A | J |
| Filter | Pressure Boundary | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Air | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | J |
| Heat Exchanger | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-23: Auxiliary Systems – Post-DBA Hydrogen Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Orifice | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | J |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Pipe Fittings | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | J |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | J |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Pump | Pressure Boundary | Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon) | Air | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-23: Auxiliary Systems – Post-DBA Hydrogen Control System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Recombiner | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | J |
| Rupture Disc | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Valve | Pressure Boundary | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | J |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.3.2-24: Auxiliary Systems – Primary Component and Neutron Shield Tank Cooling Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Element | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| | | Gray Cast Iron | Air | Loss of Material | System Monitoring | N/A | N/A | F |
| Heat Exchanger | Heat Transfer, Pressure Boundary | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | F |
| | | | | Loss of Heat Transfer Capability | Open-Cycle Cooling Water System | N/A | N/A | F |
| | | | | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | F |
| | | | Treated Water, Temperature Less Than 140 deg F | Crack Initiation and Growth | Closed-Cycle Cooling Water System | N/A | N/A | F |
| | | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | F |

**Table 3.3.2-24: Auxiliary Systems – Primary Component and Neutron Shield Tank Cooling Water System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Heat Transfer, Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Raw Water (continued) | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | F |
| | | | | Loss of Heat Transfer Capability | Open-Cycle Cooling Water System | N/A | N/A | F |
| | | | Treated Water, Temperature Less Than 140 deg F | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.3-a | 3.3.1-17 | A |
| | | | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Closed-Cycle Cooling Water System | VII.C1.3-a | 3.3.1-17 | E |
| | | | | | | N/A | N/A | Q |

**Table 3.3.2-24: Auxiliary Systems – Primary Component and Neutron Shield Tank Cooling Water System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Pressure Boundary (continued) | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | M |
| | | | | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | F |
| | | | Treated Water, Temperature Less Than 140 deg F | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| Indicator | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |

**Table 3.3.2-24: Auxiliary Systems – Primary Component and Neutron Shield Tank Cooling Water System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Orifice | Flow Restriction, Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| Pipe Fittings | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Closed-Cycle Cooling Water System | VII.C2.1-a | 3.3.1-15 | A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |

**Table 3.3.2-24: Auxiliary Systems – Primary Component and Neutron Shield Tank Cooling Water System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Closed-Cycle Cooling Water System | VII.C2.1-a | 3.3.1-15 | A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | VII.C2.1-a | 3.3.1-15 | A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |

**Table 3.3.2-24: Auxiliary Systems – Primary Component and Neutron Shield Tank Cooling Water System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pump | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Closed-Cycle Cooling Water System | VII.C2.3-a | 3.3.1-15 | A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |
| Tank | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Closed-Cycle Cooling Water System | VII.C2.4-a | 3.3.1-15 | A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |

**Table 3.3.2-24: Auxiliary Systems – Primary Component and Neutron Shield Tank Cooling Water System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | Pressure Boundary | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-24: Auxiliary Systems – Primary Component and Neutron Shield Tank Cooling Water System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Closed-Cycle Cooling Water System | VII.C2.2-a | 3.3.1-15 | A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Closed-Cycle Cooling Water System | VII.C2.2-a | 3.3.1-15 | A |
| | | Gray Cast Iron | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Closed-Cycle Cooling Water System | N/A | N/A | F |

**Table 3.3.2-24: Auxiliary Systems – Primary Component and Neutron Shield Tank Cooling Water System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Gray Cast Iron (continued) | Treated Water, Temperature Less Than 140 deg F (continued) | Loss of Material (continued) | Selective Leaching of Materials | N/A | N/A | F |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Crack Initiation and Growth | Closed-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

**Table 3.3.2-24: Auxiliary Systems – Primary Component and Neutron Shield Tank Cooling Water System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** (continued) | NSR Functional Support (continued) | Any (continued) | Treated Water (continued) | Loss of Material | Closed-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Primary Component and Neutron Shield Tank Cooling Water System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Reactor Containment Building
Unit 1 Safeguards Building

Unit 2 Auxiliary Building
Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Reactor Containment Building

**Table 3.3.2-25: Auxiliary Systems – Radiation Monitoring System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Monitor | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C3.2-a | 3.3.1-17 | C |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| Panel-Cabinet | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C3.2-a | 3.3.1-17 | C |
| Pipe Fittings | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-25: Auxiliary Systems – Radiation Monitoring System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure Boundary | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Air | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |

**Table 3.3.2-25: Auxiliary Systems – Radiation Monitoring System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pump | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.5-a | 3.3.1-17 | A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| Valve | Pressure Boundary | Cast Austenitic Stainless Steel | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A |

**Table 3.3.2-25: Auxiliary Systems – Radiation Monitoring System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Closed-Cycle Cooling Water System | N/A | N/A | N/A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

**Table 3.3.2-25: Auxiliary Systems – Radiation Monitoring System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** (continued) | NSR Functional Support (continued) | Any (continued) | Treated Water | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Radiation Monitoring System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Reactor Containment Building
Unit 1 Safeguards Building
Unit 1 Service Building

Unit 2 Auxiliary Building
Unit 2 Diesel Generator Building
Unit 2 Main Steam Valve and Cable Vault Area

**Table 3.3.2-26: Auxiliary Systems – Reactor Plant Sample System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | Boric Acid Corrosion | N/A | N/A | F |
| | | | | Loss of Material | Boric Acid Corrosion | N/A | N/A | F |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | VII.I.1-a | 3.3.1-14 | A |
| Piping | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Water Chemistry | N/A | N/A | Q |
| | | | | | One-Time Inspection | N/A | N/A | Q |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.3.2-26: Auxiliary Systems – Reactor Plant Sample System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Potential for Leaking Borated Water | Loss of Material | One-Time Inspection | N/A | N/A | N |
| | | Cast Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | L |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | L |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Water Chemistry | N/A | N/A | Q |
| | | | | | One-Time Inspection | N/A | N/A | Q |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.3.2-26: Auxiliary Systems – Reactor Plant Sample System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Air, Potential for Leaking Borated Water | Loss of Material | Boric Acid Corrosion | N/A | N/A | U |
| | | | Treated Water | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Reactor Plant Sample System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Reactor Containment Building
Unit 1 Safeguards Building

Unit 2 Auxiliary Building
Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Reactor Containment Building

**Table 3.3.2-27: Auxiliary Systems – River Water System – Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| | | | Soil, Above the Water Table | Loss of Material | Buried Piping and Tanks Inspection | VII.C1.1-b | 3.3.1-18 | A<br>R |
| | | Gray Cast Iron | Air | Loss of Material | System Monitoring | N/A | N/A | F |
| | | Wrought Austenitic Stainless Steel | Soil, Above the Water Table | Loss of Material | Buried Piping and Tanks Inspection | N/A | N/A | F |
| Heat Exchanger | Pressure Boundary | Gray Cast Iron | Raw Water | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | F<br>M |
| | | | | | Selective Leaching of Materials | N/A | N/A | F |

**Table 3.3.2-27: Auxiliary Systems – River Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | J |
| | | | | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | J |
| Orifice | Flow Restriction, Pressure Boundary | Wrought Austenitic Stainless Steel | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.4-a | 3.3.1-17 | A<br>R |
| | | | | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | F |
| | | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.4-a | 3.3.1-17 | A<br>R |

**Table 3.3.2-27: Auxiliary Systems – River Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pipe Fittings | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A |
| | | | | | | | | R |
| | | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A |
| | | | | | | | | R |

**Table 3.3.2-27: Auxiliary Systems – River Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A<br>R |
| | | | Raw Water, Low Flow | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Raw Water, Low Flow | Loss of Material 1 | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A |
| | | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A<br>R |

**Table 3.3.2-27: Auxiliary Systems – River Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Raw Water, Low Flow | Crack Initiation and Growth | Open-Cycle Cooling Water System | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A |
| Pump | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.5-a | 3.3.1-17 | A<br>R |
| | | Gray Cast Iron | Raw Water | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | F |
| | | | | | Selective Leaching of Materials | N/A | N/A | F |

**Table 3.3.2-27: Auxiliary Systems – River Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Strainer | Filtration, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.6-a | 3.3.1-17 | A<br>R |
| | | Cast Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.6-a | 3.3.1-17 | A<br>R |
| | | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |

**Table 3.3.2-27: Auxiliary Systems – River Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Strainer (continued) | Filtration, Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Raw Water (continued) | Loss of Material | Open-Cycle Cooling Water System | VII.C1.6-a | 3.3.1-17 | A |
| | | | | | | | | C |
| | | | | | | | | R |
| | | | | | | | | T |
| | | Gray Cast Iron | Raw Water | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | F |
| | | | | | Selective Leaching of Materials | N/A | N/A | F |
| | Pressure Boundary | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.6-a | 3.3.1-17 | A |
| | | | | | | | | R |

**Table 3.3.2-27: Auxiliary Systems – River Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A<br>R |
| | | | Raw Water, Low Flow | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A<br>R |
| | | Cast Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A<br>R |

**Table 3.3.2-27: Auxiliary Systems – River Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Cast Austenitic Stainless Steel (continued) | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A |
| | | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Raw Water, Low Flow | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A |
| | | | | | Selective Leaching of Materials | VII.C1.2-a | 3.3.1-29 | B |
| | | Gray Cast Iron | Raw Water | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | F |
| | | | | | Selective Leaching of Materials | N/A | N/A | F |

**Table 3.3.2-27: Auxiliary Systems – River Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A |
| | | | | | | | | R |
| | | | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A |

**Table 3.3.2-27: Auxiliary Systems – River Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Raw Water | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Open-Cycle Cooling Water System | N/A | N/A | U |
| | | | | Crack Initiation and Growth | Open-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the River Water System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Diesel Generator Building
Unit 1 Safeguards Building

Common Intake Structure

**Table 3.3.2-28: Auxiliary Systems – Security - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| | | | Soil, Above the Water Table | Loss of Material | Buried Piping and Tanks Inspection | N/A | N/A | G |
| | | Plastic Pipe | Air | Crack Initiation and Growth | System Monitoring | N/A | N/A | M |
| | | | | Hardening and Shrinkage | System Monitoring | N/A | N/A | M |
| | | | | Loss of Strength | System Monitoring | N/A | N/A | M |
| | | | Soil, Above the Water Table | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-28: Auxiliary Systems – Security - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| | | Polymers | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| Pump | Pressure Boundary | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| Tank | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Fuel Oil | Loss of Material | Fuel Oil Chemistry Program | VII.H1.4-a | 3.3.1-07 | B<br>V |
| Valve | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |
| | | Gray Cast Iron | Fuel Oil Without Water Contamination | None | N/A | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.3.2-29: Auxiliary Systems – Service Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| | | | Soil, Above the Water Table | Loss of Material | Buried Piping and Tanks Inspection | VII.C1.1-b | 3.3.1-18 | A<br>R |
| Indicator | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A<br>R |

**Table 3.3.2-29: Auxiliary Systems – Service Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Indicator (continued) | Pressure Boundary (continued) | Glass | Raw Water | None | N/A | N/A | N/A | N/A |
| Orifice | Flow Restriction, Pressure Boundary | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.4-a | 3.3.1-17 | A |
| | | | | | | | | R |
| | Pressure Boundary | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.4-a | 3.3.1-17 | A |
| | | | | | | | | R |

**Table 3.3.2-29: Auxiliary Systems – Service Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pipe Fittings | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A |
| | | | | | | | | R |
| | | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A |
| | | | | | | | | R |
| Piping | NSR Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A |
| | | | | | | | | R |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A |
| | | | | | | | | R |

**Table 3.3.2-29: Auxiliary Systems – Service Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Nickel-Based Alloys | Raw Water | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | F |
| | | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A |
| | | | | | | | | R |
| | | | Raw Water, Low Flow | Crack Initiation and Growth | Open-Cycle Cooling Water System | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.1-a | 3.3.1-17 | A |
| Pump | Pressure Boundary | Cast Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.5-a | 3.3.1-17 | A |
| | | | | | | | | R |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.5-a | 3.3.1-17 | A |
| | | | | | | | | R |

**Table 3.3.2-29: Auxiliary Systems – Service Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Strainer | Filtration, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.6-a | 3.3.1-17 | A |
| | | | | | | | | R |
| | | Cast Austenitic Stainless Steel | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.6-a | 3.3.1-17 | A |
| | | | | Crack Initiation and Growth | One-Time Inspection | VII.C1.6-a | 3.3.1-17 | R |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.6-a | 3.3.1-17 | A |
| | | | | | | | | R |

**Table 3.3.2-29: Auxiliary Systems – Service Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | NSR Functional Support | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A<br>R |
| | | | | | Selective Leaching of Materials | VII.C1.2-a | 3.3.1-29 | B |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A<br>R |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A<br>R |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | | Raw Water | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A<br>R |
| | | | Raw Water, Low Flow | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A |

**Table 3.3.2-29: Auxiliary Systems – Service Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Cast Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A |
| | | | | | | | | R |
| | | | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A |

**Table 3.3.2-29: Auxiliary Systems – Service Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A |
| | | | | | | | | R |
| | | | Raw Water, Low Flow | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | H |
| | | | | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A |

**Table 3.3.2-29: Auxiliary Systems – Service Water System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Raw Water | Crack Initiation and Growth | Open-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | Open-Cycle Cooling Water System | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.
** For the Service Water System, those safety-related buildings and areas are:

Common Intake Structure

Unit 2 Auxiliary Building
Unit 2 Diesel Generator Building
Unit 2 Pipe Tunnels
Unit 2 Safeguards Building
Unit 2 Service Water Valve Pits

**Table 3.3.2-30: Auxiliary Systems – Solid Waste Disposal System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping | Pressure Boundary | Wrought Austenitic Stainless Steel | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | J |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | J |
| | | | Demineralized Untreated Water | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.3.2-30: Auxiliary Systems – Solid Waste Disposal System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air, Potential for Leaking Borated Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | J |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | J |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Demineralized Untreated Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.
** For the Solid Waste Disposal System, those safety-related buildings and areas are:
Unit 1 Auxiliary Building
Unit 1 Fuel Building

Unit 2 Auxiliary Building

**Table 3.3.2-31: Auxiliary Systems – Supplementary Leak Collection and Release System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Bolting Integrity | VII.F2.1-a | 3.3.1-05 | B |
| Collar | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| | | | | Hardening and Shrinkage | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| | | | | Loss of Strength | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| Conditioner | Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Damper Housing | Fire Barrier, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.F2.1-a | 3.3.1-05 | A |

**Table 3.3.2-31: Auxiliary Systems – Supplementary Leak Collection and Release System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Damper Housing (continued) | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.F2.1-a | 3.3.1-05 | A |
| Duct | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.F2.1-a | 3.3.1-05 | A |
| Element | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.F2.1-a | 3.3.1-05 | A |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VII.I.1-b | 3.3.1-05 | A |
| Fan | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.F2.1-a | 3.3.1-05 | A |

**Table 3.3.2-31: Auxiliary Systems – Supplementary Leak Collection and Release System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Filter | Filtration, Pressure Boundary | Polymers | Air | Crack Initiation and Growth | Periodic Surveillance and Preventive Maintenance | VII.F2.4-b | 3.3.1-02 | A |
| | | | | Hardening and Shrinkage | Periodic Surveillance and Preventive Maintenance | VII.F2.4-b | 3.3.1-02 | A |
| | | | | Loss of Strength | Periodic Surveillance and Preventive Maintenance | VII.F2.4-b | 3.3.1-02 | A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | VII.F2.4-a | 3.3.1-05 | A |
| Pipe Fittings | Pressure Boundary | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | Polymers | Air | Crack Initiation and Growth | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |

**Table 3.3.2-31: Auxiliary Systems – Supplementary Leak Collection and Release System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pipe Fittings (continued) | Pressure Boundary (continued) | Polymers (continued) | Air (continued) | Hardening and Shrinkage | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| | | | | Loss of Strength | System Monitoring | VII.F2.1-b | 3.3.1-02 | A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Air | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Seal | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | Periodic Surveillance and Preventive Maintenance | VII.F2.1-b | 3.3.1-02 | A |

**Table 3.3.2-31: Auxiliary Systems – Supplementary Leak Collection and Release System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Seal (continued) | Pressure Boundary (continued) | Polymers (continued) | Air (continued) | Hardening and Shrinkage | Periodic Surveillance and Preventive Maintenance | VII.F2.1-b | 3.3.1-02 | A |
| | | | | Loss of Strength | Periodic Surveillance and Preventive Maintenance | VII.F2.1-b | 3.3.1-02 | A |
| Separator | Pressure Boundary | Wrought Austenitic Stainless Steel | Air, Moisture or Wetting, Temperature Less Than 140 deg F | Loss of Material | One-Time Inspection | N/A | N/A | J |
| Tank | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| Valve | Pressure Boundary | Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon) | Dried Air or Gas | None | N/A | N/A | N/A | N/A |

**Table 3.3.2-31: Auxiliary Systems – Supplementary Leak Collection and Release System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Dried Air or Gas | None | N/A | N/A | N/A | N/A |
| | | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Air | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.3.2-32: Auxiliary Systems – Water Treating System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Demineralized Untreated Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Water Treating System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Intake Structure
Unit 1 Safeguards Building
Unit 1 Service Building

Unit 2 Auxiliary Building
Unit 2 Decontamination Building
Unit 2 Diesel Generator Building
Unit 2 Fuel Building
Unit 2 Main Steam and Cable Vault Area
Unit 2 Pipe Tunnels
Unit 2 Safeguards Building
Unit 2 Service Building

Definitions of the LRA Notes shown in Tables 3.3.2-1 through 3.3.2-32

A. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 for material, environment, and aging effect, but a different aging management program is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material, and environment combination.

I. Aging effect and/or mechanism 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.

K. Material and environment not in NUREG-1801 for this component and aging effect.

L. Aging effect and environment not in NUREG-1801 for this component and material.

M. Aging effect and material not in NUREG-1801 for this component and environment.

N. Aging effect, material, and environment not in NUREG-1801 for this component.

P. Component and aging effect not in NUREG-1801 for this material and environment.

Q. Component not in NUREG-1801 for this material, environment, and aging effect.

R. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801.

S. AMP and aging mechanism are not consistent with NUREG-1801.

T. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801.

U. Specific material/environment combinations were not determined. Comparison to NUREG-1801 is not possible.

V. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801. AMP takes some exceptions to NUREG-1801 AMP.

(Note “O” was not used to avoid confusion with the number zero)

Plant-Specific Notes

None.

## 3.4 AGING MANAGEMENT OF STEAM AND POWER CONVERSION SYSTEMS

### 3.4.1 Introduction

This section provides the results of the aging management review for those components identified in Section 2.3.4, Steam and Power Conversion Systems, as being subject to aging management review. The systems, or portions of systems, which are addressed in this section, are described in the indicated sections.

- Auxiliary Feedwater System (2.3.4.1)
- Auxiliary Steam and Condensate System (2.3.4.2)
- Condensate System (2.3.4.3)
- Main Feedwater System (2.3.4.4)
- Main Steam System (2.3.4.5)
- Main Turbine and Condenser System (2.3.4.6)
- Steam Generator Blowdown System (2.3.4.7)

Table 3.4.1, Summary of Aging Management Evaluations in Chapter VIII of NUREG-1801 for Steam and Power Conversion Systems, provides the summary of the programs evaluated in NUREG-1801 for the Steam and Power Conversion Systems component groups that are relied on for license renewal.

This table uses the format described in Section 3.0 above. Note that this table only includes those component groups that are applicable to a PWR.

### 3.4.2 Results

The following tables summarize the results of the aging management review for systems in the Steam and Power Conversion Systems group. The tables appear after Table 3.4.1, which appears after Section 3.4.3, Conclusion.

Table 3.4.2-1, Steam and Power Conversion Systems - Auxiliary Feedwater System - Summary of Aging Management Evaluation

Table 3.4.2-2, Steam and Power Conversion Systems - Auxiliary Steam and Condensate System - Summary of Aging Management Evaluation

Table 3.4.2-3, Steam and Power Conversion Systems - Condensate System - Summary of Aging Management Evaluation

Table 3.4.2-4, Steam and Power Conversion Systems - Main Feedwater System - Summary of Aging Management Evaluation

Table 3.4.2-5, Steam and Power Conversion Systems - Main Steam System - Summary of Aging Management Evaluation

Table 3.4.2-6, Steam and Power Conversion Systems - Main Turbine and Condenser System - Summary of Aging Management Evaluation

Table 3.4.2-7, Steam and Power Conversion Systems - Steam Generator Blowdown System - Summary of Aging Management Evaluation

The materials that specific components are fabricated from, the environments to which components are exposed, the aging effects requiring management, and the aging management programs used to manage these aging effects are provided for each of the above systems in the following subsections of Section 3.4.2.1, Materials, Environments, Aging Effects Requiring Management and Aging Management Programs:

Section 3.4.2.1.1, Auxiliary Feedwater System

Section 3.4.2.1.2, Auxiliary Steam and Condensate System

Section 3.4.2.1.3, Condensate System

Section 3.4.2.1.4, Main Feedwater System

Section 3.4.2.1.5, Main Steam System

Section 3.4.2.1.6, Main Turbine and Condenser System

Section 3.4.2.1.7, Steam Generator Blowdown System

### 3.4.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

#### 3.4.2.1.1 Auxiliary Feedwater System

**Materials**

The materials of construction for the Auxiliary Feedwater System components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Gray Cast Iron
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Wrought Austenitic Stainless Steel

### Environments

The Auxiliary Feedwater System components are exposed to the following environments:

- Air
- Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than or Equal To 212 deg F
- Lubricating Oil
- Raw Water, Low Flow
- Soil, Above the Water Table
- Treated Water
- Treated Water, Temperature Less Than 140 deg F, Low Flow
- Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F, Low Flow

### Aging Effects Requiring Management

The following aging effects, associated with the Auxiliary Feedwater System, require management:

- Crack Initiation and Growth
- Loss of Heat Transfer Capability
- Loss of Material
- Loss of Preload

### Aging Management Programs

The following aging management programs manage the aging effects for the Auxiliary Feedwater System components:

- Bolting Integrity
- Buried Piping and Tanks Inspection
- Metal Fatigue of Reactor Coolant Pressure Boundary
- One-Time Inspection
- Open-Cycle Cooling Water System
- Selective Leaching of Materials
- System Monitoring
- Water Chemistry

### 3.4.2.1.2 Auxiliary Steam and Condensate System

**Materials**

The materials of construction for the Auxiliary Steam and Condensate System components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Wrought Austenitic Stainless Steel

**Environments**

The Auxiliary Steam and Condensate System components are exposed to the following environments:

- Air
- Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than Or Equal To 212 deg F
- Treated Water
- Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F

**Aging Effects Requiring Management**

The following aging effects, associated with the Auxiliary Steam and Condensate System, require management:

- Crack Initiation and Growth
- Loss of Material
- Loss of Preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the Auxiliary Steam and Condensate System components:

- Bolting Integrity
- Flow-Accelerated Corrosion
- Metal Fatigue of Reactor Coolant Pressure Boundary
- System Monitoring
- Water Chemistry

### 3.4.2.1.3 Condensate System

**Materials**

The materials of construction for the Condensate System components are:

- Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon)
- Copper Alloys with Zinc Contents Less Than or Equal to 15%
- Cast Austenitic Stainless Steel
- Gray Cast Iron
- Wrought Austenitic Stainless Steel

**Environments**

The Condensate System components are exposed to the following environments:

- Air
- Air, Moisture or Wetting, Temperature Less Than 140 deg F
- Soil, Above the Water Table
- Treated Water, Temperature Less Than 140 deg F
- Treated Water, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Condensate System, require management:

- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Condensate System components:

- Buried Piping and Tanks Inspection
- One-Time Inspection
- Selective Leaching of Materials
- System Monitoring
- Water Chemistry

### 3.4.2.1.4 Main Feedwater System

**Materials**

The materials of construction for the Main Feedwater System components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Wrought Austenitic Stainless Steel

**Environments**

The Main Feedwater System components are exposed to the following environments:

- Air
- Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than or Equal To 212 deg F
- Treated Water
- Treated Water, Temperature Less than 140 deg F, Low Flow
- Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F
- Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F, Low Flow
- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Main Feedwater System, require management:

- Crack Initiation and Growth
- Loss of Material
- Loss of Preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the Main Feedwater System components:

- Bolting Integrity

- Flow-Accelerated Corrosion
- Metal Fatigue of Reactor Coolant Pressure Boundary
- One-Time Inspection
- System Monitoring
- Water Chemistry

#### 3.4.2.1.5 Main Steam System

**Materials**

The materials of construction for the Main Steam System components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Copper Alloys with Zinc Contents Less Than or Equal To 15%
- Nickel Based Alloy
- Wrought Austenitic Stainless Steel

**Environments**

The Main Steam System components are exposed to the following environments:

- Air
- Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than or Equal To 212 deg F
- Treated Water
- Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F, Low Flow
- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F
- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow
- Treated Water, Temperature Less than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Main Steam System, require management:

- Crack Initiation and Growth
- Loss of Fracture Toughness
- Loss of Material

- Loss of Preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the Main Steam System components:

- Bolting Integrity
- Flow-Accelerated Corrosion
- Metal Fatigue of Reactor Coolant Pressure Boundary
- One-Time Inspection
- System Monitoring
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)
- Water Chemistry

### 3.4.2.1.6 Main Turbine and Condenser System

**Materials**

The materials of construction for the Main Turbine and Condenser System components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Wrought Austenitic Stainless Steel

**Environments**

The Main Turbine and Condenser System components are exposed to the following environments:

- Air
- Air, Moisture or Wetting, Temperature Less Than 140 deg F
- Treated Water

**Aging Effects Requiring Management**

The following aging effects, associated with the Main Turbine and Condenser System, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Main Turbine and Condenser System components:

- One-Time Inspection
- System Monitoring
- Water Chemistry

### 3.4.2.1.7 Steam Generator Blowdown System

**Materials**

The materials of construction for the Steam Generator Blowdown System components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cast Austenitic Stainless Steel
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Wrought Austenitic Stainless Steel

**Environments**

The Steam Generator Blowdown System components are exposed to the following environments:

- Air
- Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than or Equal To 212 deg F
- Raw Water
- Treated Water
- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F
- Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow
- Treated Water, Temperature Less Than 140 deg F, Low Flow

**Aging Effects Requiring Management**

The following aging effects, associated with the Steam Generator Blowdown System, require management:

- Crack Initiation and Growth

- Loss of Fracture Toughness
- Loss of Material
- Loss of Preload

**Aging Management Programs**

The following aging management programs manage the aging effects for the Steam Generator Blowdown System components:

- Bolting Integrity
- Flow-Accelerated Corrosion
- Metal Fatigue of Reactor Coolant Pressure Boundary
- One-Time Inspection
- System Monitoring
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)
- Water Chemistry

#### 3.4.2.2 TIME-LIMITED AGING ANALYSES

The time-limited aging analyses (TLAA) identified below are associated with the Steam and Power Conversion Systems components. The section of the LRA that contains the TLAA review results is indicated in parenthesis.

- Criteria for B31.1 Systems (Section 4.3.5)
- Environmental Qualification (Section 4.4)

### 3.4.3 Conclusion

The Steam and Power Conversion Systems components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Steam and Power Conversion Systems components are identified in the summary tables and Section 3.4.2.1.

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 Systems components will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

**Table 3.4.1 Summary of Aging Management Evaluations in Chapter VIII of NUREG-1801 for Steam and Power Conversion Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.4.1-01 | Piping and fittings in main feedwater line, steam line and auxiliary feedwater (AFW) piping (PWR only) | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) | Yes, TLAA | Consistent with NUREG-1801 except as noted below.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801:<br>• Certain Main Steam piping segments that are not between the steam generator and the second containment isolation valve.<br><br>Further evaluation is documented in TLAA (Section 4.3). |
| 3.4.1-02 | Piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head, and shell (except main steam system) | Loss of material due to general (carbon steel only), pitting, and crevice corrosion | Water chemistry and one-time inspection | Yes, detection of aging effects is to be further evaluated | Consistent with NUREG-1801.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.20), One Time Inspection. |
| 3.4.1-03 | AFW piping | Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling | Plant specific | Yes, plant specific | Not applicable because BVPS has no AFW piping with the environment indicated in NUREG-1801 (untreated water from backup water supply).<br><br>Further evaluation is not applicable. |

**Table 3.4.1 Summary of Aging Management Evaluations in Chapter VIII of NUREG-1801 for Steam and Power Conversion Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.4.1-04 | Oil coolers in AFW system (lubricating oil side possibly contaminated with water) | Loss of material due to general (carbon steel only), pitting, and crevice corrosion, and MIC | Plant specific | Yes, plant specific | Not applicable because BVPS results do not assign any AERMs to lubricating oil in oil coolers. |
| 3.4.1-05 | External surface of carbon steel components | Loss of material due to general corrosion | Plant specific | Yes, plant specific | Consistent with NUREG-1801.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.28), System Monitoring. |
| 3.4.1-06 | Carbon steel piping and valve bodies | Wall thinning due to flow-accelerated corrosion | Flow-accelerated corrosion | No | Consistent with NUREG-1801. |
| 3.4.1-07 | Carbon steel piping and valve bodies in main steam system | Loss of material due to pitting and crevice corrosion | Water chemistry | No | Consistent with NUREG-1801 except as noted below.<br><br>The following BVPS components are consistent with, but not addressed by, NUREG-1801 in this row:<br>• Steam Drains<br><br>BVPS results include the mechanism General Corrosion for certain Main Steam orifices, piping, and valves. |

**Table 3.4.1 Summary of Aging Management Evaluations in Chapter VIII of NUREG-1801 for Steam and Power Conversion Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.4.1-08 | Closure bolting in high-pressure or high-temperature systems | Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC. | Bolting integrity | No | Consistent with NUREG-1801, with Bolting Integrity exceptions. See Appendix B, Section B.2.1.5.<br><br>For bolting crack initiation and growth due to fatigue, Metal Fatigue of Reactor Coolant Pressure Boundary (Appendix B, Section B.2.1.20) is credited. |
| 3.4.1-09 | Heat exchangers and coolers/ condensers serviced by open-cycle cooling water | Loss of material due to general (carbon steel only), pitting, and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling | Open-cycle cooling water system | No | Not applicable because BVPS does not have a raw water environment for these components. |
| 3.4.1-10 | Heat exchangers and coolers/ condensers serviced by closed-cycle cooling water | Loss of material due to general (carbon steel only), pitting, and crevice corrosion | Closed-cycle cooling water system | No | Not applicable because this material and environment combination (stainless steel tubes/carbon steel tubesheet, channel head, and shell, in a closed-cycle cooling water environment) does not occur at BVPS. |
| 3.4.1-11 | External surface of aboveground condensate storage tank | Loss of material due to general (carbon steel only), pitting, and crevice corrosion | Aboveground carbon steel tanks | No | Consistent with NUREG-1801. |

**Table 3.4.1 Summary of Aging Management Evaluations in Chapter VIII of NUREG-1801 for Steam and Power Conversion Systems**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.4.1-12 | External surface of buried condensate storage tank and AFW piping | Loss of material due to general, pitting, and crevice corrosion, and MIC | Buried piping and tanks surveillance<br><br>or<br><br>Buried piping and tanks inspection | No<br><br>Yes, detection of aging effects and operating experience are to be further evaluated | Consistent with NUREG-1801.<br><br>BVPS results also include the mechanism Galvanic Corrosion for buried Auxiliary Feedwater piping.<br><br>Further evaluation is documented in Appendix B (Section B.2.1.8), Buried Piping and Tanks Inspection. |
| 3.4.1-13 | External surface of carbon steel components | Loss of material due to boric acid corrosion | Boric acid corrosion | No | Not applicable because BVPS results only apply boric acid corrosion for systems that contain borated water. |

**Table 3.4.2-1: Steam and Power Conversion Systems – Auxiliary Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than Or Equal To 212 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.H.2-b | 3.4.1-08 | E |
| | | | | Loss of Material | Bolting Integrity | VIII.H.2-a | 3.4.1-08 | B |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| | | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than Or Equal To 212 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | F |
| | | | | | Bolting Integrity | N/A | N/A | F |
| | | | | Loss of Material | Bolting Integrity | N/A | N/A | F |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VIII.H.1-b | 3.4.1-05 | A |

**Table 3.4.2-1: Steam and Power Conversion Systems – Auxiliary Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger | Heat Transfer, Pressure Boundary | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Heat Transfer Capability | Water Chemistry | N/A | N/A | M |
| | | | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| | | | | Loss of Heat Transfer Capability | Water Chemistry | N/A | N/A | H |
| | Pressure Boundary | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Lubricating Oil | None | N/A | N/A | N/A | N/A |

**Table 3.4.2-1: Steam and Power Conversion Systems – Auxiliary Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger (continued) | Pressure Boundary (continued) | Gray Cast Iron | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | Loss of Material | Water Chemistry | N/A | N/A | F |
| | | | | | One-Time Inspection | N/A | N/A | F |
| | | | | | Selective Leaching of Materials | N/A | N/A | F |
| | | Wrought Austenitic Stainless Steel | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| Orifice | Flow Restriction, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water, Temperature Less than 140 deg F, Low Flow | Loss of Material | Water Chemistry | N/A | N/A | J |
| | | | | | One-Time Inspection | N/A | N/A | J |

**Table 3.4.2-1: Steam and Power Conversion Systems – Auxiliary Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Orifice (continued) | Flow Restriction, Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Pipe Fittings | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | | Soil, Above the Water Table | Loss of Material | Buried Piping and Tanks Inspection | VIII.G.1-e | 3.4.1-12 | A |
| | | | | | Buried Piping and Tanks Inspection | VIII.G.1-e | 3.4.1-12 | R |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | Loss of Material | Water Chemistry | VIII.G.1-c | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.G.1-c | 3.4.1-02 | A |

**Table 3.4.2-1: Steam and Power Conversion Systems – Auxiliary Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi (continued) | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.G.1-b | 3.4.1-01 | A |
| | | | | Loss of Material | Water Chemistry | VIII.G.1-c | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.G.1-c | 3.4.1-02 | A |
| | | Copper Alloys with Zinc Content Less Than or Equal to 15% | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Pump | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | Loss of Material | Water Chemistry | VIII.G.2-a | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.G.2-a | 3.4.1-02 | A |

**Table 3.4.2-1: Steam and Power Conversion Systems – Auxiliary Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Pump (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Strainer | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water, Temperature Less than 140 deg F, Low Flow | Loss of Material | Water Chemistry | VIII.G.1-c | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.G.1-c | 3.4.1-02 | A |
| Tank | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VIII.G.4-c | 3.4.1-11 | A |
| | | | | | One-Time Inspection | VIII.G.4-c | 3.4.1-11 | A |
| | | | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | Loss of Material | Water Chemistry | VIII.G.4-a | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.G.4-a | 3.4.1-02 | A |

**Table 3.4.2-1: Steam and Power Conversion Systems – Auxiliary Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Tank (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Valve | Pressure Boundary | Copper Alloys with Zinc Contents Less Than or Equal to 15% | Lubricating Oil | None | N/A | N/A | N/A | N/A |
| | | Cast Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | | Lubricating Oil | None | N/A | N/A | N/A | N/A |

**Table 3.4.2-1: Steam and Power Conversion Systems – Auxiliary Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi (continued) | Raw Water, Low Flow | Loss of Material | Open-Cycle Cooling Water System | VII.C1.2-a | 3.3.1-17 | A |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | Loss of Material | Water Chemistry | VIII.G.3-a | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.G.3-a | 3.4.1-02 | A |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | L |
| | | | | Loss of Material | Water Chemistry | VIII.G.3-a | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.G.3-a | 3.4.1-02 | A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.4.2-1: Steam and Power Conversion Systems – Auxiliary Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Auxiliary Feedwater System, those safety-related buildings and areas are:

Unit 1 Safeguards Building
Unit 2 PDWS

**Table 3.4.2-2: Steam and Power Conversion Systems – Auxiliary Steam and Condensate System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than Or Equal To 212 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.H.2-b | 3.4.1-08 | E |
| | | | | Loss of Material | Bolting Integrity | VIII.H.2-a | 3.4.1-08 | A |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VIII.H.1-b | 3.4.1-05 | A |
| Valve | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | Loss of Material | Flow-Accelerated Corrosion | VIII.B1.2-b | 3.4.1-06 | A |
| | | | | | Water Chemistry | VIII.B1.2-b | 3.4.1-06 | A |

**Table 3.4.2-2: Steam and Power Conversion Systems – Auxiliary Steam and Condensate System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Crack Initiation and Growth | Flow Accelerated Corrosion | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Loss of Material | Flow Accelerated Corrosion | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Auxiliary Steam and Condensate System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Pipe Tunnels
Unit 1 Primary Water Storage Building
Unit 1 Safeguards Building

Unit 2 Auxiliary Building
Unit 2 Decontamination Building
Unit 2 Fuel Building
Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Pipe Tunnels

**Table 3.4.2-3: Steam and Power Conversion Systems – Condensate System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surfaces | NSR Functional Support | Wrought Austenitic Stainless Steel | Soil, Above the Water Table | Loss of Material | Buried Piping and Tanks Inspection | N/A | N/A | K |
| | NSR Functional Support | Gray Cast Iron | Air | Loss of Material | System Monitoring | N/A | N/A | F |
| Piping | NSR Functional Support | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |
| | | Copper Alloys with Zinc Contents Less Than or Equal To 15% | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.4.2-3: Steam and Power Conversion Systems – Condensate System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Tank | NSR Functional Support | Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon) | Air, Moisture or Wetting, Temperature Less Than 140 deg F | Loss of Material | One-Time Inspection | N/A | N/A | F |
| | | | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air, Moisture or Wetting, Temperature Less Than 140 deg F | Loss of Material | One-Time Inspection | N/A | N/A | F |
| | | | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.4.2-3: Steam and Power Conversion Systems – Condensate System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | NSR Functional Support | Cast Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |
| | | Gray Cast Iron | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Water Chemistry | N/A | N/A | F |
| | | | | | One-Time Inspection | N/A | N/A | F |
| | | | | | Selective Leaching of Materials | N/A | N/A | F |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.4.2-4: Steam and Power Conversion Systems – Main Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than or Equal To 212 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.H.2-b | 3.4.1-08 | E |
| | | | | Loss of Material | Bolting Integrity | VIII.H.2-a | 3.4.1-08 | B |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| | | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than or Equal To 212 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | F |
| | | | | | Bolting Integrity | N/A | N/A | F |
| | | | | Loss of Material | Bolting Integrity | N/A | N/A | F |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| Element | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.D1.1-a | 3.4.1-06 | A |
| | | | | Loss of Material | Flow-Accelerated Corrosion | VIII.D1.1-b | 3.4.1-01 | A |
| | | | | | Water Chemistry | VIII.D1.1-b | 3.4.1-01 | A |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VIII.H.1-b | 3.4.1-05 | A |

**Table 3.4.2-4: Steam and Power Conversion Systems – Main Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Heat Exchanger | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | J |
| | | | | | Water Chemistry | N/A | N/A | J |
| | | | | | One-Time Inspection | N/A | N/A | J |
| Orifice | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.D1.1-b | 3.4.1-01 | A |
| | | | | Loss of Material | Flow-Accelerated Corrosion | VIII.D1.1-a | 3.4.1-06 | A |
| | | | | | Water Chemistry | VIII.D1.1-a | 3.4.1-06 | A |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.D1.1-b | 3.4.1-01 | A |
| | | | | Loss of Material | Flow-Accelerated Corrosion | VIII.D1.1-a | 3.4.1-06 | A |
| | | | | | Water Chemistry | VIII.D1.1-a | 3.4.1-06 | A |

**Table 3.4.2-4: Steam and Power Conversion Systems – Main Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi (continued) | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.D1.1-b | 3.4.1-01 | A |
| | | | | Loss of Material | Water Chemistry | VIII.D1.1-c | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.D1.1-c | 3.4.1-02 | A |
| | | | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.D.1.1-b | 3.4.1-01 | A |
| | | | | Loss of Material | Water Chemistry | VIII.D1.1-c | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.D1.1-c | 3.4.1-02 | A |
| | | Copper Alloys with Zinc Content Less Than or Equal to 15% | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Water Chemistry | N/A | N/A | M |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |

**Table 3.4.2-4: Steam and Power Conversion Systems – Main Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water, Temperature Less than 140 deg F, Low Flow | Loss of Material | Water Chemistry | VIII.D1.2-b | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.D1.2-b | 3.4.1-02 | A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | Loss of Material | Flow-Accelerated Corrosion | VIII.D1.2-a | 3.4.1-06 | A |
| | | | | | Water Chemistry | VIII.D1.2-a | 3.4.1-06 | A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | Loss of Material | Water Chemistry | VIII.D1.2-b | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.D1.2-b | 3.4.1-02 | A |

**Table 3.4.2-4: Steam and Power Conversion Systems – Main Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi (continued) | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | Loss of Material | Water Chemistry | VIII.D1.2-b | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.D1.2-b | 3.4.1-02 | A |
| | | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | | Water Chemistry | N/A | N/A | M |
| | | | | | One-Time Inspection | N/A | N/A | M |
| | | | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | M |
| | | | | | Water Chemistry | N/A | N/A | M |
| | | | | | One-Time Inspection | N/A | N/A | M |

**Table 3.4.2-4: Steam and Power Conversion Systems – Main Feedwater System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | | Water Chemistry | N/A | N/A | M |
| | | | | | One-Time Inspection | N/A | N/A | M |
| | | | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Crack Initiation and Growth | Flow-Accelerated Corrosion | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Loss of Material | Flow Accelerated Corrosion | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Main Feedwater System, those safety-related buildings and areas are:

Unit 1 Safeguards Building
Unit 1 Service Building

Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Service Building

**Table 3.4.2-5: Steam and Power Conversion Systems – Main Steam System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than or Equal To 212 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.H.2-b | 3.4.1-08 | E |
| | | | | Loss of Material | Bolting Integrity | VIII.H.2-a | 3.4.1-08 | B |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VIII.H.1-b | 3.4.1-05 | A |
| Orifice | Flow Restriction, Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.B1.1-b | 3.4.1-01 | A |
| | | | | Loss of Material | Water Chemistry | VIII.B1.1-c | 3.4.1-06 | A |
| | | | | | Flow-Accelerated Corrosion | VIII.B1.1-c | 3.4.1-06 | A |
| | | Nickel Based Alloy | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.B1.1-b | 3.4.1-01 | A |
| | | | | | Water Chemistry | N/A | N/A | F |

**Table 3.4.2-5: Steam and Power Conversion Systems – Main Steam System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Orifice (continued) | Flow Restriction, Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.B1.1-b | 3.4.1-01 | A |
| | | | | Loss of Material | Water Chemistry | VIII.B1.1-a | 3.4.1-07 | R |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.B1.1-b | 3.4.1-01 | A |
| | | | | Loss of Material | Flow-Accelerated Corrosion | VIII.B1.1-c | 3.4.1-06 | A |
| | | | | | Water Chemistry | VIII.B1.1-c | 3.4.1-06 | A |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.B1.1-b | 3.4.1-01 | A |

**Table 3.4.2-5: Steam and Power Conversion Systems – Main Steam System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi (continued) | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F (continued) | Loss of Material | Flow-Accelerated Corrosion | VIII.B1.1-c | 3.4.1-06 | A |
| | | | | | Water Chemistry | VIII.B1.1-c | 3.4.1-06 | A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.B1.1-b | 3.4.1-01 | A |
| | | | | Loss of Material | Water Chemistry | VIII.B1.1-a | 3.4.1-07 | R |
| | | | | | | VIII.B1.1-a | 3.4.1-07 | T |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | Loss of Material | Water Chemistry | VIII.B1.1-a | 3.4.1-07 | R |
| | | | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.B1.1-b | 3.4.1-01 | C |
| | | | | Loss of Material | Water Chemistry | VIII.B1.1-a | 3.4.1-07 | R |

**Table 3.4.2-5: Steam and Power Conversion Systems – Main Steam System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Copper Alloys with Zinc Content Less Than 15% | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Turbine | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | J |
| | | Cast Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.4.2-5: Steam and Power Conversion Systems – Main Steam System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | Loss of Material | Flow-Accelerated Corrosion | VIII.B1.2-b | 3.4.1-06 | A |
| | | | | | Water Chemistry | VIII.B1.2-b | 3.4.1-06 | A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | Loss of Material | Water Chemistry | VIII.B1.2-a | 3.4.1-07 | R |
| | | | Treated Water, Temperature Less than 140 deg F, Low Flow | Loss of Material | Water Chemistry | VIII.B1.2-a | 3.4.1-07 | R |
| | | | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | Loss of Material | Water Chemistry | VIII.B1.2-a | 3.4.1-07 | R |

**Table 3.4.2-5: Steam and Power Conversion Systems – Main Steam System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Cast Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than Or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | M |
| | | | | | Water Chemistry | N/A | N/A | M |
| | | | | Loss of Fracture Toughness | Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) | N/A | N/A | M |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | M |
| | | | | | Water Chemistry | N/A | N/A | M |
| | | | Treated Water or Steam, Temperature Greater Than or Equal to 212 deg F But Less Than 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | M |
| | | | | | Water Chemistry | N/A | N/A | M |

**Table 3.4.2-5: Steam and Power Conversion Systems – Main Steam System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water, Temperature Less than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Crack Initiation and Growth | Flow Accelerated Corrosion | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Loss of Material | Flow Accelerated Corrosion | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Main Steam System, those safety-related buildings and areas are:

Unit 1 Reactor Containment Building
Unit 1 Safeguards Building
Unit 1 Service Building

Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Pipe Tunnels
Unit 2 Safeguards Building
Unit 2 Service Building

**Table 3.4.2-6: Steam and Power Conversion Systems – Main Turbine and Condenser System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VIII.H.1-b | 3.4.1-05 | A |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Moisture or Wetting, Temperature Less Than 140 deg F | Loss of Material | One-Time Inspection | N/A | N/A | G |
| Valve | Pressure Boundary | Cast Austenitic Stainless Steel | Air, Moisture or Wetting, Temperature Less Than 140 deg F | Loss of Material | One-Time Inspection | N/A | N/A | G |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Moisture or Wetting, Temperature Less Than 140 deg F | Loss of Material | One-Time Inspection | N/A | N/A | G |

**Table 3.4.2-6: Steam and Power Conversion Systems – Main Turbine and Condenser System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Air, Moisture or Wetting, Temperature Less Than 140 deg F | Loss of Material | One-Time Inspection | N/A | N/A | G |
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Treated Water | Loss of Material | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Crack Initiation and Growth | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Main Turbine and Condenser System, those safety-related buildings and areas are:

Unit 1 Safeguards Building

Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Service Building

**Table 3.4.2-7: Steam and Power Conversion Systems – Steam Generator Blowdown System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Bolting | Pressure Boundary | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than or Equal To 212 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | VIII.H.2-b | 3.4.1-08 | E |
| | | | | Loss of Material | Bolting Integrity | VIII.H.2-a | 3.4.1-08 | B |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| | | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Closure Bolting for Non-Borated Water Systems With Operating Temperatures Greater Than or Equal To 212 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | F |
| | | | | | Bolting Integrity | N/A | N/A | F |
| | | | | Loss of Material | Bolting Integrity | N/A | N/A | F |
| | | | | Loss of Preload | Bolting Integrity | N/A | N/A | H |
| External Surfaces | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | System Monitoring | VIII.H.1-b | 3.4.1-05 | A |
| Piping | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | Loss of Material | Flow-Accelerated Corrosion | VIII.F.1-a | 3.4.1-06 | A |
| | | | | | Water Chemistry | VIII.F.1-a | 3.4.1-06 | A |

**Table 3.4.2-7: Steam and Power Conversion Systems – Steam Generator Blowdown System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi (continued) | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | Loss of Material | Water Chemistry | VIII.F.1-b | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.F.1-b | 3.4.1-02 | A |
| | | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | | Water Chemistry | N/A | N/A | M |
| | | | | | One-Time Inspection | N/A | N/A | M |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | | Water Chemistry | N/A | N/A | M |
| | | | | | One-Time Inspection | N/A | N/A | M |

**Table 3.4.2-7: Steam and Power Conversion Systems – Steam Generator Blowdown System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Piping (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water, Temperature Less Than 140 deg F, Low Flow | None | Water Chemistry | N/A | N/A | N/A |
| Valve | Pressure Boundary | Cast Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | | Water Chemistry | N/A | N/A | M |
| | | | | | One-Time Inspection | N/A | N/A | M |
| | | | | Loss of Fracture Toughness | Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) | N/A | N/A | M |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |

**Table 3.4.2-7: Steam and Power Conversion Systems – Steam Generator Blowdown System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Valve (continued) | Pressure Boundary (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi (continued) | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F (continued) | Loss of Material | Flow-Accelerated Corrosion | VIII.F.2-a | 3.4.1-06 | A |
| | | | | | Water Chemistry | VIII.F.2-a | 3.4.1-06 | A |
| | | | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | Loss of Material | Water Chemistry | VIII.F.2-b | 3.4.1-02 | A |
| | | | | | One-Time Inspection | VIII.F.2-b | 3.4.1-02 | A |
| | | Wrought Austenitic Stainless Steel | Treated Water or Steam, Temperature Greater Than or Equal To 482 deg F, Low Flow | Crack Initiation and Growth | Metal Fatigue of Reactor Coolant Pressure Boundary | N/A | N/A | H |
| | | | | | Water Chemistry | N/A | N/A | M |
| | | | | | One-Time Inspection | N/A | N/A | M |

**Table 3.4.2-7: Steam and Power Conversion Systems – Steam Generator Blowdown System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| NSR fluid-retaining components in safety-related buildings and areas** | NSR Functional Support | Any | Raw Water | Crack Initiation and Growth | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | Loss of Material | One-Time Inspection | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | Treated Water | Crack Initiation and Growth | Flow-Accelerated Corrosion | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |
| | | | | Loss of Material | Flow-Accelerated Corrosion | N/A | N/A | U |
| | | | | | System Monitoring | N/A | N/A | U |
| | | | | | Water Chemistry | N/A | N/A | U |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

** For the Steam Generator Blowdown System, those safety-related buildings and areas are:

Unit 1 Auxiliary Building
Unit 1 Service Building
Unit 1 Safeguards Building

Unit 2 Auxiliary Building
Unit 2 Main Steam Valve and Cable Vault Area
Unit 2 Pipe Tunnels
Unit 2 Service Building

Definitions of the LRA Notes shown in Tables 3.4.2-1 through 3.4.2-7

A. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 for material, environment, and aging effect, but a different aging management program is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material, and environment combination.

I. Aging effect and/or mechanism 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.

K. Material and environment not in NUREG-1801 for this component and aging effect.

L. Aging effect and environment not in NUREG-1801 for this component and material.

M. Aging effect and material not in NUREG-1801 for this component and environment.

N. Aging effect, material, and environment not in NUREG-1801 for this component.

P. Component and aging effect not in NUREG-1801 for this material and environment.

Q. Component not in NUREG-1801 for this material, environment, and aging effect.

R. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801.

S. AMP and aging mechanism are not consistent with NUREG-1801.

T. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801.

U. Specific material/environment combinations were not determined. Comparison to NUREG-1801 is not possible.

V. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801. AMP takes some exceptions to NUREG-1801 AMP.

(Note “O” was not used to avoid confusion with the number zero)

Plant-Specific Notes

None.

## 3.5 AGING MANAGEMENT OF CONTAINMENT, STRUCTURES, AND COMPONENT SUPPORTS

### 3.5.1 Introduction

This section provides the results of the aging management review for those components identified in Section 2.4, Scoping and Screening Results for Structures, subject to aging management review. The commodities and systems addressed in this section are described in the indicated sections.

- Reactor Containment Building (2.4.1)
- Alternate Intake Structure (2.4.2.1)
- Auxiliary Building (2.4.2.2)
- Component Supports (2.4.2.3)
- Containment System Structural Components (2.4.2.4)
- Control Building (2.4.2.5)
- Cranes and Hoists (2.4.2.6)
- Essential Yard Structures (2.4.2.7)
- Fire Barriers (2.4.2.8)
- Intake Structure (2.4.2.9)
- Safeguards Building (2.4.2.10)
- Turbine Building (2.4.2.11)

Table 3.5.1, Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Containment, Structures, and Component Supports, provides the summary of the programs evaluated in NUREG-1801 for the Containment, Structures, and Component Supports component groups that are relied on for license renewal.

This table uses the format described in Section 3.0 above. Note that this table only includes those component groups that are applicable to a PWR.

### 3.5.2 Results

The following tables summarize the results of the aging management review for component types of the Containment, Structures, and Component Supports group. The tables appear after Table 3.5.1, which appears after Section 3.5.3, Conclusion.

Table 3.5.2-1, Containment, Structures, and Component Supports - Reactor Containment Building - Summary of Aging Management Evaluation

Table 3.5.2-2, Containment, Structures, and Component Supports - Alternate Intake Structure - Summary of Aging Management Evaluation

Table 3.5.2-3, Containment, Structures, and Component Supports - Auxiliary Building - Summary of Aging Management Evaluation

Table 3.5.2-4, Containment, Structures, and Component Supports - Component Supports - Summary of Aging Management Evaluation

Table 3.5.2-5, Containment, Structures, and Component Supports - Containment System Structural Components - Summary of Aging Management Evaluation

Table 3.5.2-6, Containment, Structures, and Component Supports - Control Building - Summary of Aging Management Evaluation

Table 3.5.2-7, Containment, Structures, and Component Supports - Cranes and Hoists - Summary of Aging Management Evaluation

Table 3.5.2-8, Containment, Structures, and Component Supports - Essential Yard Structures - Summary of Aging Management Evaluation

Table 3.5.2-9, Containment, Structures, and Component Supports - Fire Barriers - Summary of Aging Management Evaluation

Table 3.5.2-10, Containment, Structures, and Component Supports - Intake Structure - Summary of Aging Management Evaluation

Table 3.5.2-11, Containment, Structures, and Component Supports - Safeguards Building - Summary of Aging Management Evaluation

Table 3.5.2-12, Containment, Structures, and Component Supports - Turbine Building - Summary of Aging Management Evaluation

The materials that components are fabricated from, the environments to which components are exposed, the aging effects requiring management, and the aging management programs used to manage these aging effects are provided for each of the above structures in the following subsections of Section 3.5.2.1, Materials, Environments, Aging Effects Requiring Management and Aging Management Programs:

Section 3.5.2.1.1, Reactor Containment Building

Section 3.5.2.1.2, Alternate Intake Structure

Section 3.5.2.1.3, Auxiliary Building

Section 3.5.2.1.4, Component Supports

Section 3.5.2.1.5, Containment System Structural Components

Section 3.5.2.1.6, Control Building

Section 3.5.2.1.7, Cranes and Hoists

Section 3.5.2.1.8, Essential Yard Structures

Section 3.5.2.1.9, Fire Barriers

Section 3.5.2.1.10, Intake Structure

Section 3.5.2.1.11, Safeguards Building

Section 3.5.2.1.12, Turbine Building

### 3.5.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

#### 3.5.2.1.1 Reactor Containment Building

**Materials**

The materials of construction for the Reactor Containment Building components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Concrete
- Concrete at Expansion/Grouted Anchors
- Expansion/Grouted Anchors (CLASL)
- Polymers
- Wrought Austenitic Stainless Steel

**Environments**

The Reactor Containment Building components are exposed to the following environments:

- Air
- Soil, Above the Water Table
- Treated Water, Temperature Less Than 140 deg F

**Aging Effects Requiring Management**

The following aging effects, associated with the Reactor Containment Building, require management:

- Crack Initiation and Growth
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Reactor Containment Building components:

- 10 CFR Part 50, Appendix J
- ASME Section XI, Subsection IWE
- ASME Section XI, Subsection IWL
- Fire Protection
- Structures Monitoring Program

### 3.5.2.1.2 Alternate Intake Structure

**Materials**

The materials of construction for the Alternate Intake Structure components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Concrete
- Concrete at Expansion/Grouted Anchors
- Expansion/Grouted Anchors (CLASL)

**Environments**

The Alternate Intake Structure components are exposed to the following environments:

- Air
- Raw Water, Low Flow
- Raw Water, Low Flow, Relative Motion Between Components
- Soil, Above the Water Table
- Soil, Below the Water Table
- Undisturbed Soil

**Aging Effects Requiring Management**

The following aging effects, associated with the Alternate Intake Structure, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Alternate Intake Structure components:

- Structures Monitoring Program

### 3.5.2.1.3 Auxiliary Building

**Materials**

The materials of construction for the Auxiliary Building components are:

- Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon)
- Boral
- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cellular Concrete
- Concrete
- Concrete at Expansion/Grouted Anchors
- Expansion/Grouted Anchors (CLASL)
- Fire Stop
- Masonry Walls
- Polymers
- Wrought Austenitic Stainless Steel

**Environments**

The Auxiliary Building components are exposed to the following environments:

- Air
- Air, Relative Motion Between Components
- Soil, Above the Water Table

- Treated Water, Temperature Less Than 140 deg F

**Aging Effects Requiring Management**

The following aging effects, associated with the Auxiliary Building, require management:

- Crack Initiation and Growth
- Cracking/Delamination
- Hardening and Shrinkage
- Loss of Material
- Loss of Strength
- Separation

**Aging Management Programs**

The following aging management programs manage the aging effects for the Auxiliary Building components:

- Fire Protection
- Masonry Wall Program
- Structures Monitoring Program

### 3.5.2.1.4 Component Supports

**Materials**

The materials of construction for the Component Supports components are:

- Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon)
- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Concrete at Expansion/Grouted Anchors
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Expansion/Grouted Anchors (CLASL)
- Expansion/Grouted Anchors (WASS)
- Grout
- Polymers
- Wrought Austenitic Stainless Steel

**Environments**

The Component Supports components are exposed to the following environments:

- Air
- Air, Relative Motion Between Components
- Raw Water, Low Flow
- Treated Water, Temperature Less Than 140 deg F

**Aging Effects Requiring Management**

The following aging effects, associated with the Component Supports, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Component Supports components:

- ASME Section XI, Subsection IWF
- Structures Monitoring Program

### 3.5.2.1.5 Containment System Structural Components

**Materials**

The materials of construction for the Containment System Structural Components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze
- Copper Alloys with Zinc Contents Less Than or Equal to 15%
- Glass
- Nickel Based Alloy
- Polymers
- Wrought Austenitic Stainless Steel

**Environments**

The Containment System Structural Components are exposed to the following environments:

- Air
- Air, Cyclic Loading
- Air, Relative Motion Between Components
- Treated Water, Temperature Less Than 140 deg F
- Treated Water, Temperature Less Than 140 deg F, Cyclic Loading

**Aging Effects Requiring Management**

The following aging effects, associated with the Containment System Structural Components, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Containment System components:

- ASME Section XI, Subsection IWE
- 10 CFR Part 50, Appendix J

### 3.5.2.1.6 Control Building

**Materials**

The materials of construction for the Control Building components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Concrete
- Concrete at Expansion/Grouted Anchors
- Expansion/Grouted Anchors (CLASL)
- Polymers

**Environments**

The Control Building components are exposed to the following environments:

- Air
- Air, Relative Motion Between Components
- Soil, Above the Water Table

**Aging Effects Requiring Management**

The following aging effects, associated with the Control Building, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Control Building components:

- Fire Protection
- Structures Monitoring Program

### 3.5.2.1.7 Cranes and Hoists

**Materials**

The materials of construction for the Cranes and Hoists components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels
- Wrought Austenitic Stainless Steel

**Environments**

The Cranes and Hoists components are exposed to the following environments:

- Air
- Air, Relative Motion Between Components

- Treated Water, Temperature Less Than 140 deg F

**Aging Effects Requiring Management**

The following aging effects, associated with the Cranes and Hoists, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Cranes and Hoists components:

- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

### 3.5.2.1.8 Essential Yard Structures

**Materials**

The materials of construction for the Essential Yard Structures components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Concrete
- Concrete at Expansion/Grouted Anchors
- Expansion/Grouted Anchors (CLASL)
- Masonry Walls
- Polymers
- Wrought Austenitic Stainless Steel

**Environments**

The Essential Yard Structures components are exposed to the following environments:

- Air
- Raw Water, Low Flow
- Soil, Above the Water Table
- Soil, Below the Water Table
- Undisturbed Soil

**Aging Effects Requiring Management**

The following aging effects, associated with the Essential Yard Structures, require management:

- Crack Initiation and Growth
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Essential Yard Structures components:

- Fire Protection
- Masonry Wall Program
- Structures Monitoring Program

### 3.5.2.1.9 Fire Barriers

**Materials**

The materials of construction for the Fire Barriers components are:

- Cellular Concrete
- Fire Stop
- Fire Wrap
- Wrought Austenitic Stainless Steel

**Environments**

The Fire Barriers components are exposed to the following environments:

- Air

**Aging Effects Requiring Management**

The following aging effects, associated with the Fire Barriers, require management:

- Crack Initiation and Growth
- Cracking/Delamination
- Loss of Material
- Separation

**Aging Management Programs**

The following aging management programs manage the aging effects for the Fire Barriers components:

- Fire Protection

### 3.5.2.1.10 Intake Structure

**Materials**

The materials of construction for the Intake Structure components are:

- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Cellular Concrete
- Concrete
- Concrete at Expansion/Grouted Anchors
- Expansion/Grouted Anchors (CLASL)
- Polymers

**Environments**

The Intake Structure components are exposed to the following environments:

- Air
- Air, Relative Motion Between Components
- Raw Water, Low Flow
- Raw Water, Low Flow, Relative Motion Between Components
- Soil, Above the Water Table
- Soil, Below the Water Table

**Aging Effects Requiring Management**

The following aging effects, associated with the Intake Structure, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Intake Structure components:

- Fire Protection
- Periodic Surveillance and Preventive Maintenance
- Structures Monitoring Program
- System Monitoring

### 3.5.2.1.11 Safeguards Building

**Materials**

The materials of construction for the Safeguards Building components are:

- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Concrete
- Concrete at Expansion/Grouted Anchors
- Expansion/Grouted Anchors (CLASL)
- Polymers
- Wrought Austenitic Stainless Steel

**Environments**

The Safeguards Building components are exposed to the following environments:

- Air
- Air, Relative Motion Between Components
- Soil, Above the Water Table
- Treated Water, Temperature Less Than 140 deg F

**Aging Effects Requiring Management**

The following aging effects, associated with the Safeguards Building, require management:

- Crack Initiation and Growth
- Hardening and Shrinkage
- Loss of Material
- Loss of Strength

**Aging Management Programs**

The following aging management programs manage the aging effects for the Safeguards Building components:

- Fire Protection
- Structures Monitoring Program

### 3.5.2.1.12 Turbine Building

**Materials**

The materials of construction for the Turbine Building components are:

- Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon)
- Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi
- Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi
- Concrete
- Concrete at Expansion/Grouted Anchors
- Expansion/Grouted Anchors (CLASL)
- Masonry Walls
- Wrought Austenitic Stainless Steel

**Environments**

The Turbine Building components are exposed to the following environments:

- Air
- Air, Relative Motion Between Components
- Soil, Above the Water Table

**Aging Effects Requiring Management**

The following aging effects, associated with the Turbine Building, require management:

- Crack Initiation and Growth
- Loss of Material

**Aging Management Programs**

The following aging management programs manage the aging effects for the Turbine Building components:

- Fire Protection
- Masonry Wall Program
- Structures Monitoring Program

#### 3.5.2.2 Time-Limited Aging Analyses

The time-limited aging analyses (TLAA) identified below are associated with Containment, Structures, and Component Supports components. The section of the LRA that contains the TLAA review results is indicated in parenthesis.

- Containment Liner Plate Fatigue (Section 4.6.1)
- Containment Liner Test Channels Corrosion Analysis (Section 4.6.2)
- Crane Fatigue (Section 4.7.1)
- Settlement of Structures (Section 4.7.4)

### 3.5.3 Conclusion

Containment, Structures, and Component Supports components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Containment, Structures, and Component Supports components are identified in the summary tables and Section 3.5.2.1.

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 Containment, Structures, and Component Supports components will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

**Table 3.5.1 Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Containment, Structures, and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| **Common Components of All Types of PWR and BWR Containments** | | | | | |
| 3.5.1-01 | Penetration sleeves, penetration bellows, and dissimilar metal welds | Cumulative fatigue damage (CLB fatigue analysis exists) | TLAA evaluated in accordance with 10 CFR 54.21(c) | Yes, TLAA | Not applicable for penetration sleeves because a CLB fatigue analysis does not exist at BVPS.<br><br>For Unit 2 fuel transfer tube penetration bellows, further evaluation is documented in (TLAA Section 4.6.3). |
| 3.5.1-02 | Penetration sleeves, bellows, and dissimilar metal welds | Cracking due to cyclic loading; crack initiation and growth due to SCC | Containment inservice inspection (ISI) and containment leak rate test | Yes, detection of aging effects is to be evaluated | Not applicable because BVPS components with this aging effect/mechanism are considered under row 3.5.1-01. |
| 3.5.1-03 | Penetration sleeves, penetration bellows, and dissimilar metal welds | Loss of material due to corrosion | Containment ISI and Containment leak rate test | No | Not applicable because the aging effect/ mechanism does not occur for these components at BVPS. |
| 3.5.1-04 | Personnel airlock and equipment hatch | Loss of material due to corrosion | Containment ISI and containment leak rate test | No | Consistent with NUREG-1801. |

**Table 3.5.1 Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Containment, Structures, and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-05 | Personnel airlock and equipment hatch | Loss of leak tightness in closed position due to mechanical wear of locks, hinges, and closure mechanisms | Containment leak rate test and plant technical specifications | No | Consistent with NUREG-1801.<br><br>BVPS results also credit ASME Section XI, Subsection IWE (discussed in Appendix B, Section B.2.1.3) for these components. |
| 3.5.1-06 | Seals, gaskets, and moisture barriers | Loss of sealant and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers | Containment ISI and containment leak rate test | No | Consistent with NUREG-1801. |

**Table 3.5.1 Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Containment, Structures, and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| **PWR Concrete (Reinforced and Prestressed) and Steel Containment<br>BWR Concrete (Mark II and III) and Steel (Mark I, II, and III) Containment** | | | | | |
| 3.5.1-07 | Concrete elements: foundation, dome, and wall | Aging of accessible and inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel | Containment ISI | Yes, if aging mechanism is significant for inaccessible areas | Consistent with NUREG-1801. |
| 3.5.1-08 | Concrete elements: foundation | Cracks, distortion, and increases in component stress level due to settlement | Structures monitoring | No, if within the scope of the applicant's structures monitoring program | Not applicable because BVPS AMR results do not include any AERM due to the mechanism settlement for any structural components.<br><br>Settlement of the Unit 2 Valve Pit is being evaluated by a time limited aging analysis, based on potential effects on piping within the pit (TLAA Section 4.7.4). |

**Table 3.5.1 Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Containment, Structures, and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-09 | Concrete elements: foundation | Reduction in foundation strength due to erosion of porous concrete subfoundation | Structures monitoring | No, if within the scope of the applicant's structures monitoring program | Not applicable because the structure foundations that are located below the ground water table do not utilize a porous concrete subfoundation. |
| 3.5.1-10 | Concrete elements: foundation, dome, and wall | Reduction of strength and modulus due to elevated temperature | Plant specific | Yes, for any portions of concrete containment that exceed specified temperature limits | Not applicable because temperatures do not exceed specified temperature limits. |
| 3.5.1-11 | Prestressed containment: tendons and anchorage components | Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature | TLAA evaluated in accordance with 10 CFR 54.21(c) | Yes, TLAA | Not applicable because BVPS does not utilize a prestressing system in the design of the containments. |
| 3.5.1-12 | Steel elements: liner plate and containment shell | Loss of material due to corrosion in accessible and inaccessible areas | Containment ISI and containment leak rate test | Yes, if corrosion is significant for inaccessible areas | Consistent with NUREG-1801. |
| 3.5.1-13 | BWR only | | | | |

**Table 3.5.1 Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Containment, Structures, and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-14 | Steel elements: protected by coating | Loss of material due to corrosion in accessible areas only | Protective coating monitoring and maintenance | No | Not applicable because BVPS does not credit the existence of coatings in performing aging management review. |
| 3.5.1-15 | Prestressed containment: tendons and anchorage components | Loss of material due to corrosion of prestressing tendons and anchorage components | Containment ISI | No | Not applicable because BVPS does not utilize a prestressing system in the design of the containments. |
| 3.5.1-16 | Concrete elements: foundation, dome, and wall | Scaling, cracking, and spalling due to freeze-thaw; expansion and cracking due to reaction with aggregate | Containment ISI | No | Consistent with NUREG-1801. |
| 3.5.1-17 | BWR only | | | | |
| 3.5.1-18 | BWR only | | | | |
| 3.5.1-19 | BWR only | | | | |

**Table 3.5.1 Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Containment, Structures, and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| **Class I Structures** | | | | | |
| 3.5.1-20 | All Groups except Group 6: accessible interior/exterior concrete and steel components | All types of aging effects | Structures monitoring | No, if within the scope of the applicant's structures monitoring program | Consistent with NUREG-1801.<br><br>BVPS results also credit ASME Section XI, Subsection IWF (discussed in Appendix B, Section B.2.1.2) for component supports. |
| 3.5.1-21 | Groups 1-3, 5, 7-9: inaccessible concrete components, such as exterior walls below grade and foundation | Aging of inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel | Plant specific | Yes, if an aggressive below-grade environment exists | Not applicable because below-grade exterior reinforced concrete at BVPS is not exposed to an aggressive environment.<br><br>Periodic monitoring of below grade water chemistry will be conducted during the period of extended operation to demonstrate that the below-grade environment is not aggressive (see Appendix B, (Section B.2.1.30), Structures Monitoring Program). |
| 3.5.1-22 | Group 6: all accessible/ inaccessible concrete, steel, and earthen components | All types of aging effects, including loss of material due to abrasion, cavitation, and corrosion | Inspection of water-control structures or FERC/US Army Corp of Engineers dam inspection and maintenance | No | BVPS results credit the Structures Monitoring Program (discussed in Appendix B, Section B.2.1.30) for these components; NUREG-1801 program XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated With Nuclear Power Plants," which includes FERC/US Army Corp of Engineers dam inspection and maintenance, is not applicable to BVPS. |

**Table 3.5.1 Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Containment, Structures, and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-23 | Group 5: liners | Crack initiation and growth due to SCC; loss of material due to crevice corrosion | Water chemistry and monitoring of spent fuel pool water level | No | Not applicable because BVPS results do not identify any aging effects for wrought austenitic stainless steel in a treated water environment less than 140 degrees F. |
| 3.5.1-24 | Groups 1-3, 5, 6: all masonry block walls | Cracking due to restraint, shrinkage, creep, and aggressive environment | Masonry wall | No | Consistent with NUREG-1801. |
| 3.5.1-25 | Groups 1-3, 5, 7-9: foundation | Cracks, distortion, and increases in component stress level due to settlement | Structures monitoring | No, if within the scope of the applicant's structures monitoring program | Not applicable because BVPS AMR results do not include any AERM due to the mechanism settlement for any structural components.<br><br>Settlement of the Unit 2 Valve Pit is being evaluated by a time limited aging analysis, based on potential effects on piping within the pit (TLAA Section 4.7.4). |
| 3.5.1-26 | Groups 1-3, 5-9: foundation | Reduction in foundation strength due to erosion of porous concrete subfoundation | Structures monitoring | No, if within the scope of the applicant's structures monitoring program | Not applicable because the structure foundations that are located below the ground water table do not utilize a porous concrete subfoundation. |

**Table 3.5.1 Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Containment, Structures, and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-27 | Groups 1-5: concrete | Reduction of strength and modulus due to elevated temperature | Plant specific | Yes, for any portions of concrete that exceed specified temperature limits | Consistent with NUREG-1801. |
| 3.5.1-28 | Groups 7, 8: liners | Crack Initiation and growth due to SCC; loss of material due to crevice corrosion | Plant specific | Yes | Not applicable because BVPS does not have concrete tanks that are in scope for license renewal, and because the environments for carbon steel tanks with stainless steel liners include low temperature and therefore no aging effects requiring management. |
| **Component Supports** | | | | | |
| 3.5.1-29 | All Groups: support members: anchor bolts, concrete surrounding anchor bolts, welds, grout pad, bolted connections, etc. | Aging of component supports | Structures monitoring | No, if within the scope of the applicant's structures monitoring program | Consistent with NUREG-1801. |
| 3.5.1-30 | Groups B1.1, B1.2, and B1.3: support members: anchor bolts and welds | Cumulative fatigue damage (CLB fatigue analysis exists) | TLAA evaluated in accordance with 10 CFR 54.21(c) | Yes, TLAA | Not applicable because a CLB fatigue analysis does not exist at BVPS. |

**Table 3.5.1 Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Containment, Structures, and Component Supports**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.5.1-31 | All Groups: support members: anchor bolts and welds | Loss of material due to boric acid corrosion | Boric acid corrosion | No | Not applicable because the BVPS approach assigned the boric acid corrosion mechanism to systems containing borated water, including the external surfaces, but not including the component supports. The aging management program used for the external surfaces includes consideration for adjacent systems and components, including component supports. |
| 3.5.1-32 | Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds, spring hangers, guides, stops, and vibration isolators | Loss of material due to environmental corrosion; loss of mechanical function due to corrosion, distortion, dirt, overload, etc. | ISI | No | Consistent with NUREG-1801, except for the following:<br><br>For Expansion/Grouted Anchors in Air, BVPS results credit the Structures Monitoring Program (discussed in Appendix B, Section B.2.1.30). |
| 3.5.1-33 | Group B1.1: high strength low-alloy bolts | Crack initiation and growth due to SCC | Bolting integrity | No | Not applicable because the BVPS results did not identify an aggressive environment for high strength bolting. |

**Table 3.5.2-1: Containment, Structures, and Component Supports - Reactor Containment Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Concrete at Expansion/Grouted Anchors in Air | Structural/Functional Support | Concrete at Expansion/Grouted Anchors | Air | Crack Initiation and Growth | Structures Monitoring Program | III.B5.2-a | 3.5.1-29 | A |
| Concrete in Air | Direct Flow<br>Fire Barrier<br>Flood Protection<br>Heat Sink<br>(HELB) Shielding<br>Missile Barrier<br>Pipe Whip Restraint<br>Pressure Boundary<br>Radiation Shielding<br>Shelter/Protection<br>Structural/Functional Support | Concrete | Air | None | Fire Protection | VII.G.5-a | 3.3.1-30 | B |
| | | | | | ASME Section XI, Subsection IWL | II.A1.1-a | 3.5.1-16 | A |
| | | | | | | II.A1.1-b | 3.5.1-07 | A |
| | | | | | | II.A1.1-d | 3.5.1-16 | A |
| | | | | | Structures Monitoring Program | III.A4.1-b | 3.5.1-20 | A |
| | | | | | | III.A4.1-c | 3.5.1-27 | A |
| | | | | | | VII.G.5-a | 3.3.1-30 | A |
| Concrete in Soil Above the Ground Water Table | Flood Protection<br>Heat Sink<br>Shelter/Protection<br>Structural/Functional Support | Concrete | Soil, Above the Water Table | None | ASME Section XI, Subsection IWL | II.A1.1-b | 3.5.1-07 | A |
| | | | | | | II.A1.1-d | 3.5.1-16 | A |

**Table 3.5.2-1: Containment, Structures, and Component Supports - Reactor Containment Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Expansion/Grouted Anchors in Air | Structural/Functional Support | Expansion/Grouted Anchors (CLASL) | Air | Loss of Material | Structures Monitoring Program | III.A4.2-a | 3.5.1-20 | A |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |
| Polymer in Soil Above the GWT | Flood Protection | Polymers | Soil, Above the Water Table | Crack Initiation and Growth | Structures Monitoring Program | N/A | N/A | J |
| | | | | Loss of Strength | Structures Monitoring Program | N/A | N/A | J |
| Structural Steel in Air | Filtration<br>Heat Sink<br>Pipe Whip Restraint<br>Structural/Functional Support | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | Filtration | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A4.2-a | 3.5.1-20 | A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.5.2-1: Containment, Structures, and Component Supports - Reactor Containment Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air (continued) | Fission Product Barrier<br>Heat Sink<br>Pipe Whip Restraint<br>Pressure Boundary<br>Radiation Shielding<br>Structural/Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | ASME Section XI, Subsection IWE | II.A1.2-a | 3.5.1-12 | A |
| | | | | | 10 CFR Part 50, Appendix J | II.A1.2-a | 3.5.1-12 | A |
| | | | | | Structures Monitoring Program | III.A4.2-a | 3.5.1-20 | A |
| | Heat Sink<br>Pipe Whip Restraint | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A4.2-a | 3.5.1-20 | A |
| | | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A4.2-a | 3.5.1-20 | A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | Missile Barrier<br>Structural Support for NSR | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.5.2-1: Containment, Structures, and Component Supports - Reactor Containment Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air (continued) | NSR Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A4.2-a | 3.5.1-20 | A |
| | Structural/Functional Support | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A4.2-a | 3.5.1-20 | A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A4.2-a | 3.5.1-20 | A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.5.2-1: Containment, Structures, and Component Supports - Reactor Containment Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air (continued) | Structural Support for NSR | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | Structural Support for NSR Structural/Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A4.2-a | 3.5.1-20 | A |
| Structural Steel in Treated Water, Less Than 140 deg F | Heat Sink Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |
| | Heat Sink Pressure Boundary Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |
| | Pressure Boundary Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |

**Table 3.5.2-1: Containment, Structures, and Component Supports - Reactor Containment Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Treated Water, Less Than 140 deg F (continued) | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.5.2-2: Containment, Structures, and Component Supports - Alternate Intake Structure - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Concrete at Expansion/Grouted Anchors in Air | Structural Support for NSR | Concrete at Expansion/Grouted Anchors | Air | Crack Initiation and Growth | Structures Monitoring Program | III.B5.2-a | 3.5.1-29 | A |
| Concrete in Air | Structural Support for NSR | Concrete | Air | None | Structures Monitoring Program | III.A6.1-a | 3.5.1-22 | E |
| | | | | | | III.A6.1-b | 3.5.1-22 | E |
| | | | | | | III.A6.1-c | 3.5.1-22 | E |
| Concrete in Raw Water | Structural Support for NSR | Concrete | Raw Water, Low Flow | None | Structures Monitoring Program | III.A6.1-b | 3.5.1-22 | E |
| | | | | | | III.A6.1-c | 3.5.1-22 | E |
| | | | | | | III.A6.1-h | 3.5.1-22 | E |
| Concrete in Soil Above the Ground Water Table | Structural Support for NSR | Concrete | Soil, Above the Water Table | None | Structures Monitoring Program | III.A6.1-b | 3.5.1-22 | E |
| | | | | | | III.A6.1-c | 3.5.1-22 | E |

**Table 3.5.2-2: Containment, Structures, and Component Supports - Alternate Intake Structure - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Expansion/Grouted Anchors in Air | Structural Support for NSR | Expansion/Grouted Anchors (CLASL) | Air | Loss of Material | Structures Monitoring Program | III.A6.2-a | 3.5.1-22 | E |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |
| Foundation Piles in Undisturbed Soil | Structural Support for NSR | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Undisturbed Soil | None | N/A | N/A | N/A | N/A |
| Structural Steel in Air | Structural Support for NSR | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A6.2-a | 3.5.1-22 | E |
| Structural Steel in Raw Water | Filtration | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water, Low Flow, Relative Motion Between Components | Loss of Material | Structures Monitoring Program | III.A6.2-a | 3.5.1-22 | E |
| | | | | | | N/A | N/A | S |

**Table 3.5.2-2: Containment, Structures, and Component Supports - Alternate Intake Structure - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Raw Water (continued) | Structural Support for NSR | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ks | Raw Water, Low Flow | Loss of Material | Structures Monitoring Program | III.A6.2-a | 3.5.1-22 | E |
| Structural Steel in Soil Above the GWT | Structural Support for NSR | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Soil, Above the Water Table | Loss of Material | Structures Monitoring Program | III.A6.2-a | 3.5.1-22 | E |
| Structural Steel in Soil Below the GWT | Structural Support for NSR | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ks | Soil, Below the Water Table | Loss of Material | Structures Monitoring Program | III.A6.2-a | 3.5.1-22 | E |
| Structural Steel in Undisturbed Soil | Structural Support for NSR | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Undisturbed Soil | None | N/A | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.5.2-3: Containment, Structures, and Component Supports – Auxiliary Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Aluminum Alloys in Air | NSR Functional Support | Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon) | Air | None | N/A | N/A | N/A | N/A |
| Block Wall in Air | Fire Barrier Structural Support for NSR | Masonry Walls | Air | Crack Initiation and Growth | Masonry Wall Program | III.A3.3-a | 3.5.1-24 | A |
| | Fire Barrier Structural Support for NSR Structural /Functional Support | Masonry Walls | Air | Crack Initiation and Growth | Masonry Wall Program | III.A3.3-a | 3.5.1-24 | A |
| Boral in Treated Water, Less Than 140 deg F | Absorb Neutrons | Boral | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |
| Cellular Concrete in Air | Flood Protection | Cellular Concrete | Air | Crack Initiation and Growth | Structures Monitoring Program | N/A | N/A | J |

**Table 3.5.2-3: Containment, Structures, and Component Supports – Auxiliary Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Concrete at Expansion/Grouted Anchors in Air | Structural /Functional Support | Concrete at Expansion/Grouted Anchors | Air | Crack Initiation and Growth | Structures Monitoring Program | III.B5.2-a | 3.5.1-29 | A |
| | Structural Support for NSR<br>Structural /Functional Support | Concrete at Expansion/Grouted Anchors | Air | Crack Initiation and Growth | Structures Monitoring Program | III.B5.2-a | 3.5.1-29 | A |
| Concrete in Air | Fire Barrier<br>Flood Protection<br>Heat Sink<br>(HELB) Shielding<br>Missile Barrier<br>Radiation Shielding<br>Shelter/Protection<br>Structural Support for NSR<br>Structural /Functional Support | Concrete | Air | None | Fire Protection | VII.G.3-b | 3.3.1-30 | B |
| | | | | | Structures Monitoring Program | III.A3.1-a | 3.5.1-20 | A |
| | | | | | | III.A3.1-b | 3.5.1-20 | A |
| | | | | | | III.A3.1-c | 3.5.1-20 | A |
| | | | | | | VII.G.3-b | 3.3.1-30 | A |

**Table 3.5.2-3: Containment, Structures, and Component Supports – Auxiliary Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Concrete in Air (continued) | Fire Barrier<br>Flood Protection<br>Heat Sink<br>Missile Barrier<br>Shelter /Protection<br>Structura /Functional Support | Concrete | Air | None | Fire Protection | VII.G.3-b | 3.3.1-30 | B |
| | | | | | Structures Monitoring Program | III.A3.1-a | 3.5.1-20 | A |
| | | | | | | III.A3.1-b | 3.5.1-20 | A |
| | | | | | | III.A3.1-c | 3.5.1-20 | A |
| | | | | | | VII.G.3-b | 3.3.1-30 | A |
| Concrete in Soil Above the Ground Water Table | Flood Protection<br>Heat Sink<br>Shelter /Protection<br>Structural /Functional Support | Concrete | Soil, Above the Water Table | None | Structures Monitoring Program | III.A3.1-b | 3.5.1-20 | A |
| | | | | | | III.A3.1-c | 3.5.1-20 | A |
| | Flood Protection<br>Heat Sink<br>Shelter/Protection<br>Structural Support for NSR<br>Structural /Functional Support | Concrete | Soil, Above the Water Table | None | Structures Monitoring Program | III.A3.1-b | 3.5.1-20 | A |
| | | | | | | III.A3.1-c | 3.5.1-20 | A |

**Table 3.5.2-3: Containment, Structures, and Component Supports – Auxiliary Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Door | Fire Barrier Flood Protection | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Fire Protection | N/A | N/A | H |
| | | | | | | VII.G.3-d | 3.3.1-20 | B |
| | | | | | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |
| | Fire Barrier Flood Protection (HELB) Shielding | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Fire Protection | N/A | N/A | H |
| | | | | | | VII.G.3-d | 3.3.1-20 | B |
| | | | | | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |
| | Fire Barrier (HELB) Shielding | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Fire Protection | N/A | N/A | H |
| | | | | | | VII.G.3-d | 3.3.1-20 | B |
| | | | | | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |

**Table 3.5.2-3: Containment, Structures, and Component Supports – Auxiliary Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Door (continued) | Fire Barrier | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Fire Protection | N/A | N/A | H |
| | | | | | | VII.G.3-d | 3.3.1-20 | B |
| | | | | | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |
| | Flood Protection | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |
| | (HELB) Shielding | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |
| | Missile Barrier | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |

**Table 3.5.2-3: Containment, Structures, and Component Supports – Auxiliary Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Expansion/Grouted Anchors in Air | Structural /Functional Support | Expansion/Grouted Anchors (CLASL) | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |
| | Structural Support for NSR Structural /Functional Support | Expansion/Grouted Anchors (CLASL) | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |
| Fire Stop in Air | Shelter /Protection | Fire Stop | Air | Cracking/ Delamination | Structures Monitoring Program | N/A | N/A | J |
| | | | | Loss of Material | Structures Monitoring Program | N/A | N/A | J |
| | | | | Separation | Structures Monitoring Program | N/A | N/A | J |

**Table 3.5.2-3: Containment, Structures, and Component Supports – Auxiliary Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Polymer in Air | Flood Protection | Polymers | Air | Crack Initiation and Growth | Structures Monitoring Program | N/A | N/A | J |
| | | | | Hardening and Shrinkage | Structures Monitoring Program | N/A | N/A | J |
| | | | | Loss of Strength | Structures Monitoring Program | N/A | N/A | J |
| Polymer in Soil Above the GWT | Flood Protection | Polymers | Soil, Above the Water Table | Crack Initiation and Growth | Structures Monitoring Program | N/A | N/A | J |
| | | | | Loss of Strength | Structures Monitoring Program | N/A | N/A | J |
| Structural Steel in Air | Missile Barrier | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.5.2-3: Containment, Structures, and Component Supports – Auxiliary Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air (continued) | Missile Barrier<br>Pipe Whip Restraint<br>Structural Support for NSR<br>Structural /Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | Pipe Whip Restraint | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | Pipe Whip Restraint<br>Structural Support for NSR<br>Structural /Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | Structural/Functional Support | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |

**Table 3.5.2-3: Containment, Structures, and Component Supports – Auxiliary Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Treated Water, Less Than 140 deg F | Structural/Functional Support | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | Structural Support for NSR | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | Structural Support for NSR Structural /Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | Pressure Boundary Structural /Functional Support | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |
| | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |
| | Structural /Functional Support | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |

**Table 3.5.2-3: Containment, Structures, and Component Supports – Auxiliary Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Transite in Air | Shelter /Protection | Fire Stop | Air | Cracking/ Delamination | Structures Monitoring Program | N/A | N/A | J |
| | | | | Loss of Material | Structures Monitoring Program | N/A | N/A | J |
| | | | | Separation | Structures Monitoring Program | N/A | N/A | J |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.5.2-4: Containment, Structures, and Component Supports – Component Supports - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Aluminum Alloys in Air | Structural Support for NSR Structural/Functional Support | Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon) | Air | None | N/A | N/A | N/A | N/A |
| Concrete at Expansion/Grouted Anchors in Air | Structural Support for NSR Structural/Functional Support | Concrete at Expansion/Grouted Anchors | Air | Crack Initiation and Growth | Structures Monitoring Program | III.B1.1.4-a | 3.5.1-29 | A |
| | | | | | | III.B1.2.3-a | 3.5.1-29 | A |
| | | | | | | III.B2.2-a | 3.5.1-29 | A |
| | | | | | | III.B3.2-a | 3.5.1-29 | A |
| | | | | | | III.B4.3-a | 3.5.1-29 | A |
| | | | | | | III.B5.2-a | 3.5.1-29 | A |
| Copper Alloys with Zinc Greater Than 15% and Aluminum Bronze in Air | Structural/Functional Support | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Air, Relative Motion Between Components | Loss of Material | ASME Section XI, Subsection IWF | III.A4.2-b | 3.5.1-20 | E |
| | | | | | | III.B1.1.3-a | 3.5.1-32 | A |
| | | | | | | III.B1.2.2-a | 3.5.1-32 | A |

**Table 3.5.2-4: Containment, Structures, and Component Supports – Component Supports - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Expansion/Grouted Anchors in Air | Structural Support for NSR Structural/Functional Support | Expansion/Grouted Anchors (CLASL) | Air | Loss of Material | Structures Monitoring Program | III.B1.1.1-a | 3.5.1-32 | E |
| | | | | | | III.B1.2.1-a | 3.5.1-32 | E |
| | | | | | | III.B2.1-a | 3.5.1-29 | A |
| | | | | | | III.B3.1-a | 3.5.1-29 | A |
| | | | | | | III.B4.1-a | 3.5.1-29 | A |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |
| | | Expansion/Grouted Anchors (WASS) | Air | None | N/A | N/A | N/A | N/A |
| Grout in Air | Structural Support for NSR Structural/Functional Support | Grout | Air | Crack Initiation and Growth | Structures Monitoring Program | III.B1.1.4-a | 3.5.1-29 | A |
| | | | | | | III.B1.2.3-a | 3.5.1-29 | A |
| | | | | | | III.B2.2-a | 3.5.1-29 | A |
| | | | | | | III.B3.2-a | 3.5.1-29 | A |
| | | | | | | III.B4.3-a | 3.5.1-29 | A |
| | | | | | | III.B5.2-a | 3.5.1-29 | A |

**Table 3.5.2-4: Containment, Structures, and Component Supports – Component Supports - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Polymer in Air | Structural Support for NSR Structural/Functional Support | Polymers | Air, Relative Motion Between Components | Crack Initiation and Growth | Structures Monitoring Program | III.B4.2-a | 3.5.1-29 | A |
| | | | | Hardening and Shrinkage | Structures Monitoring Program | III.B4.2-a | 3.5.1-29 | A |
| | | | | Loss of Material | Structures Monitoring Program | III.B4.2-a | 3.5.1-29 | A |
| | | | | Loss of Strength | Structures Monitoring Program | III.B4.2-a | 3.5.1-29 | A |
| Structural Steel in Air | Heat Sink Structural/Functional Support | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | ASME Section XI, Subsection IWF | III.B1.1.1-a | 3.5.1-32 | A |
| | | | | | | III.B1.1.3-a | 3.5.1-32 | A |

**Table 3.5.2-4: Containment, Structures, and Component Supports – Component Supports - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air (continued) | Heat Sink Structural/Functional Support (continued) | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi (continued) | Air (continued) | Loss of Material (continued) | ASME Section XI, Subsection IWF (continued) | III.B1.2.1-a | 3.5.1-32 | A |
| | | | | | | III.B1.2.2-a | 3.5.1-32 | A |
| | Heat Sink Structural Support for NSR Structural/Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | ASME Section XI, Subsection IWF | III.B1.1.1-a | 3.5.1-32 | A |
| | | | | | | III.B1.1.3-a | 3.5.1-32 | A |
| | | | | | | III.B1.2.1-a | 3.5.1-32 | A |
| | | | | | | III.B1.2.2-a | 3.5.1-32 | A |
| | | | | | Structures Monitoring Program | III.B2.1-a | 3.5.1-29 | A |
| | | | | | | III.B3.1-a | 3.5.1-29 | A |
| | | | | | | III.B4.1-a | 3.5.1-29 | A |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.5.2-4: Containment, Structures, and Component Supports – Component Supports - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air (continued) | Structural/Functional Support | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | ASME Section XI, Subsection IWF | III.B1.1.1-a | 3.5.1-32 | A |
| | | | | | | III.B1.1.3-a | 3.5.1-32 | A |
| | | | | | | III.B1.2.1-a | 3.5.1-32 | A |
| | | | | | | III.B1.2.2-a | 3.5.1-32 | A |
| | | | | | Structures Monitoring Program | III.B2.1-a | 3.5.1-29 | A |
| | | | | | | III.B3.1-a | 3.5.1-29 | A |
| | | | | | | III.B4.1-a | 3.5.1-29 | A |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |
| | | | Air, Relative Motion Between Components | Loss of Material | ASME Section XI, Subsection IWF | III.A4.2-b | 3.5.1-20 | E |
| | | | | | | III.B1.1.3-a | 3.5.1-32 | A |
| | | | | | | III.B1.2.2-a | 3.5.1-32 | A |

**Table 3.5.2-4: Containment, Structures, and Component Supports – Component Supports - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air (continued) | Structural/Functional Support (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | ASME Section XI, Subsection IWF | III.B1.1.3-a | 3.5.1-32 | A |
| | Structural Support for NSR Structural/Functional Support | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | ASME Section XI, Subsection IWF | III.B1.1.1-a | 3.5.1-32 | A |
| | | | | | | III.B1.1.3-a | 3.5.1-32 | A |
| | | | | | | III.B1.2.1-a | 3.5.1-32 | A |
| | | | | | | III.B1.2.2-a | 3.5.1-32 | A |
| | | | | | Structures Monitoring Program | III.B2.1-a | 3.5.1-29 | A |
| | | | | | | III.B3.1-a | 3.5.1-29 | A |
| | | | | | | III.B4.1-a | 3.5.1-29 | A |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |

**Table 3.5.2-4: Containment, Structures, and Component Supports – Component Supports - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air (continued) | Structural Support for NSR Structural/Functional Support (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | ASME Section XI, Subsection IWF | III.B1.1.1-a | 3.5.1-32 | A |
| | | | | | | III.B1.1.3-a | 3.5.1-32 | A |
| | | | | | | III.B1.2.1-a | 3.5.1-32 | A |
| | | | | | | III.B1.2.2-a | 3.5.1-32 | A |
| | | | | | Structures Monitoring Program | III.B2.1-a | 3.5.1-29 | A |
| | | | | | | III.B3.1-a | 3.5.1-29 | A |
| | | | | | | III.B4.1-a | 3.5.1-29 | A |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.5.2-4: Containment, Structures, and Component Supports – Component Supports - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Raw Water | Structural Support for NSR Structural/Functional Support | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Raw Water, Low Flow | Crack Initiation and Growth | ASME Section XI, Subsection IWF | N/A | N/A | H |
| | | | | Loss of Material | ASME Section XI, Subsection IWF | III.B1.2.1-a | 3.5.1-32 | A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water, Low Flow | Loss of Material | ASME Section XI, Subsection IWF | III.B1.2.1-a | 3.5.1-32 | A |
| Structural Steel in Treated Water, Less Than 140 deg F | Heat Sink Structural Support for NSR Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |
| | Structural Support for NSR Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.5.2-5: Containment, Structures, and Component Supports – Containment System Structural Components - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Copper Alloys w/Zinc Greater Than 15% and Aluminum Bronze in Air | Pressure Boundary | Copper Alloys with Zinc Contents Greater Than 15% and Aluminum Bronze | Air, Relative Motion Between Components | Loss of Material | ASME Section XI, Subsection IWE | N/A | N/A | K |
| | | | | | 10 CFR Part 50, Appendix J | N/A | N/A | K |
| Copper Alloys with Zinc Less Than 15% in Air | Pressure Boundary | Copper Alloys with Zinc Contents Less Than or Equal to 15% | Air, Relative Motion Between Components | Loss of Material | ASME Section XI, Subsection IWE | N/A | N/A | K |
| | | | | | 10 CFR Part 50, Appendix J | N/A | N/A | K |
| Glass in Air | Pressure Boundary | Glass | Air | None | N/A | N/A | N/A | N/A |
| Nickel-Based Alloys in Treated Water, Less Than 140 deg F | Structural/Functional Support | Nickel Based Alloy | Treated Water, Temperature Less Than 140 deg F | None | N/A | N/A | N/A | N/A |

**Table 3.5.2-5: Containment, Structures, and Component Supports – Containment System Structural Components - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Polymer in Air | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | ASME Section XI, Subsection IWE | II.A3.3-a | 3.5.1-06 | A |
| | | | | | 10 CFR Part 50, Appendix J | II.A3.3-a | 3.5.1-06 | A |
| | | | | Hardening and Shrinkage | ASME Section XI, Subsection IWE | II.A3.3-a | 3.5.1-06 | A |
| | | | | | 10 CFR Part 50, Appendix J | II.A3.3-a | 3.5.1-06 | A |
| | | | | Loss of Strength | ASME Section XI, Subsection IWE | II.A3.3-a | 3.5.1-06 | A |
| | | | | | 10 CFR Part 50, Appendix J | II.A3.3-a | 3.5.1-06 | A |

**Table 3.5.2-5: Containment, Structures, and Component Supports – Containment System Structural Components - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air | Pressure Boundary | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | ASME Section XI, Subsection IWE | II.A3.2-a | 3.5.1-04 | A |
| | | | | | 10 CFR Part 50, Appendix J | II.A3.2-a | 3.5.1-04 | A |
| | | | Air, Relative Motion Between Components | Loss of Material | ASME Section XI, Subsection IWE | II.A3.2-a | 3.5.1-04 | A |
| | | | | | | II.A3.2-b | 3.5.1-05 | E |
| | | | | | 10 CFR Part 50, Appendix J | II.A3.2-a | 3.5.1-04 | A |
| | | | | | | II.A3.2-b | 3.5.1-05 | A |

**Table 3.5.2-5: Containment, Structures, and Component Supports – Containment System Structural Components - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | | | Air, Cyclic Loading | Crack Initiation and Growth | ASME Section XI, Subsection IWE | II.A3.1-b | 3.5.1-01 | A |
| | | | | | 10 CFR Part 50, Appendix J | II.A3.1-b | 3.5.1-01 | A |
| | | | Air, Relative Motion Between Components | Loss of Material | ASME Section XI, Subsection IWE | II.A3.2-b | 3.5.1-05 | E |
| | | | | | 10 CFR Part 50, Appendix J | II.A3.2-b | 3.5.1-05 | A |
| | Structural/Functional Support | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | ASME Section XI, Subsection IWE | II.A3.2-a | 3.5.1-04 | A |
| | | | | | 10 CFR Part 50, Appendix J | II.A3.2-a | 3.5.1-04 | A |

**Table 3.5.2-5: Containment, Structures, and Component Supports – Containment System Structural Components - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air (continued) | Structural/Functional Support (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | ASME Section XI, Subsection IWE | II.A3.2-a | 3.5.1-04 | A |
| | | | | | 10 CFR Part 50, Appendix J | II.A3.2-a | 3.5.1-04 | A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Structural Steel in Treated Water, Less Than 140 deg F | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |

**Table 3.5.2-5: Containment, Structures, and Component Supports – Containment System Structural Components - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Treated Water, Less Than 140 deg F (continued) | Pressure Boundary (continued) | Wrought Austenitic Stainless Steel (continued) | Treated Water, Temperature Less Than 140 deg F, Cyclic Loading | Crack Initiation and Growth | ASME Section XI, Subsection IWE | II.A3.1-b | 3.5.1-01 | A |
| | | | | | 10 CFR Part 50, Appendix J | II.A3.1-b | 3.5.1-01 | A |
| | | | | | Water Chemistry Program | N/A | N/A | N/A |
| | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.5.2-6: Containment, Structures, and Component Supports – Control Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Concrete at Expansion/Grouted Anchors in Air | Structural/Functional Support | Concrete at Expansion/Grouted Anchors | Air | Crack Initiation and Growth | Structures Monitoring Program | III.B5.2-a | 3.5.1-29 | A |
| Concrete in Air | Fire Barrier<br>Flood Protection<br>Heat Sink<br>Missile Barrier<br>Radiation Shielding<br>Shelter/Protection<br>Structural/Functional Support | Concrete | Air | None | Fire Protection | VII.G.3-b | 3.3.1-30 | D |
| | | | | | Structures Monitoring Program | III.A1.1-a | 3.5.1-20 | A |
| | | | | | | III.A1.1-b | 3.5.1-20 | A |
| | | | | | | III.A1.1-c | 3.5.1-20 | A |
| | | | | | | VII.G.3-b | 3.3.1-30 | C |
| Concrete in Soil Above the Ground Water Table | Flood Protection<br>Heat Sink<br>Shelter/Protection<br>Structural/Functional Support | Concrete | Soil, Above the Water Table | None | Structures Monitoring Program | III.A1.1-b | 3.5.1-20 | A |
| | | | | | | III.A1.1-c | 3.5.1-20 | A |
| Door | Fire Barrier | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Fire Protection | N/A | N/A | H |
| | | | | | | VII.G.3-d | 3.3.1-20 | B |
| | | | | | Structures Monitoring Program | III.A1.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |

**Table 3.5.2-6: Containment, Structures, and Component Supports – Control Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Expansion/Grouted Anchors in Air | Structural/Functional Support | Expansion/Grouted Anchors (CLASL) | Air | Loss of Material | Structures Monitoring Program | III.A1.2-a | 3.5.1-20 | A |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |
| Polymer in Air | Pressure Boundary | Polymers | Air | Crack Initiation and Growth | Structures Monitoring Program | N/A | N/A | J |
| | | | | Hardening and Shrinkage | Structures Monitoring Program | N/A | N/A | J |
| | | | | Loss of Strength | Structures Monitoring Program | N/A | N/A | J |
| Polymer in Soil Above the GWT | Flood Protection | Polymers | Soil, Above the Water Table | Crack Initiation and Growth | Structures Monitoring Program | N/A | N/A | J |
| | | | | Loss of Strength | Structures Monitoring Program | N/A | N/A | J |
| Structural Steel in Air | Structural/Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A1.2-a | 3.5.1-20 | A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.5.2-7: Containment, Structures, and Component Supports – Cranes and Hoists - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air | Heat Sink Structural Support for NSR | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems | VII.B.1-b | 3.3.1-16 | A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems | VII.B.1-b | 3.3.1-16 | A |
| | | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Air | None | N/A | N/A | N/A | N/A |
| | Structural Support for NSR | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems | VII.B.1-b | 3.3.1-16 | A |

**Table 3.5.2-7: Containment, Structures, and Component Supports – Cranes and Hoists - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air (continued) | Structural Support for NSR (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems | VII.B.1-b | 3.3.1-16 | A |
| | | | Air, Relative Motion Between Components | Loss of Material | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems | N/A | N/A | H |
| | | | | | | VII.B.2-a | 3.3.1-16 | A |
| | | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Air | None | N/A | N/A | N/A | N/A |
| Structural Steel in Treated Water, Less Than 140 deg F | Structural Support for NSR | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Treated Water, Temperature Less Than 140 deg F | Crack Initiation and Growth | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems | N/A | N/A | L |

**Table 3.5.2-7: Containment, Structures, and Component Supports – Cranes and Hoists - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Treated Water, Less Than 140 deg F (continued) | Structural Support for NSR (continued) | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi (continued) | Treated Water, Temperature Less Than 140 deg F (continued) | Loss of Material | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems | N/A | N/A | G |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Treated Water, Temperature Less Than 140 deg F | Loss of Material | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems | N/A | N/A | G |
| | | Martensitic, Precipitation Hardened, and Super Ferritic Stainless Steels | Treated Water, Temperature Less Than 140 deg F | Crack Initiation and Growth | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems | N/A | N/A | N |
| | | | | | Water Chemistry Program | N/A | N/A | N |
| | | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.5.2-8: Containment, Structures, and Component Supports – Essential Yard Structures - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Block Wall in Air | Structural Support for NSR | Masonry Walls | Air | Crack Initiation and Growth | Masonry Wall Program | III.A3.3-a | 3.5.1-24 | A |
| Block Wall in Soil Above the GWT | Structural Support for NSR | Masonry Walls | Soil, Above the Water Table | Crack Initiation and Growth | Masonry Wall Program | N/A | N/A | G |
| Concrete at Expansion/Grouted Anchors in Air | Structural/Functional Support | Concrete at Expansion/Grouted Anchors | Air | Crack Initiation and Growth | Structures Monitoring Program | III.B5.2-a | 3.5.1-29 | A |
| Concrete in Air | Fire Barrier<br>Flood Protection<br>Missile Barrier<br>Shelter/Protection<br>Structural Support for NSR<br>Structural/Functional Support | Concrete | Air | None | Fire Protection | VII.G.3-b | 3.3.1-30 | D |
| | | | | | Structures Monitoring Program | III.A3.1-a | 3.5.1-20 | A |
| | | | | | | III.A3.1-b | 3.5.1-20 | A |
| | | | | | | III.A3.1-c | 3.5.1-20 | A |
| | | | | | | III.A6.1-a | 3.5.1-22 | E |
| | | | | | | III.A6.1-b | 3.5.1-22 | E |
| | | | | | | III.A6.1-c | 3.5.1-22 | E |
| | | | | | | VII.G.3-b | 3.3.1-30 | C |

**Table 3.5.2-8: Containment, Structures, and Component Supports – Essential Yard Structures - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Concrete in Raw Water | Missile Barrier<br>Shelter/Protection<br>Structural/Functional Support | Concrete | Raw Water, Low Flow | None | Structures Monitoring Program | III.A6.1-b | 3.5.1-22 | E |
| | | | | | | III.A6.1-c | 3.5.1-22 | E |
| | | | | | | III.A6.1-h | 3.5.1-22 | E |
| Concrete in Soil Above the Ground Water Table | Fire Barrier<br>Flood Protection<br>Missile Barrier<br>Shelter/Protection<br>Structural Support for NSR<br>Structural/Functional Support | Concrete | Soil, Above the Water Table | None | Structures Monitoring Program | III.A3.1-b | 3.5.1-20 | A |
| | | | | | | III.A3.1-c | 3.5.1-20 | A |
| | | | | | | III.A6.1-b | 3.5.1-22 | E |
| | | | | | | III.A6.1-c | 3.5.1-22 | E |
| Concrete in Soil Below the GWT | Missile Barrier<br>Shelter/Protection<br>Structural/Functional Support | Concrete | Soil, Below the Water Table | None | Structures Monitoring Program | III.A3.1-b | 3.5.1-20 | A |
| | | | | | | III.A3.1-c | 3.5.1-20 | A |
| | | | | | | III.A6.1-b | 3.5.1-22 | E |
| | | | | | | III.A6.1-c | 3.5.1-22 | E |
| Expansion/Grouted Anchors in Air | Structural/Functional Support | Expansion/Grouted Anchors (CLASL) | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |
| Foundation Piles in Undisturbed Soil | Structural Support for NSR | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Undisturbed Soil | None | N/A | N/A | N/A | N/A |

**Table 3.5.2-8: Containment, Structures, and Component Supports – Essential Yard Structures - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Polymer in Soil Above the GWT | Flood Protection | Polymers | Soil, Above the Water Table | Crack Initiation and Growth | Structures Monitoring Program | N/A | N/A | J |
| | | | | Loss of Strength | Structures Monitoring Program | N/A | N/A | J |
| Structural Steel in Air | Missile Barrier Shelter/Protection Structural Support for NSR Structural/Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | Structural Support for NSR Structural/Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | Structural/Functional Support | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Structural Steel in Soil Above the GWT | Shelter/Protection Structural/Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Soil, Above the Water Table | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.5.2-9: Containment, Structures, and Component Supports – Fire Barriers - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Cellular Concrete in Air | Fire Barrier | Cellular Concrete | Air | Crack Initiation and Growth | Fire Protection | N/A | N/A | J |
| Fire Stop in Air | Fire Barrier | Fire Stop | Air | Cracking/Delamination | Fire Protection | N/A | N/A | H |
| | | | | Loss of Material | Fire Protection | N/A | N/A | H |
| | | | | Separation | Fire Protection | N/A | N/A | H |
| Fire Wrap in Air | Fire Barrier | Fire Wrap | Air | Cracking/Delamination | Fire Protection | N/A | N/A | J |
| | | | | Loss of Material | Fire Protection | N/A | N/A | J |
| Structural Steel in Air | Structural Support for NSR | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.5.2-10: Containment, Structures, and Component Supports – Intake Structure - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Cellular Concrete in Air | Flood Protection | Cellular Concrete | Air | Crack Initiation and Growth | Structures Monitoring Program | N/A | N/A | J |
| Concrete at Expansion/Grouted Anchors in Air | Structural Support for NSR Structural/Functional Support | Concrete at Expansion/Grouted Anchors | Air | Crack Initiation and Growth | Structures Monitoring Program | III.B5.2-a | 3.5.1-29 | A |
| Concrete in Air | Fire Barrier<br>Flood Protection<br>Missile Barrier<br>Shelter/Protection<br>Structural Support for NSR Structural/Functional Support | Concrete | Air | None | Fire Protection | VII.G.1-b | 3.3.1-30 | B |
| | | | | | Structures Monitoring Program | III.A6.1-a | 3.5.1-22 | E |
| | | | | | | III.A6.1-b | 3.5.1-22 | E |
| | | | | | | III.A6.1-c | 3.5.1-22 | E |
| | | | | | | VII.G.1-b | 3.3.1-30 | A |
| Concrete in Raw Water | Structural Support for NSR Structural/Functional Support | Concrete | Raw Water, Low Flow | None | Structures Monitoring Program | III.A6.1-b | 3.5.1-22 | E |
| | | | | | | III.A6.1-c | 3.5.1-22 | E |
| | | | | | | III.A6.1-h | 3.5.1-22 | E |
| Concrete in Soil Above the Ground Water Table | Structural Support for NSR Structural/Functional Support | Concrete | Soil, Above the Water Table | None | Structures Monitoring Program | III.A6.1-b | 3.5.1-22 | E |
| | | | | | | III.A6.1-c | 3.5.1-22 | E |
| Concrete in Soil Below the Ground Water Table | Structural Support for NSR Structural/Functional Support | Concrete | Soil, Below the Water Table | None | Structures Monitoring Program | III.A6.1-b | 3.5.1-22 | E |
| | | | | | | III.A6.1-c | 3.5.1-22 | E |

**Table 3.5.2-10: Containment, Structures, and Component Supports – Intake Structure - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Door | Fire Barrier | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Fire Protection | N/A | N/A | H |
| | | | | | | VII.G.1-d | 3.3.1-20 | B |
| | | | | | Structures Monitoring Program | III.A6.2-a | 3.5.1-22 | E |
| | | | | | | N/A | N/A | H |
| | Flood Protection | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Structures Monitoring Program | III.A6.2-a | 3.5.1-22 | E |
| | | | | | | N/A | N/A | H |
| Expansion/Grouted Anchors in Air | Structural Support for NSR Structural/Functional Support | Expansion/Grouted Anchors (CLASL) | Air | Loss of Material | Structures Monitoring Program | III.A6.2-a | 3.5.1-22 | E |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |
| Polymer in Air | Fire Barrier<br>Flood Protection | Polymers | Air | Crack Initiation and Growth | Periodic Surveillance and Preventive Maintenance | N/A | N/A | J |
| | | | | | Structures Monitoring Program | N/A | N/A | J |
| | | | | | System Monitoring | N/A | N/A | J |

**Table 3.5.2-10: Containment, Structures, and Component Supports – Intake Structure - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Polymer in Air (continued) | Fire Barrier Flood Protection (continued) | Polymers (continued) | Air (continued) | Hardening and Shrinkage | System Monitoring | N/A | N/A | J |
| | | | | | Periodic Surveillance and Preventive Maintenance | N/A | N/A | J |
| | | | | | Structures Monitoring Program | N/A | N/A | J |
| | | | | Loss of Strength | System Monitoring | N/A | N/A | J |
| | | | | | Periodic Surveillance and Preventive Maintenance | N/A | N/A | J |
| | | | | | Structures Monitoring Program | N/A | N/A | J |

**Table 3.5.2-10: Containment, Structures, and Component Supports – Intake Structure - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air | Flood Protection<br>Shelter/Protection<br>Structural Support for NSR<br>Structural/Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A6.2-a | 3.5.1-22 | E |
| | Structural Support for NSR<br>Structural/Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A6.2-a | 3.5.1-22 | E |
| Structural Steel in Raw Water | Filtration | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water, Low Flow, Relative Motion Between Components | Loss of Material | Structures Monitoring Program | III.A6.2-a | 3.5.1-22 | E |
| | | | | | | N/A | N/A | H |
| | Structural Support for NSR | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Raw Water, Low Flow | Loss of Material | Structures Monitoring Program | III.A6.2-a | 3.5.1-22 | E |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.5.2-11: Containment, Structures, and Component Supports – Safeguards Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Concrete at Expansion/Grouted Anchors in Air | Structural/Functional Support | Concrete at Expansion/Grouted Anchors | Air | Crack Initiation and Growth | Structures Monitoring Program | III.B5.2-a | 3.5.1-29 | A |
| Concrete in Air | Fire Barrier<br>Flood Protection<br>Heat Sink<br>Missile Barrier<br>Shelter/Protection<br>Structural/Functional Support | Concrete | Air | None | Fire Protection | VII.G.3-b | 3.3.1-30 | D |
| | | | | | Structures Monitoring Program | III.A3.1-a | 3.5.1-20 | A |
| | | | | | | III.A3.1-b | 3.5.1-20 | A |
| | | | | | | III.A3.1-c | 3.5.1-20 | A |
| | | | | | | VII.G.3-b | 3.3.1-30 | C |
| Concrete in Soil Above the Ground Water Table | Flood Protection<br>Heat Sink<br>Missile Barrier<br>Shelter/Protection<br>Structural/Functional Support | Concrete | Soil, Above the Water Table | None | Structures Monitoring Program | III.A3.1-b | 3.5.1-20 | A |
| | | | | | | III.A3.1-c | 3.5.1-20 | A |
| Door | Fire Barrier<br>Flood Protection | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Fire Protection | N/A | N/A | H |
| | | | | | | VII.G.3-d | 3.3.1-20 | B |
| | | | | | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |

**Table 3.5.2-11: Containment, Structures, and Component Supports – Safeguards Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Door (continued) | Fire Barrier Flood Protection (HELB) Shielding | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Fire Protection | N/A | N/A | H |
| | | | | | | VII.G.3-d | 3.3.1-20 | B |
| | | | | | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |
| | Fire Barrier | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Fire Protection | N/A | N/A | H |
| | | | | | | VII.G.3-d | 3.3.1-20 | B |
| | | | | | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |
| | Flood Protection | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |
| | Missile Barrier | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |

**Table 3.5.2-11: Containment, Structures, and Component Supports – Safeguards Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Expansion/Grouted Anchors in Air | Structural/Functional Support | Expansion/Grouted Anchors (CLASL) | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |
| Polymer in Air | Flood Protection (HELB) Shielding | Polymers | Air | Crack Initiation and Growth | Structures Monitoring Program | N/A | N/A | J |
| | | | | Hardening and Shrinkage | Structures Monitoring Program | N/A | N/A | J |
| | | | | Loss of Strength | Structures Monitoring Program | N/A | N/A | J |
| Polymer in Soil Above the GWT | Flood Protection | Polymers | Soil, Above the Water Table | Crack Initiation and Growth | Structures Monitoring Program | N/A | N/A | J |
| | | | | Loss of Strength | Structures Monitoring Program | N/A | N/A | J |
| Structural Steel in Air | Flood Protection<br>Missile Barrier<br>Pipe Whip Restraint<br>Structural Support for NSR<br>Structural/Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |

**Table 3.5.2-11: Containment, Structures, and Component Supports – Safeguards Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air (continued) | Missile Barrier | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |
| | Missile Barrier Pressure Boundary | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | Structural Support for NSR Structural/Functional Support | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | Structural/Functional Support | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |

**Table 3.5.2-11: Containment, Structures, and Component Supports – Safeguards Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air (continued) | Structural/Functional Support (continued) | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| | Structural Support for NSR | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |
| Structural Steel in Treated Water, Less Than 140 deg F | Pressure Boundary | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |
| | Structural/Functional Support | Wrought Austenitic Stainless Steel | Treated Water, Temperature Less Than 140 deg F | None | Water Chemistry Program | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.5.2-12: Containment, Structures, and Component Supports – Turbine Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Block Wall in Air | Structural Support for NSR | Masonry Walls | Air | Crack Initiation and Growth | Masonry Wall Program | III.A3.3-a | 3.5.1-24 | A |
| Concrete at Expansion/Grouted Anchors in Air | Structural Support for NSR | Concrete at Expansion/Grouted Anchors | Air | Crack Initiation and Growth | Structures Monitoring Program | III.B5.2-a | 3.5.1-29 | A |
| Concrete in Air | Structural Support for NSR | Concrete | Air | None | Structures Monitoring Program | III.A3.1-a | 3.5.1-20 | A |
| | | | | | | III.A3.1-b | 3.5.1-20 | A |
| | | | | | | III.A3.1-c | 3.5.1-20 | A |
| Concrete in Soil Above the Ground Water Table | Structural Support for NSR | Concrete | Soil, Above the Water Table | None | Structures Monitoring Program | III.A3.1-b | 3.5.1-20 | A |
| | | | | | | III.A3.1-c | 3.5.1-20 | A |
| Door | Fire Barrier | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air, Relative Motion Between Components | Loss of Material | Fire Protection | N/A | N/A | H |
| | | | | | | VII.G.2-d | 3.3.1-20 | B |
| | | | | | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | N/A | N/A | H |

**Table 3.5.2-12: Containment, Structures, and Component Supports – Turbine Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Expansion/Grouted Anchors in Air | Structural Support for NSR | Expansion/Grouted Anchors (CLASL) | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | | | | | III.B5.1-a | 3.5.1-29 | A |
| Siding in Air | NSR Functional Support | Aluminum Alloy (pure aluminum alloys and aluminum alloyed with manganese, magnesium and magnesium plus silicon) | Air | None | N/A | N/A | N/A | N/A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | Wrought Austenitic Stainless Steel | Air | None | N/A | N/A | N/A | N/A |

**Table 3.5.2-12: Containment, Structures, and Component Supports – Turbine Building - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Structural Steel in Air | Structural Support for NSR | Carbon and Low Alloy Steels with Yield Strengths Greater Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |
| | | Carbon Steel, Low Alloy Steel, and Ductile/Malleable Cast Iron with Yield Strengths Less Than 100 ksi | Air | Loss of Material | Structures Monitoring Program | III.A3.2-a | 3.5.1-20 | A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

Definitions of the LRA Notes shown in Tables 3.5.2-1 through 3.5.2-13

A. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 for material, environment, and aging effect, but a different aging management program is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material, and environment combination.

I. Aging effect and/or mechanism 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.

K. Material and environment not in NUREG-1801 for this component and aging effect.

L. Aging effect and environment not in NUREG-1801 for this component and material.

M. Aging effect and material not in NUREG-1801 for this component and environment.

N. Aging effect, material, and environment not in NUREG-1801 for this component.

P. Component and aging effect not in NUREG-1801 for this material and environment.

Q. Component not in NUREG-1801 for this material, environment, and aging effect.

R. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801.

S. AMP and aging mechanism are not consistent with NUREG-1801.

T. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801.

U. Specific material/environment combinations were not determined. Comparison to NUREG-1801 is not possible.

V. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801. AMP takes some exceptions to NUREG-1801 AMP.

(Note “O” was not used to avoid confusion with the number zero)

Plant-Specific Notes

None.

## 3.6 AGING MANAGEMENT OF ELECTRICAL AND INSTRUMENTATION AND CONTROLS

### 3.6.1 Introduction

This section provides the results of the aging management review for those components identified in Section 2.5, Electrical and Instrumentation and Controls, as being subject to aging management review. The commodities and systems which are addressed in this section, are described in the indicated sections.

- Containment Electrical Penetrations (Section 2.5.7)
- Electrical Busbars (Section 2.5.9)
- Electrical Cables and Connections (Section 2.5.10)
- Electrical Grid System (Section 2.5.11)

Table 3.6.1, Summary of Aging Management Evaluations in Chapter VI of NUREG-1801 for the Electrical Components, provides the summary of the programs evaluated in NUREG-1801 for the Electrical and Instrumentation and Controls component groups that are relied on for license renewal.

This table uses the format described in Section 3.0 above. Note that this table only includes those component groups that are applicable to a PWR.

### 3.6.2 Results

The following tables summarize the results of the aging management review for systems in the Electrical and Instrumentation and Controls group. The tables appear after Table 3.6.1, which appears after Section 3.6.3, Conclusion.

Table 3.6.2-1, Electrical and Instrumentation and Controls - Containment Electrical Penetrations - Summary of Aging Management Evaluation

Table 3.6.2-2, Electrical and Instrumentation and Controls - Electrical Busbars - Summary of Aging Management Evaluation

Table 3.6.2-3, Electrical and Instrumentation and Controls – Electrical Cables and Connections - Summary of Aging Management Evaluation

Table 3.6.2-4, Electrical and Instrumentation and Controls - Electrical Grid System - Summary of Aging Management Evaluation

The materials that specific components are fabricated from, the environments to which components are exposed, the aging effects requiring management, and the aging management programs used to manage these aging effects are provided for each of the above systems in the

following subsections of Section 3.6.2.1, Materials, Environments, Aging Effects Requiring Management and Aging Management Programs:

Section 3.6.2.1.1, Containment Electrical Penetrations Commodity Group

Section 3.6.2.1.2, Electrical Busbars

Section 3.6.2.1.3, Electrical Cables and Connections

Section 3.6.2.1.4, Electrical Grid System

### 3.6.2.1 Materials, Environments, Aging Effects Requiring Management and Aging Management Programs

#### 3.6.2.1.1 Containment Electrical Penetrations

**Materials**

The materials of construction for the Containment Electrical Penetrations components are:

- Various Organic Polymers

**Environments**

The Containment Electrical Penetrations components are exposed to the following Environments:

- Moisture, Temperature, Radiation

**Aging Effects Requiring Management**

The following aging effects, associated with the Containment Electrical Penetrations, require management:

- Reduced Seal Capability

**Aging Management Programs**

The following aging management programs manage the aging effects for the Containment Electrical Penetrations components:

- ASME Section XI, Subsection IWE/L and 10 CFR 50, Appendix J

### 3.6.2.1.2 Electrical Busbars

**Materials**

The materials of construction for the Electrical Busbars components are:

- Aluminum and Stainless Steel
- Bronze, Copper, Silicon Bronze, Stainless Steel

**Environments**

The Electrical Busbars components are exposed to the following Environments:

- Outdoor
- Sheltered

**Aging Effects Requiring Management**

The following aging effects, associated with the Electrical Busbars, require management:

- None

**Aging Management Programs**

The following aging management programs manage the aging effects for the Electrical Busbars components:

- None

### 3.6.2.1.3 Electrical Cables and Connections

**Materials**

The materials of construction for the Electrical Cables and Connections components are:

- Various Metals
- Various Metals, Nylon
- Various Organic Polymers

**Environments**

The Electrical Cables and Connections components are exposed to the following Environments:

- Adverse Localized Environment Caused by Heat, Radiation, or Moisture in the Presence of Oxygen (Sheltered or Indoor)
- Adverse Localized Environment Caused by Moisture and Voltage Stress (Buried)
- Exposure to Borated Water Leakage (Sheltered or Indoor)
- Sheltered (or Indoor)

**Aging Effects Requiring Management**

The following aging effects, associated with the Electrical Cables and Connections, require management:

- Loss of Circuit Continuity
- Reduced Insulation Resistance (IR)
- Reduced Insulation Resistance (IR) (Water-Treeing)

**Aging Management Programs**

The following aging management programs manage the aging effects for the Electrical Cables and Connections components:

- Boric Acid Corrosion
- Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements
- Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits
- Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

### 3.6.2.1.4 Electrical Grid System

**Materials**

The materials of construction for the Electrical Grid System components are:

- Aluminum Conductor Steel Reinforced (ACSR)
- Structural Steel
- Treated Wood
- Various Metals, Porcelain, and Cement

**Environments**

The Electrical Grid System components are exposed to the following Environments:

- Buried
- Outdoor

**Aging Effects Requiring Management**

The following aging effects, associated with the Electrical Grid System, require management:

- Loss of Material
- Loss of Material; Change in Material Properties

**Aging Management Programs**

The following aging management programs manage the aging effects for the Electrical Grid System components:

- Electrical Transmission Tower Inspection

### 3.6.2.2 Time-Limited Aging Analyses

The time-limited aging analyses (TLAA) identified below are associated with Electrical and Instrumentation and Controls components. The section of the LRA that contains the TLAA review results is indicated in parenthesis.

- Environmental Qualification (Section 4.4)

### 3.6.3 Conclusion

Electrical and Instrumentation and Controls components that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Electrical and Instrumentation and Controls systems components are identified in the summary tables and Section 3.6.2.1.

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 Electrical and Instrumentation and Controls components will be adequately managed so that there is reasonable assurance that the intended function(s)

will be maintained consistent with the current licensing basis during the period of extended operation.

**Table 3.6.1 Summary of Aging Management Evaluations in Chapter VI of NUREG-1801 for Electrical Components**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.6.1-01 | Electrical equipment subject to 10 CFR 50.49 Environmental qualification (EQ) requirements | Degradation due to various aging mechanisms | Environmental qualification of electric components | Yes, TLAA | Consistent with NUREG-1801.<br><br>Further evaluation is documented in TLAA (Section 4.4). |
| 3.6.1-02 | Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements | Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure caused by thermal/ thermoxidative degradation of organics; radiolysis and photolysis (ultraviolet [UV] sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion | Aging management program for electrical cables and connections not subject to 10 CFR 50.49 EQ requirements | No | Consistent with NUREG-1801. |
| 3.6.1-03 | Electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance | Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced IR; electrical failure caused by thermal/ thermoxidative degradation of organics; radiation-induced oxidation; moisture intrusion | Aging management program for electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements | No | Consistent with NUREG-1801, with exceptions for the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits. See Appendix B, Section B.2.1.10. |

**Table 3.6.1 Summary of Aging Management Evaluations in Chapter VI of NUREG-1801 for Electrical Components**

| Item Number | Component | Aging Effect/ Mechanism | Aging Management Programs | Further Evaluation Recommended | Discussion |
|---|---|---|---|---|---|
| 3.6.1-04 | Inaccessible medium-voltage (2KV to 15KV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements | Formation of water trees; localized damage leading to electrical failure (breakdown of insulation) caused by moisture intrusion and water trees | Aging management program for inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements | No | Consistent with NUREG-1801. |
| 3.6.1-05 | Electrical connectors not subject to 10 CFR 50.49 EQ requirements that are exposed to borated water leakage | Corrosion of connector contact surfaces caused by intrusion of borated water | Boric acid corrosion | No | Consistent with NUREG-1801. |

**Table 3.6.2-1: Electrical and Instrumentation and Control Systems - Containment Electrical Penetrations - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Non-Environmentally Qualified Electrical Penetrations | Electrical Continuity | Various Organic Polymers | Moisture, Temperature, Radiation | None | N/A | N/A | N/A | N/A |
| | Pressure Boundary | Various Organic Polymers | Moisture, Temperature, Radiation | Reduced Seal Capability | ASME Section XI, Subsection IWE/L and 10 CFR 50, Appendix J | II.A3.3-a | 3.5.1-06 | A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.6.2-2: Electrical and Instrumentation and Control Systems - Electrical Busbars - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Non-Segregated Bus (Unit 2) | Electrical Continuity | Bronze, Copper, Silicon Bronze, Stainless Steel | Sheltered | None | N/A | N/A | N/A | N/A |
| Switchyard Bus and Connections | Electrical Continuity | Aluminum and Stainless Steel | Outdoor | None | N/A | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.6.2-3: Electrical and Instrumentation and Control Systems - Electrical Cables and Connections - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Electrical Cables and Connections not Subject to 10 CFR 50.49 EQ Requirements | Electrical Continuity | Various Organic Polymers | Adverse Localized Environment Caused by Heat, Radiation, or Moisture in the Presence of Oxygen (Sheltered or Indoor) | Reduced Insulation Resistance (IR) | Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements | VI.A.1-a | 3.6.1-02 | A |
| Electrical Cables Used In Instrumentation Circuits For High Voltage, Low Current Circuits Not Subject to 10 CFR 50.49 EQ Requirements | Electrical Continuity | Various Organic Polymers | Adverse Localized Environment Caused by Heat, Radiation, or Moisture in the Presence of Oxygen (Sheltered or Indoor) | Reduced Insulation Resistance (IR) | Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits | VI.A.1-b | 3.6.1-03 | B |
| Inaccessible Medium-Voltage Cables (e.g., installed in conduit or direct buried) Not Subject to 10 CFR 50.49 EQ Requirements | Electrical Continuity | Various Organic Polymers | Adverse Localized Environment Caused by Moisture and Voltage Stress (Buried) | Reduced Insulation Resistance (IR) (Water-Treeing) | Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements | VI.A.1-c | 3.6.1-04 | A |

**Table 3.6.2-3: Electrical and Instrumentation and Control Systems - Electrical Cables and Connections - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| Electrical Connectors Not Subject to 10 CFR 50.49 EQ Requirements That Are Exposed To Borated Water Leakage | Electrical Continuity | Various Metals | Exposure to Borated Water Leakage (Sheltered or Indoor) | Loss of Circuit Continuity | Boric Acid Corrosion | VI.A.2-a | 3.6.1-05 | A |
| Fuse Holders | Electrical Continuity | Various Metals, Nylon | Sheltered (or Indoor) | None | N/A | N/A | N/A | N/A |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

**Table 3.6.2-4: Electrical and Instrumentation and Control Systems - Electrical Grid System - Summary of Aging Management Evaluation**

| Component Type | Intended Function* | Material | Environment | Aging Effect Requiring Management | Aging Management Programs | NUREG-1801 Volume 2 Item | Table 1 Item | Notes |
|---|---|---|---|---|---|---|---|---|
| High voltage insulators | Electrically Insulate | Various metals, Porcelain, and Cement | Outdoor | None | N/A | N/A | N/A | N/A |
| Transmission Conductors | Electrical Continuity | Aluminum Conductor Steel Reinforced (ACSR) | Outdoor | None | N/A | N/A | N/A | N/A |
| Steel Transmission Towers and Poles | Structural Support for NSR | Structural Steel | Outdoor | Loss of Material | Electrical Transmission Tower Inspection | N/A | N/A | J |
| Wooden Transmission Tower | Structural Support for NSR | Treated Wood | Buried | Loss of Material; Change in Material Properties | Electrical Transmission Tower Inspection | N/A | N/A | J |
| | | | Outdoor | Loss of Material; Change in Material Properties | Electrical Transmission Tower Inspection | N/A | N/A | J |

*Intended functions are defined in Table 2.0-1, Intended Function Definitions.

Note: Insulated Electrical Cables and Connections in this system are accounted for in Table 3.6.2-3 (Electrical Cables and Connections)

Definitions of the LRA Notes shown in Tables 3.6.2-1 through 3.6.2-4

A. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

C. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP takes some exceptions to NUREG-1801 AMP.

E. Consistent with NUREG-1801 for material, environment, and aging effect, but a different aging management program is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material, and environment combination.

I. Aging effect and/or mechanism 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.

K. Material and environment not in NUREG-1801 for this component and aging effect.

L. Aging effect and environment not in NUREG-1801 for this component and material.

M. Aging effect and material not in NUREG-1801 for this component and environment.

N. Aging effect, material, and environment not in NUREG-1801 for this component.

P. Component and aging effect not in NUREG-1801 for this material and environment.

Q. Component not in NUREG-1801 for this material, environment, and aging effect.

R. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801.

S. AMP and aging mechanism are not consistent with NUREG-1801.

T. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801.

U. Specific material/environment combinations were not determined. Comparison to NUREG-1801 is not possible.

V. Consistent with NUREG-1801 item for component, material, environment, and aging effect. AMP is consistent with NUREG-1801 AMP. Aging mechanism is in addition to those in NUREG-1801. AMP takes some exceptions to NUREG-1801 AMP.

(Note “O” was not used to avoid confusion with the number zero)

Plant-Specific Notes

None.

# 4.0 TIME LIMITED AGING ANALYSES

A listing of the acronyms used in this application is provided in Section 1.12.

## 4.1 IDENTIFICATION OF TIME-LIMITED AGING ANALYSES

This section of the BVPS License Renewal Application (LRA) deals with the identification and evaluation of Time-Limited Aging Analyses (TLAAs). TLAAs capture certain plant-specific safety analyses that are explicitly based on the current operating term of the plant. In 10 CFR 54.3, TLAAs are defined as:

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 Current Licensing Basis (CLB).

The Statements of Consideration (SOC) accompanying 10 CFR 54 clarify the definition of a TLAA by explaining that an analysis is relevant if it "provides the basis for the licensee's safety determination and, in the absence of the analysis, the licensee may have reached a different safety conclusion." (60 FR 22480)

10 CFR 54 requires that a list of TLAAs (as defined above) be provided in the LRA, including a demonstration that one of the following resolutions (from §54.21(c)(1)) is true for each TLAA:

(i) The analyses remain valid for the period of extended operation;
(ii) The analyses have been [or will be] 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.

In addition, 10 CFR 54 requires that license exemptions granted pursuant to §50.12, in effect, and based on TLAAs be identified and analyzed to confirm their validity for the period of extended operation.

### 4.1.1. Process Overview

Potential TLAAs were identified first through a search of regulatory and industry literature such as:

- The Statements of Consideration (SOC) to 10 CFR 54,
- NUREG-1800, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, April 2001, and
- NEI 95-10, Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule, Revision 3, March 2001.

Additional potential TLAAs were identified through reviews of other industry LRAs. Finally, a search of the BVPS CLB (including licensing documents and the UFSAR), was performed using a full-text searchable electronic docket to identify analyses that may contain additional BVPS-specific TLAAs. The search capabilities were also used to verify details of the applicability of the generic TLAAs to BVPS and to support the conclusion that a particular TLAA did not apply to BVPS.

These potential TLAAs were screened to determine if they met the definition presented in 10 CFR 54.3. Any that applied to BVPS are addressed in Table 4.1-1.

### 4.1.2 Identification of Exemptions

10 CFR 54.21(c)(2) also requires that an applicant for license renewal provide a list of all exemptions granted under 10 CFR 50.12 which are determined to be based on a TLAA. These TLAA-based exemptions must be evaluated and justification provided for the continuation of the exemption during the period of extended operation.

BVPS exemptions were identified through a search of the BVPS electronic docket. Each exemption was then reviewed for TLAA applicability. No TLAA-based exemptions were identified for BVPS.

### 4.1.3 Timing For Evaluation of TLAA

10 CFR 54.29 permits an applicant to defer the completion of the evaluation of TLAAs to a time after the issuance of the renewal license. For TLAAs for which BVPS is deferring the completion of the evaluation, the following details generically apply to support a conclusion that the effects of aging addressed by that TLAA will be managed:

- The method that will be used for TLAA evaluation will be the same method originally used unless otherwise stated,
- Acceptance criteria that will be used to judge the adequacy of the structure or component, consistent with the CLB, when the TLAA evaluation or analysis is performed will be the same as originally used unless otherwise stated,

- The TLAA evaluation will be completed prior to the period of extended operation, or before the CLB limit is reached, whichever is earlier, to ensure that the structure or component in question would be able to perform its intended functions established by the CLB.

**Beaver Valley Identified Time-Limited Aging Analysis**
**Table 4.1-1**

| TLAA Section of the LRA | Unit | | 10 CFR 54.21 (c)(1) | | |
|---|---|---|---|---|---|
| | U1 | U2 | (i) The analyses remain valid for the period of extended operation | (ii) The analyses have been [or will be] projected to the end of the period of extended operation | (iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation. |
| **4.2 Reactor Vessel Neutron Embrittlement** | | | | | |
| Pressurized Thermal Shock Analysis | X | X | | (ii) | (iii) |
| Charpy Upper Shelf Energy | X | X | | (ii) | |
| Pressure Temperature Limits | X | X | | (ii) | |
| LTOP PORV Setpoints | X | X | | (ii) | |
| **4.3 Metal Fatigue Analysis** | | | | | |
| ASME Fatigue Analysis | X | X | | | (iii) |
| Environmentally Assisted Fatigue | X | X | | | (iii) |
| Pressurizer Surge Line Thermal Stratification | X | X | | | (iii) |
| Reactor Vessel Underclad Cracking | X | X | | (ii) | |
| Cyclic Criteria for B31.1 and ASME Section III Class 2 and 3 Piping/Components | X | X | (i) | | (iii) [(a)] |
| Motor Operated Valve Fatigue | X | | | (ii) | (iii) |
| **4.4 EQ** | X | X | | | (iii) |
| **4.5 Concrete Containment Tendon Prestress** | - | - | | | |
| **4.6 Containment Liner Plate, Metal Containments, and Penetrations Fatigue** | | | | | |
| Containment Liner Plate Fatigue | X | X | (i) | | |
| Containment Liner Test Channels Corrosion Analysis | X | X | (i) | | |
| Fuel Transfer Tube Bellows | X | X | (i) | | |
| **4.7 Other Plant Specific TLAAs** | | | | | |
| Crane Fatigue (includes Polar Cranes, Spent Fuel Cask Cranes and Fuel Handling Platforms at both Units) | X | X | (i) | | |
| Reactor Coolant Pump Flywheel | X | X | | (ii) | |
| Leak Before Break (LBB) | X | X | | (ii) | |
| Settlement of Structures | - | X | | | (iii) |

(a) CVCS charging, letdown lines, nozzles and excess letdown lines only.

## 4.2 REACTOR VESSEL NEUTRON EMBRITTLEMENT

There are four analyses affected by irradiation embrittlement that have been identified as TLAAs, and these issues are addressed specifically for BVPS in Sections 4.2.1 through 4.2.4:

- Pressurized Thermal Shock (PTS)
- Reactor Vessel Upper Shelf Energy
- Pressure/Temperatures (P/T) Curves
- Low Temperature Overpressure Protection (LTOP) PORV Setpoints

This group of TLAAs concerns the effects of neutron embrittlement and how this mechanism affects analyses, limits, and programs that provide operating restrictions or support regulatory requirements for the reactor plant.

Neutron embrittlement is an appreciable aging mechanism for all ferritic materials that have a neutron fluence of greater than or equal to $10^{17}$ n/cm2 (E>1 MeV) at the end of the period of extended operation. The relevant calculations use predictions of the cumulative effects on the reactor vessel from neutron embrittlement, and were originally based on the 40 year expected life of the plant. The reactor pressure vessel contains the core fuel assemblies and is made of thick steel plates that are welded together. Neutrons from the fuel in the reactor irradiate the vessel as the reactor is operated and change the material properties of the steel. The most pronounced changes occur in the material property known as fracture toughness. Fracture toughness is a measure of the resistance to crack extension in response to stresses. A reduction in this material property is referred to as embrittlement. The largest amount of embrittlement usually occurs at the section of the vessel's wall closest to the reactor fuel referred to as the vessel's beltline.

The peak neutron fluences have been calculated for the End of License Extension (EOLE) for both BVPS Units [31]. The methodology used complies with Regulatory Guide 1.190. The results are contained in Table 4.2-1 for BVPS Unit 1 and Table 4.2-2 for BVPS Unit 2. The fluences contained in these tables are consistent with those used in the extended (8%) power uprate. The fluence projections in Tables 4.2-1 and Table 4.2-2 assumed that the 8% power uprate occurred in the 2003 timeframe. The extended power uprate is currently under NRC review. Implementation has been delayed until at least the 2006 timeframe. Thus, these fluence projections are conservative with regards to implementation of the extended power uprates.

As discussed in detail in Section 4.2.1, BVPS Unit 1 is projected to exceed the 10 CFR 50.61 PTS screening criterion of 270 deg. F for the limiting plate using the fluence values provided in Table 4.2-1 and assuming no flux reduction measures other than low leakage (L4P) cores. Therefore, a sensitivity analysis was performed to investigate the impact of various flux reduction measures and plant capacity factors on satisfying the criterion of 10 CFR 50.61. The sensitivity analysis concluded that the PTS screening criterion can be satisfied with reasonably practicable flux reduction measures.

A detailed discussion of the sensitivity analysis is provided in Section 4.2.1 for BVPS Unit 1. No sensitivity analysis was performed for BVPS Unit 2 since the projected $RT_{PTS}$ values are well below the 270°F screening criteria, making changes in the Unit 2 capacity factor and fluence effects of changes in the power uprate implementation date inconsequential. The BVPS Unit 2 reactor vessel has lower EOLE $RT_{PTS}$ values than the BVPS Unit 1 vessel due to several factors. These include lower copper content, less test coupon data scatter, and operation with lower leakage cores in its early cycles.

**TABLE 4.2-1**

**Calculated Uprated Peak Neutron Fluence Projections At The Reactor Vessel Clad/Base Metal Interface And 1/4T Vessel Location For Beaver Valley Unit 1[(a)]**

| | **Azimuthal Location** | |
|---|---|---|
| **EFPY** | **0°** | **45°** |
| **Fluence @ Clad/Base Metal Interface** | | |
| | | |
| 44.18 | $5.87 \times 10^{19}$ | $1.174 \times 10^{19}$ |
| **Fluence @ 1/4T Location[(b)]** | | |
| | | |
| 44.18 | $3.65 \times 10^{19}$ | $7.32 \times 10^{18}$ |

(a) These fluence projections were used in the Beaver Valley extended uprate program.
(b) Calculated here using the attenuation formula from Regulatory Guide 1.99 Revision 2.

| TABLE 4.2-2<br><br>Calculated Uprated Peak Neutron Fluence Projections At The Reactor Vessel Clad/Base Metal Interface And 1/4T Vessel Location For Beaver Valley Unit 2[(a)]<br><br>Azimuthal Location | |
|---|---|
| **EFPY** | **0°** |
| **Fluence @ Clad/Base Metal Interface** | |
| 48 | $5.837 \times 10^{19}$ |
| **Fluence @ 1/4T Location[(b)]** | |
| 48 | $3.64 \times 10^{19}$ |

(a) These fluence projections were used in the Beaver Valley extended uprate program.
(b) Calculated here using the attenuation formula from Regulatory Guide 1.99 Revision 2.

### 4.2.1 Pressurized Thermal Shock (PTS) Analysis

A Pressurized Thermal Shock (PTS) event is a postulated event or transient in a Pressurized Water Reactor (PWR) resulting in severe overcooling (thermal shock) concurrent with or followed by significant pressure in the reactor vessel.

For PWRs, 10 CFR 50.61 requires that the reference temperature $RT_{PTS}$ for reactor vessel beltline materials be less than the stated PTS screening criteria at the expiration date of the operating license. The PTS screening criteria are 270°F for plates, forgings, and axial weld materials, and 300°F for circumferential weld materials. The regulations require updating of the PTS assessment upon a request for a change in the expiration date of a facility's operating license. Therefore, the $RT_{PTS}$ value must be calculated for the entire life of the facility, including the license renewal period of extended operation.

The methods chosen by the NRC Staff for the calculation of $RT_{PTS}$ for the purpose of comparison with the screening criterion are presented in 10 CFR 50.61.

**BVPS Unit 1**

The $RT_{PTS}$ values and Beltline Material Chemistry Factor Values for BVPS Unit 1 have been calculated for 44.18 Effective Full Power Years (EFPY) in accordance with Regulatory Guide

1.99, Revision 2, Position 1.1 and Position 2.1, considering the end of the period of extended operation, and the uprated power condition.[31]

All projected $RT_{PTS}$ values are below the PTS screening criteria, with the exception of Lower Shell Plate B6903-1, which slightly exceeds the plate screening criterion of 270 deg. F. Relevant data is presented in Table 4.2-3 (Beaver Valley Unit 1 Reactor Vessel Unirradiated Toughness Properties), Table 4.2-4 (Summary Of The Beaver Valley Unit 1 Beltline Material Chemistry Factor Values Based On Regulatory Guide 1.99, Revision 2, Position 1.1 And Position 2.1), and Table 4.2-5 ($RT_{PTS}$ Calculations for Beaver Valley Unit 1 Beltline Region Materials at EOLE). The projection presented in Table 4.2-5 for BVPS Unit 1 was performed using the fluence provided in Table 4.2-1. No flux suppression was assumed in these projections other than a low leakage (L4P) core. The fluences provided in Table 4.2-1 conservatively modeled the impact of an 8% uprate at the beginning of Cycle 16 (2003). This power uprate has subsequently been delayed until at least Cycle 18 (2006), which has the effect of reducing the EOLE fluence. The fluence projections were based on an assumed 90% capacity factor. Capacity factor as used in the fluence projections is defined as the number of effective full power days from the start of the fuel cycle until the end of the fuel cycle divided by the number of calendar days during the period. It does not include refueling outage days.

10 CFR 50.61 requires that, for each pressurized water nuclear power reactor for which the value of $RT_{PTS}$ for any material in the beltline is projected to exceed the PTS screening criterion using the EOL fluence, the licensee shall implement those flux reduction programs that are reasonably practicable to avoid exceeding the PTS screening criterion.

In an attempt to control the embrittlement of the RPV plate material at the peak flux locations, neutron flux reduction methods were employed at BVPS Unit 1 in the mid-1990s; the methods included fuel management adjustments and adding hafnium rods in the peripheral fuel bundles. In 2000, FENOC opted to eliminate the hafnium flux reduction, since the embrittlement projections (based on the Capsule W surveillance results at that time) demonstrated that the beltline plate would meet the PTS screening criterion for the current EOL without it, and for the EOLE operating period, the Hafnium flux suppression would be unable to provide the necessary fluence management to meet the PTS screening criteria in accordance with the requirements of RG 1.99, Rev.2. The subsequent Capsule Y data indicates that the BVPS Unit 1 reactor vessel is now projected to exceed the PTS screening criterion approximately twelve years into the period of extended operation at a conservative capacity factor of 98%, if no additional flux reduction measures are employed. (See sensitivity discussion below.) This subsequent capsule data (Capsule Y) also suggests that use of flux reduction measures will allow BVPS Unit 1 to meet the PTS screening criteria at EOLE.

Since the projections for Beaver Valley Unit 1 indicate that the PTS Screening criteria would be reached prior to the end of extended license life without fluence management measures, an assessment of the available fluence management approaches was undertaken[35][36]. The evaluation of the potential effects of flux suppression measures, such as Hafnium power suppression rods and PLSAs (Part Length Shielded Assmblies) was performed. The results of this assessment indicate that with the use of either Hafnium suppression rods or PLSAs, the

$RT_{PTS}$ value can be maintained below the 270°F screening criteria throughout the extended license life at power uprated conditions. The sensitivity analysis also investigated the impact of the operating capacity factor on the implementation timing of the various flux management options. The results of this study are presented in Table 4.2-6. The sensitivity analysis was performed using an updated implementation date for the 8% power uprate of Cycle 18 (2006), versus the 2003 date used in the Table 4.2-1 projections. The sensitivity analysis was evaluated on a fluence level basis and not correlated to an EFPY, since different fluence management programs will produce fluence levels independent of the normal correlation to a specific value of EFPY. Capacity factors of 90%, 94%, and 98% were used in the evaluation. Capacity factor is defined as the number of effective full power days from the start of the fuel cycle until the end of the fuel cycle divided by the number of calendar days during that period. It does not include refueling outage days. The assumption of a 98% capacity factor for the remaining operating life of the unit bounds historical average capacity factors. Additionally, fluence projections for the L4P core following the 8% power uprate were based on operation with a L4P loading pattern based on an average L4P pattern. This is in contrast to the Table 4.2-1 projections which assumed the historically most conservative loading pattern. The neutron flux (E > 1.0 MeV) for the L4P core used in the sensitivity study was 4.14E+10 n/cm$^2$-sec versus 4.45 E+10 n/cm$^2$-sec for the Table 4.2-1 projections.

The sensitivity analysis evaluated five fluence management scenarios at each of the three capacity factors. The first scenario assumed continued operation in the current mode using the standard L4P low leakage core. The second scenario was similar to the first except that a Modified L4P core was assumed for Cycle 18 (2006) and beyond. The Modified L4P core has extremely low power generation in the peripheral fuel assemblies located on the core flats. The third scenario assumed implementation of the Modified L4P core in Cycles 20 (2009) and 21 (2010) and then reinsertion of hafnium in Cycle 22 (2012). The fourth scenario assumed insertion of hafnium in Cycle 20 (2009) but unlike scenario 2 did not assume a Modified L4P core in the preceding cycles. The fifth scenario represents continued operation in the current mode as in scenario 1 except that PLSAs are assumed for Cycle 30 (2024) and beyond. The PLSAs replace the fuel in the bottom half of the assembly with stainless steel rods. All scenarios assumed implementation of the complete 9.4% uprate in 2006. (This uprate represents an additional 8% since a 1.4% uprate for both units occurred in 2001.)

The evaluation found that BVPS Unit 1 can be operated at extended power uprated conditions (assuming the additional 8% power uprate in the Spring 2006) for the entire license renewal period by employing reasonably practicable fluence management, even at a historically conservative capacity factor of 98%. To obtain the necessary fluence management to keep the PTS screening criterion of 270 deg. F for the limiting plate from being exceeded at a 98% capacity factor, insertion of hafnium would be required as early as 2009 using hafnium suppression only (scenario 4) or as late as 2012 if preceded by a Modified L4P core in 2009 (scenario 3). The PLSAs would need to be inserted as early as 2024 (scenario 5). Refer to Table 4.2-6 for details of the evaluation and implementation schedule for the various options.

The reactor vessel fluence at both BVPS Unit 1 and Unit 2 will be monitored to ensure the projected fluence remains below that assumed for the relevant neutron embrittlement TLAAs. A

more detailed fluence management description will be provided to the NRC in the 2007 timeframe. Therefore, with fluence management, the $RT_{PTS}$ values calculated in accordance with Regulatory Guide 1.99, Revision 2 demonstrate that Beaver Valley Unit 1 will meet the requirements of 10 CFR 50.61 considering the power uprated condition for the entire period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) and 10 CFR 54.21(c)(1)(iii).

**TABLE 4.2-3**

**Beaver Valley Unit 1 Reactor Vessel Unirradiated Toughness Properties**

| Material | Weight % of Cu | Weight % of Ni | Unirradiated $RT_{NDT}$ (°F) |
|---|---|---|---|
| Intermediate Shell Plate B6607-1 | 0.14 | 0.62 | 43 |
| Intermediate Shell Plate B6607-2 | 0.14 | 0.62 | 73 |
| Lower Shell Plate B6903-1 | 0.21 | 0.54 | 27 |
| Lower Shell Plate B7203-2 | 0.14 | 0.57 | 20 |
| Lower Shell Longitudinal Weld 20-714A/B (Heat 305414) | 0.34 | 0.61 | -56 |
| Intermediate to Lower Shell Circ. Weld 11-714 (Heat 90136) | 0.27 | 0.07 | -56 |
| Intermediate Shell Longitudinal Weld 19-714A/B (Heat 305424) | 0.27 | 0.63 | -56 |

**TABLE 4.2-4**

**Summary Of The Beaver Valley Unit 1 Beltline Material Chemistry Factor Values Based On Regulatory Guide 1.99, Revision 2, Position 1.1 And Position 2.1**

| Material | Chemistry Factor (°F) | |
|---|---|---|
| | Position 1.1 | Position 2.1 |
| Intermediate Shell Plate B6607-1 | 100.5 | - - - |
| Intermediate Shell Plate B6607-2 | 100.5 | - - - |
| Lower Shell Plate B6903-1[(a)] | 147.2 | 149.2 |
| Lower Shell Plate B7203-2 | 98.7 | - - - |
| Lower Shell Weld 20-714 A/B (Heat 305414) | 210.5 | 223.9 |
| Intermediate Shell Weld 19-714 A/B (Heat 305424) [(a)] | 191.7 | 188.8 |
| Intermediate Shell to Lower Shell Plate Circ. Weld Seam 11-714 (Heat 90136) | 124.3 | 84.8 |

(a) Indicates surveillance material

**TABLE 4.2-5**
**$RT_{PTS}$ Calculations For Beaver Valley Unit 1 Beltline Region Materials At EOLE (44.18 EFPY)**
$RT_{PTS}$ determined using RG 1.99, Rev. 2, Position 1.1 unless otherwise noted

| Material | Fluence[g] | FF | CF (°F) | $\Delta RT_{PTS}$[c] (°F) | Margin (°F) | $RT_{NDT(U)}$[a] (°F) | $RT_{PTS}$[b] (°F) |
|---|---|---|---|---|---|---|---|
| Intermediate Shell Plate B6607-1 | 5.87 | 1.433 | 100.5 | 144.0 | 34 | 43 | 221 |
| Intermediate Shell Plate B6607-2 | 5.87 | 1.433 | 100.5 | 144.0 | 34 | 73 | 251 |
| Lower Shell Plate B7203-2 | 5.87 | 1.433 | 98.7 | 141.4 | 34 | 20 | 195 |
| Lower Shell Plate B6903-1 | 5.87 | 1.433 | 147.2 | 210.9 | 34 | 27 | 272 |
| → Using S/C Data | 5.87 | 1.433 | 149.2 | 213.8 | 34[e] | 27 | 275 |
| Inter. Shell Circ. Weld 19-714A/B | 1.174 | 1.045 | 191.7 | 200.3 | 65.5 | -56 | 210 |
| → Using S/C Data | 1.174 | 1.045 | 188.8 | 197.3 | 65.5[e] | -56 | 207 |
| Lower Shell Long. Weld 20-714A/B | 1.174 | 1.045 | 210.5 | 220.0 | 65.5 | -56 | 230 |
| → Using S/C Data[f] | 1.174 | 1.045 | 223.9 | 234.0 | 65.5 | -56 | 244 |
| Circumferential Weld 11-714 | 5.87 | 1.433 | 124.3 | 178.1 | 65.5 | -56 | 188 |
| → Using S/C Data[d] | 5.87 | 1.433 | 84.8 | 121.5 | 44 | -56 | 110 |

(a) Initial $RT_{NDT}$ values are measured values, with exception to the welds, which are generic.
(b) $RT_{PTS} = RT_{NDT(U)} + \Delta RT_{PTS}$ + Margin (°F).
(c) $\Delta RT_{PTS}$ = CF * FF.
(d) Based on St. Lucie Unit 1 surveillance data and using RG 1.99, Rev. 2, Position 2.1.
(e) Data not credible, therefore ART calculated with full $\sigma_{\Delta}$.
(f) Based on Fort Calhoun data and using RG 1.99, Rev. 2, Position 2.1.
(g) See Table 4.2-1; Units are x $10^{19}$ n/cm$^2$ (E>1.0 MeV)

**TABLE 4.2-6**
**$RT_{PTS}$ Sensitivity Analysis For Beaver Valley Unit 1 Beltline Limiting Plate Material, B6903-1 At EOLE**
$RT_{PTS}$ determined using RG 1.99, Rev. 2

| Fluence Management Scenario[a] | Capacity Factor[b] | Modified L4P[c] | Hf[d] | PLSA[e] | Fluence[f] | $RT_{PTS}$[g] (°F) |
|---|---|---|---|---|---|---|
| #1 – No Change in Fluence Management | 98% | | | | 5.95 | 275.1 |
| | 94% | | | | 5.79 | 274.4 |
| | 90% | | | | 5.63 | 273.6 |
| #2 – Modified L4P Core | 98% | Cycle 18[h] | | | 4.97 | 270.1 |
| | 94% | Cycle 18 | | | 4.85 | 269.3 |
| | 90% | Cycle 18 | | | 4.73 | 268.6 |
| #3 – Modified L4P Core and Hafnium Suppression | 98% | Cycle 20[i] | Cycle 22[j] | | 4.96 | 270.0 |
| | 94% | Cycle 20 | Cycle 22 | | 4.84 | 269.3 |
| | 90% | Cycle 20 | Cycle 22 | | 4.72 | 268.5 |
| #4 – Hafnium Only | 98% | | Cycle 20 | | 4.94 | 269.9 |
| | 94% | | Cycle 20 | | 4.82 | 269.2 |
| | 90% | | Cycle 20 | | 4.71 | 268.4 |
| #5 – PLSA Only | 98% | | | Cycle 30[k] | 4.79 | 269.0 |
| | 94% | | | Cycle 30 | 4.68 | 268.3 |
| | 90% | | | Cycle 30 | 4.57 | 267.5 |

(a) All Fluence Management scenarios reflect a 1.4% Power Uprate in October, 2001 and a total uprate to 9.4% in the spring of 2006.
(b) The capacity factor is defined as the number of effective full power days from the start of the fuel cycle until the end of the fuel cycle divided by the number of calendar days during that period. The capacity factor does not include refueling outage days.
(c) Modified L4P core assumes operation at 9.4% uprated power with a radial core power distribution characteristic of Cycle 10. This fuel cycle represents an L4P loading pattern with extremely low power generation in the peripheral fuel assemblies located in the core flats. Neutron flux for the Modified L4P core at 9.4% uprate conditions of 3.05E+10 n/cm$^2$-sec, versus L4P core flux of 4.14E+10 n/cm$^2$-sec at the 9.4% uprate conditions.
(d) Hafnium suppression assembly. Neutron flux for cycles with hafnium at the 9.4% uprated condition of 2.90 E+10 n/cm$^2$-sec versus L4P core flux of 4.14E+10 n/cm$^2$-sec at the 9.4% uprate conditions.
(e) Part Length Shielded Assembly (PLSA). Scenario assumes insertion of PLSAs in the twelve peripheral core locations on the core flats. The PLSA assemblies considered for this scenario replace the fuel in the bottom half of the assembly with stainless steel rods. Neutron flux at the 9.4% uprated conditions of 4.14E+9 n/cm$^2$-sec versus L4P core flux of 4.14E+10 n/cm$^2$-sec at the 9.4% uprate conditions.
(f) All Fluence units are +E19 n/cm$^2$. Fluence Projections are at January 26, 2036 (EOLE License Extension End Date).
(g) $RT_{PTS}$ determined applying a Margin term of 34°F and a Chemistry Factor of 149.2.
(h) Cycle 18 projected to begin in 2006
(i) Cycle 20 projected to begin in 2009
(j) Cycle 22 projected to begin in 2012
(k) Cycle 30 projected to begin in 2024

**BVPS Unit 2**

The $RT_{PTS}$ values and Beltline Material Chemistry Factor Values for BVPS Unit 2 have been calculated for 48 EFPY in accordance with Regulatory Guide 1.99, Revision 2, Position 1.1 and Position 2.1, considering the end of the period of extended operation, and the uprated power condition.[31]

All projected $RT_{PTS}$ values are below the PTS sceening citeria. Relevant data is presented in Table 4.2-7 (Beaver Valley Unit 2 Reactor Vessel Unirradiated Toughness Properties), Table 4.2-8 (Summary of the Beaver Valley Unit 2 Beltline Material Chemistry Factor Values), and Table 4.2-9 ($RT_{PTS}$ Calculations for Beaver Valley Unit 2 Beltline Region Materials at EOLE).

**TABLE 4.2-7**

**Beaver Valley Unit 2 Reactor Vessel Unirradiated Toughness Properties**

| Material | Weight % of Cu | Weight % of Ni | Unirradiated $RT_{NDT}$ (°F) |
|---|---|---|---|
| Intermediate Shell Plate B9004-1 | 0.065 | 0.55 | 60 |
| Intermediate Shell Plate B9004-2 | 0.06 | 0.57 | 40 |
| Lower Shell Plate B9005-1 | 0.08 | 0.58 | 28 |
| Lower Shell Plate B9005-2 | 0.07 | 0.57 | 33 |
| Lower Shell Longitudinal Weld 101-142A & B (Heat 83642) | 0.046 | 0.086 | -30 |
| Intermediate to Lower Shell Circ. Weld 101-171 (Heat 83642) | 0.046 | 0.086 | -30 |
| Intermediate Shell Longitudinal Weld 101-124 A & B (Heat 83642) | 0.046 | 0.086 | -30 |

**TABLE 4.2-8**

**Summary Of The Beaver Valley Unit 2 Beltline Material Chemistry Factor Values Based On Regulatory Guide 1.99, Revision 2, Position 1.1 And Position 2.1**

| Material | Chemistry Factor (°F) | |
|---|---|---|
| | Position 1.1 | Position 2.1 |
| Intermediate Shell Plate B9004-1 | 40.5 | - - - |
| Intermediate Shell Plate B9004-2 [(a)] | 37 | 41.9 |
| Lower Shell Plate B9005-1 | 51 | - - - |
| Lower Shell Plate B9005-2 | 44 | - - - |
| Lower Longitudinal Weld 101-142 A & B (Heat 83642) | 34.4 | 10.6 |
| Intermediate Longitudinal Weld 101-124 A & B (Heat 83642) | 34.4 | 10.6 |
| Intermediate Shell to Lower Shell 101-171 (Heat 83642) | 34.4 | 10.6 |

(a) Indicates surveillance material.

**TABLE 4.2-9**

**$RT_{PTS}$ Calculations For Beaver Valley Unit 2 Beltline Region Materials At EOLE (48 EFPY)** $RT_{PTS}$ determined using RG 1.99, Rev. 2, Position 1.1 unless otherwise noted

| Material | Fluence[(e)] | FF | CF (°F) | $\Delta RT_{PTS}$[(c)] (°F) | Margin (°F) | $RT_{NDT(U)}$[(a)] (°F) | $RT_{PTS}$[(b)] (°F) |
|---|---|---|---|---|---|---|---|
| Intermediate Shell Plate B9004-1 | 5.837 | 1.432 | 40.5 | 58.0 | 34 | 60 | 152 |
| Intermediate Shell Plate B9004-2 | 5.837 | 1.432 | 37 | 53.0 | 34 | 40 | 127 |
| → Using Credible S/C. Data[(f)] | 5.837 | 1.432 | 41.9 | 60.0 | 17 | 40 | 117 |
| Lower Shell Plate B9005-2 | 5.837 | 1.432 | 51 | 73.0 | 34 | 33 | 140 |
| Lower Shell Plate B9005-1 | 5.837 | 1.432 | 44 | 63 | 34 | 28 | 125 |
| Vessel Beltline Welds [(d)] | 5.837 | 1.432 | 34.4 | 49.3 | 49.3 | -30 | 69 |
| → Using Credible S/C. Data[(f)] | 5.837 | 1.432 | 10.6 | 15.2 | 15.2 | -30 | 0 |

(a) Initial $RT_{NDT}$ values are measured values.
(b) $RT_{PTS} = RT_{NDT(U)} + \Delta RT_{PTS}$ + Margin (°F).
(c) $\Delta RT_{PTS}$ = CF * FF.
(d) All vessel beltline welds are from Heat # 83642, Linde 0091, Flux Lot #3536.
(e) See Table 4.2-1; Units are $x10^{19}$ $n/cm^2$ (E>1.0 MeV).
(f) Using RG 1.99, Rev. 2, Position 2.1.

Therefore, the Pressurized Thermal Shock analysis for BVPS Unit 2 is demonstrated to be projected to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii).

### 4.2.2 Upper Shelf Energy (USE) Analysis

Upper Shelf Energy (USE) is the average energy value for all Charpy specimens (typically three) whose test temperature is above the upper end of the transition region.

The pressure-retaining components of the reactor coolant pressure boundary that are made of ferritic materials must meet the requirements of the ASME Code, supplemented by the additional requirements set forth below, for fracture toughness during system hydrostatic tests and any condition of normal operation, including anticipated operational occurrences. The USE typically decreases with increasing neutron fluence. For the reactor vessel beltline materials, including welds, plates and forgings, the values of USE must be monitored for the effects of neutron radiation by means of a surveillance program in accordance with Appendix H to Part 50.

Reactor vessel beltline materials must have Charpy upper-shelf energy, in the transverse direction for base material and along the weld for weld material according to the ASME Code, of no less than 75 ft-lb initially and must maintain Charpy upper-shelf energy throughout the life of the vessel, including the period of extended operation of no less than 50 ft-lb, unless it can be demonstrated that the lower values of USE provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code.

**BVPS Unit 1**

The USE values for BVPS Unit 1 have been calculated for 44.18 Effective Full Power Years (EFPY), the end of the period of extended operation. All projected End of License Extension (EOLE) USE values are above 50 ft-lb as indicated in Table 4.2-10 (Predicted End-of-License Extension USE Calculations for BVPS Unit 1 Beltline Region Materials).[31]
Therefore, the Upper Shelf Energy Analysis for BVPS Unit 1 is demonstrated to be projected to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii).

**TABLE 4.2-10**

**Predicted End-Of-License Extension (44.18 EFPY) USE Calculations For BVPS Unit 1 Beltline Region Materials**

USE determined using RG 1.99, Rev. 2, Position 1.2 unless otherwise noted

| Material | Weight % of Cu | 1/4T EOL Fluence ($10^{19}$ n/cm$^2$) | Unirradiated USE (ft-lb) | Projected USE Decrease[a] (%) | Projected EOL USE (ft-lb) |
|---|---|---|---|---|---|
| Intermediate Shell Plate B6607-1 | 0.14 | 3.65 | 94 | 31 | 65 |
| Intermediate Shell Plate B6607-2 | 0.14 | 3.65 | 83 | 31 | 57 |
| Lower Shell Plate B6903-1 | 0.21 | 3.65 | 83 | 36[b] | 53 |
| Lower Shell Plate B7203-2 | 0.14 | 3.65 | 85 | 31 | 59 |
| Lower Shell Longitudinal Weld 20-714A/B (Heat 305414) | 0.34 | 0.732 | >100 | 41[d] | >59 |
| Intermediate to Lower Shell Circ. Weld 11-714 (Heat 90136) | 0.27 | 3.65 | 144 | 46[c] | 78 |
| Intermediate Shell Longitudinal Weld 19-714A/B (Heat 305424) | 0.27 | 0.732 | 112 | 29[b] | 80 |

(a) Calculated here using the fluence projections from Table 4.2-1.
(b) The % decrease is based on Beaver Valley Unit 1 surveillance program results and using RG 1.99 Rev. 2 Position 2.2.
(c) The % decrease is based on St. Lucie Unit 1 surveillance program results and using RG 1.99, Rev. 2 Position 2.2.
(d) The % decrease is based on Fort Calhoun surveillance program results and using RG 1.9, Rev. 2 Position 2.2.

## BVPS Unit 2

The USE values for BVPS Unit 2 have been calculated for 48 EFPY, the end of the period of extended operation. All projected EOLE USE values are above 50 ft-lb as indicated in Table 4.2-11 (Predicted End-of-License Extension USE Calculations for all the Beltline Region Materials).[31]

Therefore, the Upper Shelf Energy Analysis for BVPS Unit 2 is demonstrated to be projected to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii).

**Table 4.2-11**

**Predicted End-Of-License Extension (48 EFPY) USE Calculations For BVPS Unit 2 Beltline Region Materials**

USE determined using RG 1.99, Rev. 2, Position 1.2 unless otherwise noted

| Material | Weight % of Cu | 1/4T EOL Fluence ($10^{19}$ n/cm$^2$) | Unirradiated USE (ft-lb) | Projected USE Decrease[(a)] (%) | Projected EOL USE (ft-lb) |
|---|---|---|---|---|---|
| Intermediate Shell Plate B9004-1 | 0.065 | 3.64 | 83 | 26 | 61 |
| Intermediate Shell Plate B9004-2 | 0.06 | 3.64 | 79 | 11[(b)] | 70 |
| Lower Shell Plate B9005-1 | 0.08 | 3.64 | 82 | 26 | 61 |
| Lower Shell Plate B9005-2 | 0.07 | 3.64 | 78 | 26 | 58 |
| Lower Shell Longitudinal Weld 101-142A & B (Heat 83642) | 0.046 | 3.64 | 145 | 6[(b)] | 136 |
| Intermediate to Lower Shell Circ. Weld 101-171 (Heat 83642) | 0.046 | 3.64 | 145 | 6[(b)] | 136 |
| Intermediate Shell Longitudinal Weld 101-124 A & B (Heat 83642) | 0.046 | 3.64 | 145 | 6[(b)] | 136 |

(a) Calculated here using T vessel fluence projections from Table 4.2-2 herein.
(b) Determined using Beaver Valley Unit 2 surveillance data and using RG 1.99 Rev. 2, Position 2.2.

### 4.2.3 Pressure Temperature Curves Analysis

Appropriate limits are set on reactor pressure and temperature through the use of pressure-temperature (P-T) curves. These curves present allowable pressure versus temperature for both hydrotest and normal operating conditions, and are documented in the plant's Pressure Temperature Limits Reports, which are referenced by the Technical Specifications. These curves are established to the requirements of 10 CFR 50 Appendix G to assure that brittle fracture of the reactor vessel is prevented. Periodically, P-T curves are modified to account for irradiation embrittlement effects based on the methods of Regulatory Guide 1.99, Revision 2.

Beaver Valley reactor pressure vessels (RPV's) are manufactured of ferritic carbon steels selected for their medium strength, high toughness and good weldability. However, irradiation alters these properties as the vessel ages. An increase in hardness and tensile strength is accompanied by a reduction of fracture toughness and an increase in brittle fracture behavior. The key parameter which characterizes the fracture toughness of a material is the reference temperature of nil-ductility transition ($RT_{NDT}$), the temperature below which failure occurs in a non-ductile, brittle manner. In most cases, normal reactor operating conditions lie well above the

$RT_{NDT}$; however, various transient conditions challenge the fracture toughness capabilities of the vessel.

10 CFR Part 50 Appendix G [2] requires that the RPV be maintained within established P-T limits, including during heatup and cooldown. These limits specify the maximum allowable pressure as a function of reactor coolant temperature. As the reactor pressure vessel becomes embrittled and its fracture toughness is reduced, the allowable pressure (given the required minimum temperature) is reduced. 10 CFR 50 Appendix G requires that the methods of analysis used to determine the P-T limits be at least as conservative as the methods of ASME Section XI Appendix G. The ASME reference critical stress intensity ($K_{IC}$) curve provides the relationship between fracture toughness and $RT_{NDT}$. P-T limits are calculated such that the $K_{IC}$ curve is not exceeded for a standard postulated defect.

The P-T Curves for both BVPS Units will be projected into the period of extended operation as appropriate. Therefore, the P-T Curves for both BVPS Units will be demonstrated to be projected to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii).

### 4.2.4 Low Temperature Overpressure Protection (LTOP) PORV Setpoints

Low temperature overpressure protection (LTOP) limits are considered as part of the calculation of pressure/temperature curves. Loss of ductility at low temperatures due to irradiation must be evaluated during the period of extended operation, thus LTOP considerations are included in the analyses described in Section 4.2.3 Therefore, the analyses for both BVPS Units will be demonstrated to be projected to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii).

## 4.3 METAL FATIGUE ANALYSIS

Fatigue is the gradual deterioration of a material that is subjected to repeated cyclic loads. Components have been designed or evaluated for fatigue according to the requirements of the applicable codes.

For BVPS Unit 1, the reactor vessel and significant components in the RCS are designed in accordance with ASME III Class 1 requirements for fatigue. Plant piping, including the reactor coolant pressure boundary piping, is designed in accordance with the ANSI B31.1 Power Piping Code.

The BVPS Unit 1 and Unit 2 pressurizer surge lines have been analyzed to ASME III standards for fatigue as required by NRC Bulletin 88-11.

For BVPS Unit 2, the reactor vessel and other components in the RCS, including the reactor coolant pressure boundary piping and Class 1 auxiliary piping integral to the RCS, are designed in accordance with ASME Section III Class 1 requirements for fatigue. Other piping at BVPS Unit 2 is designed in accordance with ASME Section III Class 2 or 3, or ANSI B31.1.

The following issues are considered separately under the TLAA for Metal Fatigue and are addressed in Sections 4.3.1 through 4.3.6:

- ASME Fatigue Analysis,
- Environmentally Assisted Fatigue,
- Pressurizer Surge Line Thermal Stratification,
- Reactor Vessel Underclad Cracking, and
- Cyclic Stress Criteria for ANSI B31.1 Piping/Components .
- Motor Operated Valve Fatigue

The first five of these Metal Fatigue issues are concerned with thermal fatigue; the last involves mechanical cycling of motor operated valves.

### 4.3.1 ASME Fatigue Analysis

The Reactor Coolant System (RCS) and components for BVPS are designed in accordance with Section III of the ASME Boiler and Pressure Vessel Code for Nuclear Vessels, except for the BVPS Unit 1 piping, which is analyzed under ANSI B31.1 (see Section 4.3.5).

The RCS components designed to the Class 1 criteria of ASME III are:

- Reactor Vessel and Internals
- Steam Generators
- Reactor Coolant Pumps including Casings
- Pressurizer
- BVPS Unit 2 Safety & Relief Valves
- Loop Stop Valves
- Control Rod Drive Mechanisms

The ASME III, Class 1 code requires a design-by-analysis approach to evaluate whether the components can sustain the prescribed steady state pressure and thermal loadings and the cyclic fatigue applications of these loadings. In WCAP-16173, Westinghouse projected the original 40 year life plant NSSS design transients as indicated in Table 4.3-1. For BVPS Unit 1, the scope of the evaluation included ASME Section III Class 1 components, ANSI B31.1 reactor coolant system piping and auxiliary Safety Class 1 piping, and other ANSI B31.1 auxiliary piping integral to the reactor coolant system. For BVPS Unit 2, the scope of the evaluation included ASME Section III Class 1 components and piping, (including RCS and some integral auxiliary piping), and portions of non-ASME Section III Class 1 piping (either ASME Section III Class 2 and 3 or ANSI B31.1) integral to the RCS. The transients are identified by the types and number of applications of transients anticipated during the plant lifetime, along with the cycle counts as of October 15, 2003, and projected values for 60 years of plant operation [54]. The 60 year projected NSSS design transient cycles are shown to be bounded within the original 40 year plant NSSS design transient cycles.

In WCAP-16173, Westinghouse assembled the design transients applicable to Beaver Valley Units 1 and 2 on a component specific basis, using information from the component equipment and design specifications, plant Technical Specifications, UFSAR and input from respective component designers. Other sources used to develop the basis include design transients issued for the Beaver Valley Units 1 and 2 Extended Power Uprate NSSS Licensing Report (WCAP-16014) and the plant cycle counting procedure. Review of this documentation provides assurance that the current design basis transient set is conservative and comprehensive for use in the evaluation of plant operations, and subsequently may be used as the basis to evaluate BVPS for 60 years of operation. Additionally, this review identified locations that will be included in the plant's Fatigue Monitoring Program. The basis for inclusion and identification of these locations are shown in Table 4.3-2.

A fatigue analysis of the pressurizer lower head was performed to consider the effects of insurge, outsurge, and thermal stratification for the pressurizer vessel [44, 47, 54]. Due to the complexity of these loading conditions, the lower head and related piping have been identified as locations that need to be included in activities separate from the cycle counting described above. WCAPs 15351, 16173-P and 15352 demonstrate acceptable operation for the current Licensing Basis (CLB), however, due to the complexity of the issue, fatigue monitoring will be instituted for the period of extended operations.

The plant procedure for transient cycle counting will be expanded to more completely incorporate the plant operations information to better manage fatigue usage. Transients with accumulation rates so low that they would never reach the design limit will not be monitored further. The following design transients will not be monitored:

- Unit Loading and Unloading (Conservatively projected total substantially below design)
- Boron Concentration Equalization (Conservatively projected total substantially below design)
- Primary Side Leak Test (Bounded by Steady State Fluctuations)
- Steady State Fluctuations (Infinite cycles)

The transient cycle counting process will focus on three major activities:

- Surveillance activities to identify possible transients,
- Data collection and retention to classify and analyze possible transients, and
- Periodic review of possible transients for classification and analysis.

The results of these evaluations will be used to confirm that the original design assumptions regarding fatigue remain valid for the period of extended operation.

Therefore, for the ASME Fatigue analysis for the BVPS Units, it is demonstrated that the effects of aging on the intended function will be adequately managed for the period of extended operation per 10 CFR 54.21(c)(1)(iii).

**TABLE 4.3-1**
**BVPS1 & BVPS2 SUMMARY OF NSSS DESIGN BASIS TRANSIENT PROJECTIONS**

| **Normal Conditions** | **Design** | Unit 1[1] | Unit 1 Projected | Unit 2[1] | Unit 2 Projected |
|---|---|---|---|---|---|
| Heatup and Cooldown at 100°F/hr (Pressurizer cooldown 200°F/hr) | 200 (each) | 116/ 115 | 200 / 200 | 31/30 | 200 / 200 |
| Unit Loading and Unloading at 5% of full power/min | 18,300 (each) | 831/ 830 | 1781/ 1781 | 761/ 760 | 2686/ 2686 |
| Step Load Increase and Decrease of 10% of Full Power | 2,000 (each) | 10/ 10 | 21/ 21 | 5/ 5 | 18/ 18 |
| Large Step Load Decrease with Steam Dump | 200 | 14 | 30 | 3 | 11 |
| Steady State Fluctuations | Infinite | Exempted | Exempted | Exempted | Exempted |
| **Upset Conditions** | | | | | |
| Loss of Load, without Immediate Turbine or Reactor Trip | 80 | 1 | 2 | 2 | 7 |
| Loss of Power (blackout with natural circulation in the RCS) | 40 | 11 | 24 | 3 | 11 |
| Loss of Flow (partial loss of flow one pump only) | 80 | 20 | 43 | 5 | 18 |
| Reactor Trip from Full Power | 400 | 230 | 399 | 43 | 175 |
| Inadvertent Auxiliary Spray (Unit 2 only) | 10 | N/A | N/A | 1 | 1 |
| Inadvertent Safety Injection (Unit 2 only) | 60 | N/A | N/A | 4 | 55 |
| RCS Cold Overpressurization (Unit 2 only) | 10 | N/A | N/A | 0 | 0 |
| Operational Basis Earthquake (20 earth-quake of 20 cycles each) | 400 | 0 | 0 | 0 | 0 |
| **Test Conditions** | | | | | |
| Turbine Roll Test | 10 | 3 | 10 | 2 | 10 |
| **Hydrostatic Test Conditions** | | | | | |
| a. Primary Side | 5 | 1 | 5 | 1 | 5 |
| b. Secondary Side | 5 | 1 | 5 | 0 | 5 |
| c. Primary Side Leak Test | 50 | 13 | 50 | 0 | 50 |

[1] Through 10/15/2003

| TABLE 4.3-2<br>RECOMMENDED PRIMARY SIDE FATIGUE MANAGEMENT LOCATIONS | |
|---|---|
| **LOCATION** | **REASONS FOR INCLUDING IN A FATIGUE MONITORING PROGRAM** |
| **Pressurizer Lower Head** | The primary reasons for including this location in a fatigue management program are:<br>▪ This location has a high design fatigue usage estimate<br>▪ Multiple transients may occur during each plant heatup and cooldown operation<br>▪ Without more explicit treatment, it is difficult for operations to identify when a fatigue significant transient is happening |
| **Pressurizer Surge Line** | The primary reasons for including this location in a fatigue management program are:<br>▪ This location has a high design fatigue usage estimate<br>▪ Multiple transients may occur during each plant heatup and cooldown operation<br>▪ Without more explicit treatment, it is difficult for operations to identify when a fatigue significant transient is happening |
| **CVCS Piping And Heat Exchanger** | The primary reasons for including this location in a fatigue management program are:<br>▪ Unit 1 current cycles estimate exceeds 7000 cycles[(a)]<br>▪ Unit 2 selected CVCS piping isolation events are estimated to exceed design values[(b)]<br>▪ Multiple transients may occur during each plant heatup and cooldown operation<br>▪ It is difficult for operations to identify when a fatigue significant transient is happening<br>▪ Fatigue significant transients may occur due to the automatic response of the pressurizer level control system |
| **RHR Operations** | ▪ Unit 2 projected operational cycles exceeds the current design limit of 200; therefore the RHR System for Unit 2 was included as one of the recommended fatigue management locations. |

(a) Current operability has been demonstrated in Reference [42]
(b) Current operability has been demonstrated in Reference [41]

### 4.3.2 Environmentally Assisted Fatigue Analysis

The effects of fatigue for the initial 40-year initial reactor license period were studied and resolved under Generic Safety Issue (GSI)-78, "Monitoring of Fatigue Transient Limits for Reactor Coolant System," and GSI-166, "Adequacy of Fatigue Life of Metal Components." As part of the resolution of GSI-166, an assessment was made of the significance of the more recent fatigue test data on the fatigue life of a sample of components in plants where Code fatigue design analysis had been performed. Since the staff was less certain that sufficient excessive conservatisms in the original fatigue calculations could be removed to account for an additional 20 years of operation for renewal, the staff recommended in SECY-95-245, "Completion of The Fatigue Action Plan," that the samples in NUREG/CR-6260 should be evaluated to consider environmental effects for license renewal.

GSI-190, "Fatigue Evaluation of Metal Components for 60-year Plant Life," was established to address the residual concerns of GSI-78 and GSI-166 regarding the environmental effects on fatigue of pressure boundary components for 60 years of plant operation. The scope of GSI-190 included design basis fatigue transients. It studied the probability of fatigue failure and its effect on core damage frequency (CDF) of selected metal components for 60-year plant life.

GSI-190 was closed in December 1999 and concluded that environmental effects have a negligible impact on core damage frequency, and as such, no generic regulatory action is required. However, as part of the closure of GSI-190, NRC concluded that licensees who apply for license renewal should address the effects of coolant environment on component fatigue life as part of their aging management programs.

An analysis must satisfy all six criteria defined in 10 CFR 54.3 to qualify as a TLAA. Failure to satisfy any one of these criteria eliminates the analysis from further consideration as a TLAA. Fatigue design analysis for BVPS has been determined to be a TLAA, even though the design limits are based on cycles rather than an explicit time period.

However, reactor water environmental effects, as described in GSI-190, are not included in the current licensing basis (CLB), such that the criterion specified in 10 CFR 54.3(a)(6) is not satisfied. Nevertheless, environmental effects on Class 1 component fatigue have been evaluated to determine if any additional actions are required for the period of extended operation.

FENOC has performed a plant-specific evaluation of reactor water environmental effects for the reactor coolant system (RCS) components identified within NUREG/CR-6260 for the older Westinghouse plant for BVPS Unit 1 and the RCS components identified within NUREG/CR-6260 for the newer Westinghouse plant for BVPS Unit 2 [40]. These calculations have utilized the appropriate $F_{en}$ relationships from NUREG/CR-6583 (for carbon/low alloy steels) and NUREG/CR-5704 (for stainless steels), as appropriate for the material for each location.

Plant-specific stress report fatigue calculations are available for the BVPS Unit 1 NUREG/CR-6260 reactor pressure vessel locations and for the BVPS Unit 2 NUREG/CR-6260 reactor pressure vessel and piping locations. However, because strain rate information is not available,

the material-specific worst-case $F_{en}$ multipliers were calculated for each location to apply to the total fatigue CUF values. The resulting EAF CUF values are determined using the worst-case $F_{en}$ multipliers. For the BVPS Unit 1 NUREG/CR-6260 piping locations, plant-specific stress report fatigue calculations were not available because the B31.1 design code did not require a fatigue analysis. Further piping analysis was performed for these locations to determine the fatigue usage.

Discussions with the NRC staff have indicated that detailed, vintage-specific, fatigue calculations are required for plants applying for license renewal for the locations identified in NUREG/CR-6260. For Beaver Valley Unit 1 (BVPV Unit 1), the older vintage Westinghouse plant is the appropriate comparison, and for Beaver Valley Unit 2 (BVPS Unit 2), the newer vintage Westinghouse plant is the appropriate comparison. Therefore, BVPS performed detailed environmentally-assisted fatigue calculations for the locations associated with the older and newer vintage Westinghouse plants using the appropriate $F_{en}$ relationships from NUREG/CR-6583 (for carbon/low alloy steel associated with the RPV locations), or NUREG/CR-5704 (for stainless steel associated with the piping locations), as appropriate for the material for each location.

The locations identified in NUREG/CR-6260, and the corresponding locations for BVPS Unit 1 and BVPS Unit 2 are identified in the Tables 4.3-3 and 4.3-4, respectively. A diagram of the piping locations for BVPS Unit 1 is shown in Figure 4.3-1 and a diagram of the piping locations for BVPS Unit 2 is shown in Figure 4.3-2.

The license renewal position is that the environmental fatigue usage is applicable to the 20-year extended operating period only and is not part of the current Licensing Basis (CLB), so the cumulative fatigue usage values resulting from the design-basis or special fatigue analysis presented herein are considered 60-year values.

To determine the environmental fatigue usage for each of the RPV and piping analysis locations, the cumulative fatigue usage values were multiplied by the $F_{en}$ for the particular location. Table 4.3-5 shows a summary of the results for the BVPV Unit 1 locations and Table 4.3-6 shows a summary of results for the BVPS Unit 2 locations.

## Table 4.3-3 Beaver Valley Unit 1 NUREG/CR-6260 Locations

| Location Number | Component | Location Name [NUREG/CR-6260] | Material [NUREG/CR-6260] | Comments |
|---|---|---|---|---|
| 1-1 | Reactor Pressure Vessel (RPV) | Shell and Lower Head | Low Alloy Steel | The NUREG/CR-6260 location is on the inside surface of the lower head near the shell-to-head transition, where core support guides are welded to the interior of the shell. |
| 1-2 | | Inlet Nozzle | Low Alloy Steel | The inlet nozzle is protected from the coolant by a layer of stainless steel cladding. |
| 1-3 | | Outlet Nozzle | Low Alloy Steel | The outlet nozzle is protected from the coolant by a layer of stainless steel cladding. |
| 1-4 | Surge Line | Hot Leg Nozzle Safe End | Stainless Steel | The NUREG/CR-6260 location is at hot leg nozzle safe end. |
| 1-5 | Charging Nozzle | Nozzle | Stainless Steel | The NUREG/CR-6260 location is at the end of the thermal sleeve. Figure 1, Location A. |
| 1-6 | Safety Injection Nozzle | Nozzle | Stainless Steel | The NUREG/CR-6260 location is at the nozzle to -safety injection piping weld. Figure 1, Location B. |
| 1-7 | RHR Line | Tee | Stainless Steel | The NUREG/CR-6260 location is at the tee junction of the Accumulator Tank line and the Cold Leg. Figure 1, Location C. |

## Table 4.3-4 Beaver Valley Unit 2 NUREG/CR-6260 Locations

| Location Number | Component | Location Name [NUREG/CR-6260] | Material {NUREG/CR-6260] | Comments |
|---|---|---|---|---|
| 2-1 | Reactor Pressure Vessel (RPV) | Lower Head to Shell Juncture | Low Alloy Steel | The NUREG/CR-6260 location is at the lower head at the shell-to-head transition. |
| 2-2 | | Inlet Nozzle | Low Alloy Steel | The inlet nozzle is protected from the coolant by a layer of stainless steel cladding. |
| 2-3 | | Outlet Nozzle | Low Alloy Steel | The outlet nozzle is protected from the coolant by a layer of stainless steel cladding. |
| 2-4 | Surge Line | Hot Leg Nozzle | Stainless Steel | The NUREG/CR-6260 location is the hot leg nozzle near the safe-end-to-piping transition. |
| 2-5 | Charging Nozzle | Nozzle | Stainless Steel | The NUREG/CR-6260 location is near the knuckle region thermal sleeve. Figure 2, Location A. |
| 2-6 | Safety Injection Nozzle | Nozzle | Stainless Steel | The NUREG/CR-6260 location is the boron injection tank (BIT) nozzle near the knuckle region. Figure 2, Location B. |
| 2-7 | RHR Line | Inlet Transition | Stainless Steel | The NUREG/CR-6260 location is the inlet piping transition. Figure 2, Location C . |

Figure 4.3-1. Beaver Valley Unit 1 NUREG/CR-6260 Piping Locations

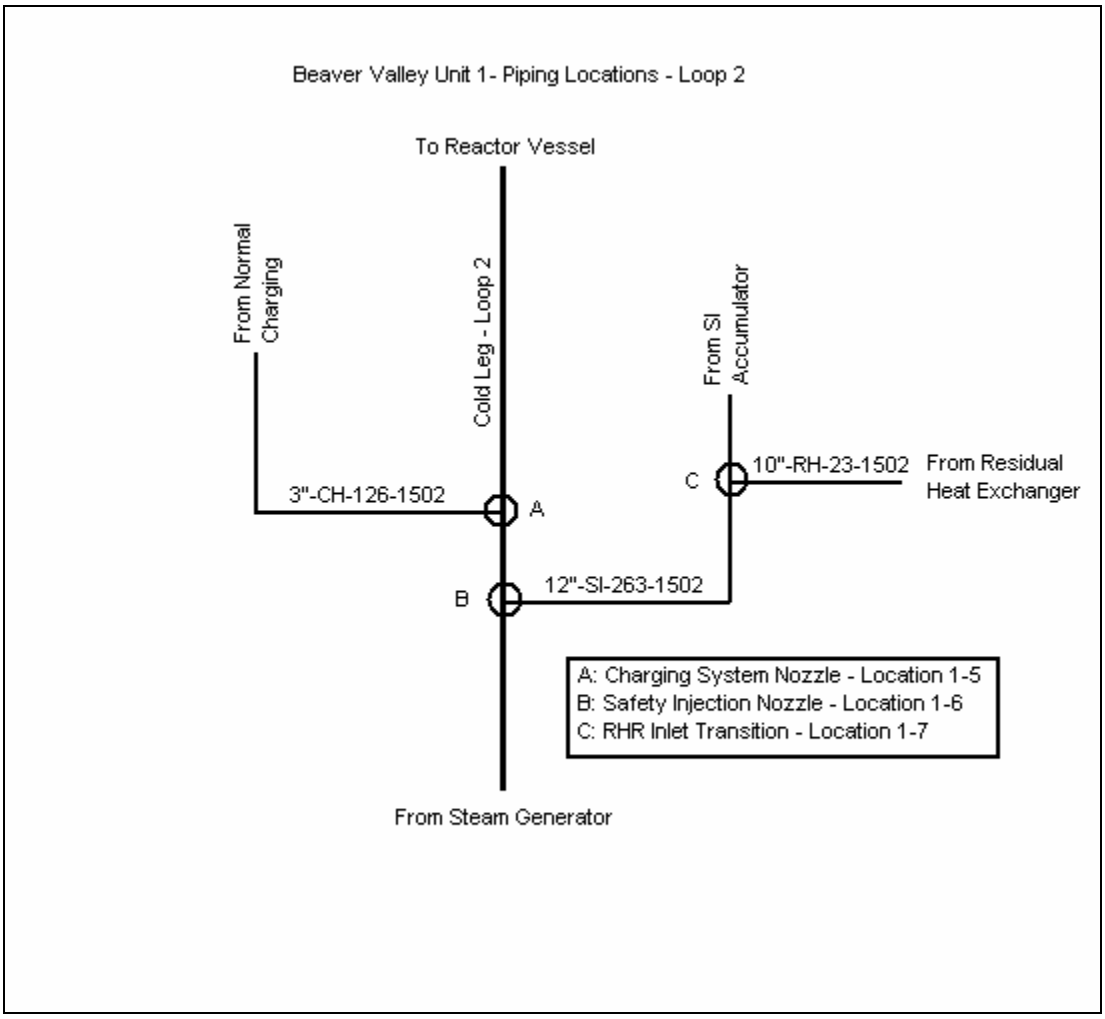

Figure 4.3-2. Beaver Valley Unit 2 NUREG/CR-6260 Piping Locations

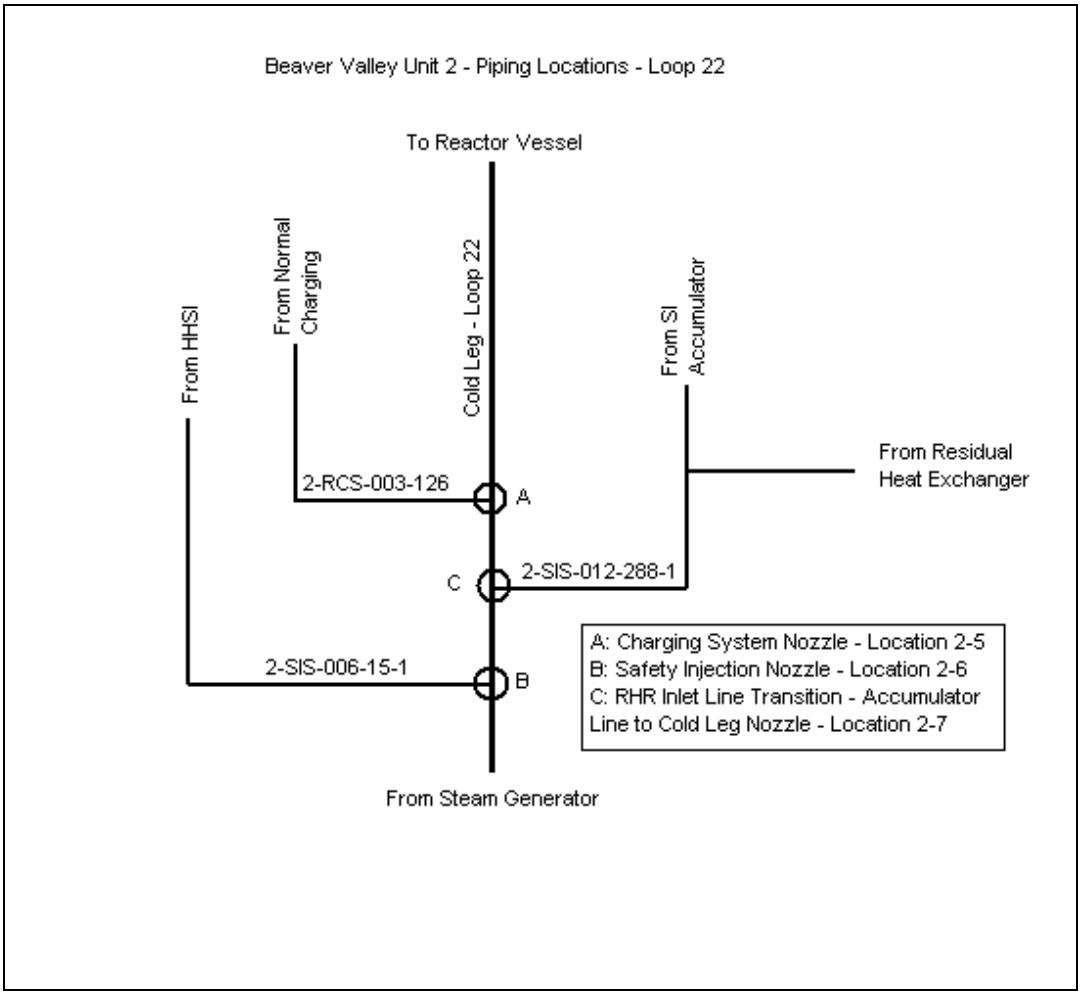

**Table 4.3-5 Summary of BVPS Unit 1 EAF Results**

| No. | Component | Material Type | Design CUF | Multiplier | Environmental CUF | P/F |
|---|---|---|---|---|---|---|
| 1-1 | RPV Shell and Lower Head Transition | Low Alloy Steel | 0.0102 | 2.53 | 0.0258 | Pass |
| 1-2 | RPV Inlet Nozzle | Low Alloy Steel | 0.0663 | 2.53 | 0.1679 | Pass |
| 1-3 | RPV Outlet Nozzle | Low Alloy Steel | 0.0508 | 2.53 | 0.1286 | Pass |
| 1-4 | Surge Line Hot Leg Nozzle Safe End | Stainless Steel | 0.7500 | 15.35 | 11.5125 | Fail |
| 1-5 | Charging System Nozzle | Stainless Steel | 0.1271 | 15.35 | 1.951 | Fail |
| 1-6 | Safety Injection Nozzle | Stainless Steel | 0.0121 | 15.35 | 0.1857 | Pass |
| 1-7 | RHR Line | Stainless Steel | 0.0087 | 15.35 | 0.1335 | Pass |

**Table 4.3-6 Summary of BVPS Unit 2 EAF Results**

| No. | Component | Material Type | Design CUF | Multiplier | Environmental CUF | P/F |
|---|---|---|---|---|---|---|
| 2-1 | Lower Head to Shell Juncture | Low Alloy Steel | 0.0016 | 2.53 | 0.0041 | Pass |
| 2-2 | RPV Inlet Nozzle | Low Alloy Steel | 0.0891 | 2.53 | 0.2256 | Pass |
| 2-3 | RPV Outlet Nozzle | Low Alloy Steel | 0.0601 | 2.53 | 0.1522 | Pass |
| 2-4 | Surge Line Hot Leg Nozzle | Stainless Steel | 0.6800 | 15.35 | 10.4380 | Fail |
| 2-5 | Charging System Nozzle | Stainless Steel | 0.7500 | 15.35 | 11.5125[(a)] | Fail |
| 2-6 | Safety Injection Nozzle | Stainless Steel | 0.0149 | 15.35 | 0.229 | Pass |
| 2-7 | RHR Line Inlet Transition - Nozzle | Stainless Steel | 1.0305 | 15.35 | 15.818 | Fail |

(a) The location analyzed differs from the NUREG/CR-6260 location. The NUREG specifies the charging system nozzle location as near the knuckle region protected by the thermal sleeve. The analysis for this location was not available. The location analyzed is the pipe-to-thermal sleeve weld connection, which is beyond the nozzle safe end region and is therefore not representative of the location specified in NUREG/CR-6260. The CUF at the actual NUREG/CR-6260 is expected to be much lower than the CUF at the reported location.

For BVPS Unit 1, the environmentally-assisted fatigue cumulative usage factor for the following NUREG/CR-6260 locations is less than 1.0:

- RPV Shell and Lower Head Transition
- RPV Inlet Nozzle
- RPV Outlet Nozzle
- Safety Injection Nozzle
- RHR Line

For BVPS Unit 1, the environmentally-assisted fatigue cumulative usage factor for the following NUREG/CR-6260 location is greater than 1.0:

- Surge Line Hot Leg Nozzle Safe End
- Charging System Nozzle

For BVPS Unit 2, the environmentally assisted fatigue cumulative usage factor for the following NUREG/CR-6260 locations is less than 1.0:

- Lower Head to Shell Juncture
- RPV Inlet Nozzle
- RPV Outlet Nozzle
- Safety Injection Nozzle

For BVPS Unit 2, the environmentally assisted fatigue cumulative usage factor for the following NUREG/CR-6260 locations is greater than 1.0:

- Surge Line Hot Leg Nozzle
- Charging System Nozzle
- RHR Line Inlet Transition Nozzle

The locations evaluated with projected CUF greater than 1.0 require further evaluation for the period of extended operation. For the locations with projected CUF greater than 1.0, more detailed stress analyses or fatigue monitoring and cycle counting would have to be used to reduce CUF below 1.0. FENOC has selected aging management to address these locations during the period of extended operation, in lieu of performing additional analyses to refine the fatigue usage factors. Due to conservatisms included in the ASME Code, a CUF of greater than 1.0 does not mean that fatigue cracking will occur; only that there is a potential for fatigue cracking to occur over the period of extended operation. Utilizing these conservatisms, an approach will be developed to manage the effects of environmentally assisted fatigue for those specific locations with a CUF greater than 1.0. The expected approach is to manage these effects through the use of an inspection program. The program would be expected to include, for example, periodic non-destructive examinations. The necessity of any potential repair or replacement activities would be based upon the inspection results.

Inspection details such as scope, qualification, method, and frequency will be provided to the NRC prior to entering the period of extended operation. The FENOC position to address the effects of environmentally assisted fatigue meets the requirements specified in the NRC closure of GSI-190. The position takes a proactive approach by performing examinations of the locations most sensitive to the effects of environmental fatigue. Inspection of fatigue sensitive locations provides reasonable assurance that potential environmental effects of fatigue will be managed such that components within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

### 4.3.3 Pressurizer Surge Line Thermal Stratification Analysis

Thermal stratification in the Pressurizer Surge Line is the direct result of differences in density between the pressurizer water and the generally cooler hot leg water. The lighter pressurizer water tends to float on the cooler, heavier hot leg water. The potential for stratification is

increased as the difference in temperature between the pressurizer and the hot leg increases and as the insurge or outsurge flowrate decreases.

The pressurizer surge line has been qualified for the cyclical effects of thermal stratification in conjunction with the design transients (the most relevant data are those associated with heatup and cooldown cycles) as specified in Table 4.3-1. These qualifications were performed as a result of NRC Bulletin No. 88-11 [4] and are documented in "Evaluation of Thermal Stratification for the Beaver Valley Unit 1 Pressurizer Surge Line," WCAP-12727, Westinghouse Electric Corporation [5], and "Evaluation of Thermal Stratification for the Beaver Valley Unit 2 Pressurizer Surge Line," WCAP-12093, Westinghouse Electric Corporation [6].

Review of the detailed plant specific fatigue analyses indicates that the surge line fatigue life is dependent upon the number of operational heatup and cooldown cycles, rather than the years of operation. Therefore, based on the current understanding of the thermal stratification phenomenon, it is concluded that thermal stratification has a limited impact on the integrity of the pressurizer surge line and will not change the conclusions drawn from that of the operational heatup and cooldown cycle evaluation.

FENOC has reverified the existing cycle counts for the current design/licensing basis transient set for each unit and projected these results to the end of the period of extended operation [54]. Based on these projections, the pressurizer surge line thermal stratification evaluations / conclusions will remain valid for 60 years. To confirm these projections, BVPS will incorporate cycle counting activities into the Fatigue Monitoring Program. Also, due to the complexity of the loads caused by thermal stratification, the pressurizer surge line will undergo additional evaluation and/or monitoring to augment the cycle counting to demonstrate long-term structural acceptability (see section 4.3.1 for additional information).

Therefore, for the pressurizer surge line thermal stratification analysis for the BVPS Units, it is demonstrated that the effects of aging on the intended function will be adequately managed for the period of extended operation per 10 CFR 54.21(c)(1)(iii).

### 4.3.4 Reactor Vessel Underclad Cracking

Underclad cracking is associated with the reactor pressure vessel. The industry has reported cracking in the low-alloy base metal heat-affected zone (HAZ) beneath the austenitic stainless steel weld overlay that is deposited to protect the ferritic material from corrosion. A detailed analysis of underclad cracks was provided by Westinghouse.[34] This report justified the continued operation of Westinghouse plants for 32 effective full power years with underclad cracks in the vessel. A re-evaluation of the underclad cracking issue for 60 years of plant operation was performed in WCAP-15338[7] and concluded that “underclad cracks in a reactor vessel are of no concern relative to the structural integrity of the vessel for continued plant operation, even through 60 years of operation.” The NRC reviewed WCAP-15338 and included two applicant action items to verify that a plant is bounded by the report evaluation and that the TLAA be described in the plant UFSAR supplement.

WCAP-15338 is bounding for all Westinghouse plants and the Underclad Cracking TLAA is described in the UFSAR supplement. Therefore, the two applicant action items have been resolved. The analysis associated with reactor vessel underclad crack growth has been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

### 4.3.5 Criteria for B31.1 Systems

The design code for the Reactor Coolant System (RCS) and other piping at BVPS Unit 1 is ANSI B31.1 [46] and for Unit 2 is ASME III. Additionally, BVPS Unit 2 has some piping designed to ASME Section III, Class 2 or Class 3, and ANSI B31.1 requirements. ANSI B31.1 and ASME Section III Class 2 and 3 account for fatigue by means of conservatively determined stress range reduction factors that vary based on the expected number of full-range thermal cycles. For up to 7000 equivalent full-range thermal cycles, the applicable stress range reduction factor is 1.0.

While no explicit calculations or analyses meeting the definition of a TLAA were identified for this issue, the fatigue of these components will conservatively be treated as a TLAA. The 7000 cycle limit could only be reached if the piping system endured the equivalent of a full temperature cycle approximately once every 3 days.

Practical experience with plant operation has demonstrated that the design cycle limit will generally not be reached during the period of extended operation. In addition, WCAP -16173 determined the number of cycles accumulated to date for portions of several BVPS piping systems designed to B31.1 or ASME Section IIII Class 2 or 3, and projected these cycles for a 60-year operating life [54]. All the systems with the exception of the BVPS Unit 1 CVCS system charging and letdown lines were projected to accumulate less than 7000 cycles for a 60-year operating life. The BVPS Unit 1 CVCS charging and letdown lines current cycle count exceeds 7000 cycles. The CVCS system has been included in the fatigue monitoring program as indicated in Table 4.3-2.

The existing analyses will remain valid through the period of extended operation for all applicable systems, with the exception of the CVCS charging and letdown lines. Therefore, for the ANSI B31.1 and ASME Section III Class 2 and 3 analyses for the BVPS systems, with the noted exception, it is demonstrated that the analyses remain valid for the period of extended operation per 10 CFR 54.21(c)(1)(i). For the BVPS Unit 1 CVCS charging and letdown lines, the effects of fatigue will be adequately managed during the period of extended operation per 10 CFR 54.21 (c)(1)(iii).

### 4.3.6 Motor Operated Valve Fatigue

Calculations have been performed for certain Motor Operated Valves (MOV) at both Units to validate desired operational thrust load requirements. These calculations involve fatigue analyses. The valve components evaluated include; valve stem, valve disc and valve yoke. The calculations for these valve component parts evaluate the desired thrust loading, and then determine the allowable mechanical cycles for the applicable material from the ASME Section III Code design fatigue S-N curve for the resultant alternating stress [53]. A Cumulative Usage Factor (CUF) was then calculated to assess the subject valve components projected life. For the

calculations associated with the Unit 1 fatigue analyses, a conservative number of valve cycles was used based on the projected operation of the valve over a 40-year plant life. These Unit 1 calculations are considered to qualify as TLAAs. For the calculations associated with the Unit 2 fatigue analyses, the number of operational cycles was not dependent upon the 40-year life of the plant. These Unit 2 motor operated valves are subjected to a managed program for monitoring and implementing required maintenance activities based on actual operational cycles. These Unit 2 motor operated valves are considered to not qualify as TLAAs. BVPS will update the Unit 1 calculations, which are currently evaluated for the 40-year life of the plant, to consider the projected cycles for a 60-year plant life, prior to the period of extended operation. The original methodology will be used in the re-analyses to evaluate the component parts for the 60-year life of the plant. In the event calculational results are not acceptable, BVPS will replace the affected components prior to the period of extended operation. Therefore, the MOV Fatigue calculations for BVPS Unit 1 will be demonstrated to be projected to the end of the period of extended operation per 10CFR54.21(c)(1)(ii), or the effects of cyclic operation on the intended functions(s) will be adequately managed for the period of extended operation.

## 4.4 ENVIRONMENTAL QUALIFICATION (EQ) OF ELECTRICAL EQUIPMENT

10 CFR 50.49 requires that certain safety related and non-safety related electrical equipment remain functional during and after identified Design Basis Events (DBEs). For the period of extended operation, EQ is a TLAA affecting all equipment in the scope of the EQ program with a qualified life equal to or longer than the original license period, whether active or passive.

All operating nuclear power plants must meet the requirements of 10 CFR 50.49 for certain electrical equipment important to safety. 10 CFR 50.49 defines the scope of equipment to be included, requires the preparation and maintenance of a list of in-scope equipment, and requires the preparation and maintenance of an auditable qualification file that includes equipment performance specifications, electrical characteristics, and the potential service conditions to which the equipment could be subjected.

The BVPS Environmental Qualification (EQ) Program manages the effects of aging for Class 1E equipment located in harsh or potentially harsh areas due to enviromental conditions such as temperature, pressure, humidity, radiation, chemicals, and submergence. As required by 10 CFR 50.49, EQ equipment not qualified throughout the current operating license term is to be refurbished, replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation.

To establish reasonable assurance that the equipment can survive when exposed to postulated harsh environmental conditions, licensees are required to determine the equipment's qualified life and to develop a program that maintains the qualification of that equipment. Environmentally qualified equipment is refurbished or replaced as required, with qualified new equipment, prior to the end of its qualified life. Preventive maintenance or equipment replacement necessary for qualification is scheduled and performed under the program.

Determining qualified lives is an ongoing activity that considers both normal and accident operating environments. When required by ongoing analyses of updated or revised test data, accident profiles, or normal operating environments, qualified life re-evaluations are performed under the current EQ Program. This will continue during the period of extended operation and appropriate changes will be implemented as required by evolving regulatory requirements.

Applicants for license renewal must also address Generic Safety Issue (GSI) 168, "Environmental Qualification of Electrical Equipment." GSI-168 has been recently resolved by issuance of Regulatory Issue Summary (RIS) 2003-09. The RIS recommends:

"For license renewal, a reanalysis (based on the Arrhenius methodology) to extend the life of the cables by using the available margin based on a knowledge of the actual operating environment, coupled with observations of the condition of the cables during walkdowns, was found to be an acceptable approach."

BVPS intends to implement this approach. When required by ongoing analyses of updated or revised test data, accident profiles, or normal operating environments, qualified life re-evaluations will be performed under the current EQ Program.

As part of the CLB, the EQ Program will provide for extension of the qualification, as required, to the end of the period of extended operation. Program revisions will be made as appropriate to accommodate changes to the licensing basis, regulatory requirements, and resolutions of generic safety issues. Therefore, the effects of aging on components included in the Environmental Qualification Program will be adequately managed in accordance with 10 CFR 54.21 (c)(1)(iii).

## 4.5 CONCRETE CONTAINMENT TENDON PRESTRESS ANALYSIS

The BVPS Containments do not make use of prestressing tendons; therefore, there are no TLAAs pertaining to this section.

## 4.6 CONTAINMENT LINER PLATE, METAL CONTAINMENTS, AND PENETRATIONS FATIGUE ANALYSIS

The interior surface of the concrete containment structure is a continuous steel membrane, supported by and anchored to the inside of the containment structure. Its function is to act as a gas-tight membrane.

The steel liner is not considered as making any contribution to the structural integrity of the containment shell. However, the resultant composite action due to the anchorage of the steel liner to the concrete shell does contribute, and adds to the conservatism of the containment design. The liner is designed for loads encountered under normal, test, severe operational, and emergency conditions including loads including dead weight, thermal, pressure and earthquake loads.

All welded seams in the mat, cylindrical liner wall, hemispherical dome, and liner penetrations are covered with continuously welded test channels (except for two at Unit 1 that had the channels removed and protective coating applied in 1982), which may be pressurized to containment design pressure to permit inspecting and testing the leaktightness of the covered areas. All bolted closures are double gasketed with means provided for introducing a pressurized halogen gas between the gaskets so that the closures may be examined for leaks, using a halogen gas detector.

Fatigue of the liner plates is considered in the design, based on an assumed number of loading cycles for the current operating term. The cyclic loads include reactor building interior temperature variation during the heatup and cooldown of the reactor coolant system, and the differential pressure between operating and atmospheric pressure. [13, 15]

### 4.6.1 Containment Liner Plate and Penetrations Fatigue Analysis

The liner plate and penetrations are designed to resist all loads anticipated during normal, test, severe operational, and emergency conditions and accommodate deformation of the concrete containment without jeopardizing leaktight integrity. [11, 12, 13 15] There are two load combinations analyzed for the containment liner plate for which a certain number of cycles are anticipated based on the current operating term. [13, 15] One hundred cycles of loading due to the differential pressure between operating and atmospheric pressure are anticipated on the basis of 2.5 refueling cycles per year on a 40-year span. Four hundred cycles of loading due to thermal expansion resulting when the liner is exposed to the differential temperature between operating and seasonal refueling temperatures are anticipated on the basis of 10 such variations per year on a 40 year span. However, the actual numbers of cycles used in the design analysis for the liner plate are 1000 and 4000, respectively for the pressure and temperature transients.[48,49]

The load combinations for the penetrations do not consider any number of cycles; therefore, the calculations and analyses for the penetrations do not constitute TLAAs.[13, 15]

For the temperature transient, since it is defined by the NSSS operational transient, the actual cycles will be bounded by the two hundred cycles of heatups and cooldowns for the NSSS (see Section 4.3.1). The pressure transient, however, is not strictly defined in relation to the NSSS operational transient, but since, operationally, Tech Specs require shutting down if the containment partial pressure approaches atmospheric[50], the pressure transient can be considered bounded, because the actual number of occurrences (less than or equal to 200) will be much lower than the number of design pressure cycles (1000).

The number of heatups and cooldowns will not be changed for the period of extended operation (see Section 4.3.1). Therefore, for the Containment Liner Fatigue analysis for the BVPS Units, it is demonstrated that the analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

### 4.6.2 Containment Liner Test Channels Corrosion Analysis

The design of the reactor containment provides access to all important areas for periodic inspection. The design includes the placement of leak test channels over most liner seam welds, which are inaccessible after construction, and penetration-liner welds. These channels are not considered as safety related, however, they may be pressurized to containment design pressure to permit inspecting and testing the leaktightness of the covered areas.

A condition involving missing vent plugs on the test channels was evaluated, and the predicted corrosion rate of the containment liner over the life of the plant was calculated. In the Safety Evaluation Report (SER) provided by the Nuclear Regulatory Commission (NRC),[1] two evaluations [16,17] titled "Containment Liner Test Channels at Beaver Valley Power Station" were used to make the determination that the corrosion rates inside the test channels with missing vent plugs are not large enough to significantly degrade the containment. NRC approval of the amendments was based, in part, on an expected worst case corrosion rate of 88 mils over a forty-year lifetime.

After further evaluation, it was concluded that the above referenced reports contained some non-conservative assumptions with regard to the effect of electrolyte oxygen concentration on the corrosion rates in the test channels. Therefore, BVPS took corrective action to arrest the corrosion rate in the affected test channels, including inerting and sealing the test channels. This significantly reduced the theoretical corrosion rates in the channels. Projecting the revised corrosion rates in a simple linear fashion for the period of extended operation would result in remaining liner plate thickness within the calculated liner minimum wall thickness. [18, 37,38,39]

Therefore, for the test channels corrosion analysis, it is demonstrated that the analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

### 4.6.3 Fuel Transfer Tube Bellows

The BVPS Unit 1 fuel transfer tube bellows assemblies are designed in accordance with ANSI B31.1. B31.1 accounts for fatigue by means of conservatively determined stress range reduction factors that vary based on the expected number of full-range thermal cycles. For up to 7000 equivalent full-range thermal cycles, the applicable stress range reduction factor is 1.0. The 7000 cycle limit could only be exceeded if the bellows assemblies endured the equivalent of a full cycle approximately once every 3 days. Since these assemblies are typically cycled during refueling operations, they will see pressure and temperature cycles much more infrequently than this over a plant life extending to 60 years. Therefore, for the Unit 1 fuel transfer tube bellows assemblies, it is demonstrated that the analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The BVPS Unit 2 fuel transfer tube bellows assemblies are designed, fabricated, and code stamped ASME III, Class MC. Design calculations indicate that the fatigue limit was determined to be "> 7000 cycles."[52] The 7000 cycle limit could only be exceeded if the bellows assemblies endured the equivalent of a full cycle approximately once every 3 days. Since these

assemblies are typically cycled during refueling operations, they will see pressure and temperature cycles much more infrequently than this over a plant life extending to 60 years. Therefore, for the Unit 2 fuel transfer tube bellows assemblies, it is demonstrated that the analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

## 4.7 PLANT SPECIFIC TLAA

This section deals with the following plant-specific safety analyses that are time-limited aging analyses (TLAAs):

- Crane Fatigue
  - Polar Crane
  - Fuel Handling Crane
  - Spent Fuel Crane
- Reactor Coolant Pump Flywheel
- Leak Before Break (LBB) and Thermal Aging Embrittlement of Cast Austenitic Stainless Steel
- Settlement of Structures

### 4.7.1 Crane Fatigue

The BVPS Unit 1 Polar Crane is designed in accordance with EOCI-61, which does not address fatigue; therefore, this is not a TLAA for Unit 1 [19].

The BVPS Unit 2 Polar Crane is designed in accordance with CMAA-70[8]. CMAA-70, Article 3.3.3.1.3 provides guidance with respect to fatigue failure by indicating allowable stress ranges for various structural members in joints under repeated loads[20].

The most limiting number of load cycles to be assumed in the crane design required by CMAA-70 is 100,000 cycles. This corresponds to 1,667 lifts per year at the rated load over a sixty year period. The polar crane will perform only a limited number of lifts throughout the design life of the plant, and will not remotely approach this usage rate.

Therefore, the fatigue analysis of the Polar Crane for BVPS Unit 2 is demonstrated to remain valid for the period of extended operation in accordance with 10 CFR 54.21 (c)(1)(i).

Two other cranes at each Unit are designed to the requirements of CMAA-70: the Fuel Handling Platforms and the Spent Fuel Cask Cranes.

The Fuel Handling Platforms handle each fuel assembly twice each refueling, accounting for 314 lifts. Rounding this number to 400 to account for the handling of new fuel, this will result in 16,000 lifts using an assumption of 40 refuelings over 60 years. This is well within the cycle limits established in CMAA-70.

The Spent Fuel Cask Cranes have not yet been used for a significant lift near their rated capacity, but may be used for their intended purpose sometime in the future. Conservatively assuming that 90 fuel assemblies are replaced during each of the 39 refuelings, and adding 157 assemblies that were loaded for the first cycle, there will have been a total of 3667 fuel assemblies discharged from the core to be shipped for final storage at the end of the period of extended operation. Assuming that the cranes will lift each spent fuel cask twice (once into the pool and once out of the pool), and assuming that only one fuel assembly is placed into each cask, 7334 shipping cask lifts will be required for each units' Spent Fuel Cask Crane. This total is much less than the 100,000 cycles assumed in CMAA-70.

Therefore, the fatigue analysis of the Fuel Handling Platforms and the Spent Fuel Cask Cranes is demonstrated to remain valid for the period of extended operation in accordance with 10 CFR 54.21 (c)(1)(i).

### 4.7.2 Reactor Coolant Pump Flywheel Analysis

The reactor coolant pump (RCP) ensures an adequate core cooling flow rate for sufficient heat transfer to maintain a departure from nucleate boiling ratio within the parameters of operation. Sufficient pump rotation inertia is provided by a flywheel, in conjunction with the pump and rotor assembly, to provide adequate flow during coastdown. This forced flow following an assumed loss of pump power and the subsequent natural circulation effect provides the core with adequate cooling. [22]

During normal operation, the RCP flywheel possesses sufficient kinetic energy to produce high energy missiles in the event of a failure. As consequence, Regulatory Guide 1.14 [23] recommends regular inservice inspections of flywheels.

Flywheels are subject to an inservice inspection program in accordance with the requirements of Section XI of the ASME Code, but the requirements have been relaxed based on the conclusions of WCAP-14535A [24].

The WCAP-14535A 60 year analysis is an extension of the original 40 year failure analysis. Since WCAP-14535A has extended the analysis from 40 to 60 years, and has been accepted via SER by the NRC for use at BVPS[43], it can be concluded that the TLAA for the Reactor Coolant Pump Flywheel analysis has been demonstrated to be projected for the period of extended operation in accordance with 10 CFR54.21(c)(1)(ii).

### 4.7.3 Leak Before Break Analysis and Thermal Aging Embrittlement of Cast Austenitic Stainless Steel

The concept of testing and analyzing crack growth to eliminate consideration of primary loop pipe breaks from plant design bases is termed "leak-before-break" (LBB). The focus of the evaluation is whether or not a postulated crack which is assumed to appear instantaneously in plant piping will become unstable and lead to a full circumferential break when subjected to the worst possible combinations of plant loading. A similar evaluation is performed to qualify

reactor coolant pump casings to ASME Code Case N-481, to allow alternative inspection requirements.

The plant has leakage detection systems that can identify a crack with margin and provide adequate warning to limit the final crack size. LBB evaluations have shown double-ended breaks of reactor coolant pipes are unrealistic and, as a result, the probability of large loss of coolant accident (LOCA) loads on primary system components has been reduced to an insignificant value.

The LBB piping evaluations for the BVPS Units are contained in WCAP-11317 [25] for Unit 1 and WCAP-11923 [26] for Unit 2, and the fracture toughness properties of thermally aged cast stainless steel materials are contained in WCAP-10456 [27] and WCAP-10931[28].

There are two TLAA aspects to LBB, crack growth and thermal aging embrittlement of cast austenitic stainless steel. The referenced analyses for the BVPS Units are based on the current license period.

BVPS has reevaluated the plant specific LBB piping analyses for both Units considering the period of extended operation[14]. In addition, the LBB analysis to qualify both BVPS Units' reactor coolant pumps for Code Case N-481 for the period of extended operation has been documented in WCAP-16243[45]. These evaluations, which considered both a 60-year fatigue life and thermal aging embrittlement effects of the CASS, concluded:

- The calculated saturation (fully aged) toughness properties are applicable for the period of extended operation and were used in the LBB analyses, and
- The 60 years transients and cycles are the same as those for 40 years (see section 4.3.1), so the fatigue crack growth remains valid for the period of extended operation.

The LBB conditions remain satisfied for both BVPS Units for the period of extended operation. Therefore, the LBB analyses and Thermal Aging Embrittlement of Cast Austenitic Stainless Steel for both BVPS Units have been demonstrated to be projected to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii).

### 4.7.4 Settlement of Structures

Predicted settlement values of plant structures are utilized in the design analysis to account for the resulting stresses induced in plant piping. Settlement assumptions based on projected 40 year settlement values constitute a TLAA.

Settlement at BVPS Unit 1 has essentially halted and is no longer a concern. Also, several Unit 2 settlement monitoring points have been discontinued due to the fact that settlement has essentially stopped and the value is less than predicted.

BVPS Unit 2 has one area of current concern for settlement. For the Unit 2 Valve Pit, the projected settlement has been revised, and the affected piping calculations updated, based on the trend of the actual measured settlement [30]. Based upon current extrapolation, this area will be

close to the value used in the piping analysis by the end of the current license period. If the license is renewed, and the settlement continues, the assumptions used in the piping analysis may become invalid. It is also possible that the settlement will arrest, and the total actual settlement will remain within the projected values, even through the period of extended operation. In this case, no additional actions will be required.

The current Unit 2 UFSAR commits BVPS to continue a Settlement Monitoring Program to assure that the settlement of safety related structures is monitored versus predicted settlement [29]. BVPS will continue the Settlement Monitoring Program on Unit 2 to verify that settlement (and the resulting pipe stress calculation assumptions) remain within the projected values. If the monitored settling continues such that the projected values may be exceeded, corrective actions such as reanalyzing the pipe stress, or physical modifications to arrest the settlement or reconfigure the pipe, will be evaluated.

Therefore, the effects of aging on components affected by assumptions derived from the Settlement Monitoring Program will be adequately managed for the period of extended operation in accordance with 10 CFR 54.21 (c)(1)(iii).

## 4.8 REFERENCES

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# A.1 Appendix A – UFSAR Supplement

## A.2 Introduction

This appendix provides the information to be submitted in an Updated Final Safety Analysis Report Supplement as required by 10 CFR 54.21(d) for the Beaver Valley Power Station, Units 1 and 2 License Renewal Application (LRA). The LRA contains the technical information required by 10 CFR 54.21(a) and (c). Appendix B of the LRA provides descriptions of the programs and activities that manage the effects of aging for the period of extended operation. The period of extended operation is that period authorized by the new license that is beyond the expiration date of the original license. Section 4 of the LRA documents the evaluations of time-limited aging analyses for the period of extended operation. These LRA sections have been used to prepare the program and activity descriptions for the BVPS Updated Final Safety Analysis Report (UFSAR) Supplement information in this Appendix. BVPS has a separate UFSAR for Unit 1 and Unit 2. Any information specific to only one unit is spelled out.

This Appendix is divided into two parts. The first part summarizes the programs and activities credited for aging management. The second part summarizes the analysis of TLAAs. The information presented in both parts will be incorporated into each Unit's UFSAR, as appropriate, following issuance of the renewed operating licenses. Upon inclusion of the UFSAR Supplement in the UFSARs, future changes to the descriptions of the programs, activities, and TLAAs will be made in accordance with 10 CFR 50.59.

The information in this Appendix is not intended to reduce or supercede any commitments.

### A.2.1 Aging Management Programs and Activities

The integrated plant assessment for license renewal identified aging management programs necessary to provide reasonable assurance that components within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis (CLB) for the period of extended operation. This section describes the aging management programs and activities that will be required during the period of extended operation. The FENOC Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls, and is applicable to the aging management programs credited for license renewal including programs for safety-related and non-safety-related structures, systems, and components.

#### A.2.1.1 10 CFR 50, Appendix J

(*UFSAR wording for Unit 1*)

The 10 CFR 50, Appendix J Program monitors leakage rates through the containment pressure boundary in order to detect age-related degradation of the primary containment pressure boundary components. Containment leak rate tests are performed as described in Section 5.6, Containment Leakage Rate Tests.

(*UFSAR wording for Unit 2*)

The 10 CFR 50, Appendix J Program monitors leakage rates through the containment pressure boundary in order to detect age-related degradation of the primary containment pressure boundary components. Containment leak rate tests are performed as described in Section 6.2.6.

### A.2.1.2 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD

The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program provides the requirements for inservice inspection, repair, and replacement for all Class 1, 2 and 3 components. The program also includes the requirements for Class 1, 2, and 3 components and component supports, as provided in ASME Section XI, Subsection IWF. Periodic visual, surface, and/or volumetric examinations are directed by the program to manage component cracking, loss of material, loss of fracture toughness, and loss of pre-load. The program is implemented in accordance with 10 CFR 50.55a(g).

### A.2.1.3 ASME Section XI, Subsection IWE

The ASME Section XI, Subsection IWE Program provides the inspection requirements for steel liners for concrete containments and their integral attachments, containment hatches and airlocks, seals, gaskets and moisture barriers and pressure-retaining bolting. The program includes visual and augmented inspections. Certain steel and stainless steel penetration components subject to thermal fatigue are also inspected for cracking. Elastomeric components, such as gaskets and seals, are visually inspected for evidence of degradation. The program also credits leak rate inspection and testing activities performed in accordance with 10 CFR 50 Appendix J. The program is implemented in accordance with 10 CFR 50.55a(g).

### A.2.1.4 ASME Section XI, Subsection IWL

The ASME Section XI, Subsection IWL Program provides the inspection requirements for the reinforced concrete of Class CC containments. The program relies primarily on visual examinations to assess the condition of the concrete portions of the containment structure and to detect evidence of concrete degradation, such as cracking, spalling, or evidence of reinforcing steel corrosion. The program also credits leak rate inspection and testing activities performed in accordance with 10 CFR 50 Appendix J. The program is implemented in accordance with 10 CFR 50.55a(g).

### A.2.1.5 Bolting Integrity

The Bolting Integrity Program manages age related degradation of all bolting within the scope of license renewal; including safety-related bolting, bolting for NSSS component supports, bolting for other pressure retaining components, and structural bolting. The program provides administrative guidance on bolting inspection techniques, material selection, strength and hardness properties, installation, lubrication and sealant selection, and corrosion considerations in the selection and installation of pressure retaining bolting for nuclear applications. Aging

management of pressure retaining and structural bolting is accomplished through routine inspections that are administered in other license renewal defined aging management programs. The program is implemented in accordance with the guidance contained in NUREG-1339 and EPRI NP-5769 (with exceptions noted in NUREG-1339). Additionally, the program incorporates the guidance for pressure retaining bolting and structural bolting contained in EPRI TR-104213.

### A.2.1.6 Boric Acid Corrosion

The Boric Acid Corrosion Program provides identification, trending, and remediation of any abnormal borated fluid leakage to prevent unacceptable degradation of pressure boundary components or other affected structures, systems, or components. The program implements the plant-specific commitments made in response to Nuclear Regulatory Commission (NRC) Generic Letter (GL) 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants." Program elements include walkdown inspections of principle locations that provide for timely detection of leakage, evaluations of areas identified with boric acid residue or material degradation, appropriate corrective actions, and follow-up confirmation inspections.

### A.2.1.7 Buried Piping and Tanks Inspection

The Buried Piping and Tanks Inspection Program manages the aging effects on buried piping and tanks by verifying the integrity of coatings and wrappings. Visual inspections are the primary means of detecting degradation. Buried piping and tanks will be inspected when they are excavated for any reason. Evaluations of inspection results will determine the need for follow-up inspections, and periodicity, if warranted. Additional inspections will be performed, if needed to ensure that the population of in-scope buried components is bounded.

### A.2.1.8 Closed-Cycle Cooling Water System

The Closed-Cycle Cooling Water System Program manages the aging effects in closed-cycle cooling water systems by maintaining corrosion inhibitor concentrations and other chemistry parameters within specified limits. EPRI TR-107396 is used as guidance for establishing chemistry limits and monitored parameters. Heat exchanger and pump performance data are periodically monitored and trended and opportune visual inspections of system internal surfaces are performed. These activities are used to assess the effectiveness of chemistry controls and to evaluate system and component performance in accordance with the EPRI guidance.

### A.2.1.9 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program manages cable and connection insulation materials within the scope of license renewal and not included in the EQ Program. Periodic visual inspections of accessible cables and connections installed in adverse localized environments are conducted to detect degradation (e.g. embrittlement, cracking, melting, discoloration or swelling) that could

lead to the loss of the intended function of the cable. An adverse localized environment (caused by heat, radiation, or moisture) is a condition in a limited plant area that is significantly more severe than the specified service environment for the cable.

### A.2.1.10 Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits

The Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program manages the aging of cable and connection insulation materials used in circuits with sensitive high voltage, low-level signals, in-scope for license renewal and not included in the EQ Program. Periodic testing of circuits with high voltage, low-level signals installed in adverse localized environments is conducted to detect degradation that could lead to the loss of the intended function of the cable.

### A.2.1.11 Electrical Transmission Tower Inspection

The Electrical Transmission Tower Inspection Program manages the aging of electrical transmission towers that are in-scope for license renewal. The program provides for inspections of wooden poles and steel (lattice towers and poles) structures to manage material loss, material degradation, and physical damage. Program monitoring and inspection activities ensure that in-scope structures retain their intended functions between inspection cycles.

### A.2.1.12 Environmental Qualification (EQ) of Electric Components

The Environmental Qualification (EQ) of Electric Components Program managescomponent thermal, radiation, and cyclical aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components 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. Aging evaluations for EQ components are considered time-limited aging analyses (TLAAs) for license renewal.

### A.2.1.13 Fire Protection

The Fire Protection Program provides aging management for fire barriers and penetration seals, fire dampers and doors, halon and carbon dioxide fire suppression systems, and the engine-driven fire pump fuel oil supply line. The program includes visual inspections, performance and functional testing, established acceptance criteria, and trending to ensure that operability is maintained and age related degradation is detected and managed for in-scope systems and components.

### A.2.1.14 Fire Water System

The Fire Water System Program provides aging management for water-based fire protection system components, such as sprinkler suppression systems, hydrants and hose stations, strainers, pumps, and aboveground and underground piping and valves. The program includes flow testing

and system performance testing in accordance with applicable NFPA codes and insurance carrier requirements to maintain operability and manage aging. Loss of material of system piping is primarily monitored and trended through periodic NDE volumetric examinations. Additionally, periodic chemical treatments of pre-determined piping sections are made to control and minimize MIC type corrosion. Silting and biofouling is managed by monitoring and control of system water quality during program surveillance activities and chemical treatment of system branches when determined necessary. Internal inspections are also performed and documented when the system is breached for maintenance or repair.

### A.2.1.15 Flow-Accelerated Corrosion

Flow Accelerated Corrosion (FAC) Program activities include analyses to determine susceptible locations, performance of baseline inspections for wall thickness, detection of wall-thinning, scheduling follow-up inspections, corrective actions, wear rate trending, and predictive modeling techniques. The program relies on the implementation of the EPRI guidance in NSAC-202L-R2.

### A.2.1.16 Flux Thimble Tube Examination

The Flux Thimble Tube Examination Program manages loss of material in the in-core flux thimble tubes through detection, trending, and monitoring of wall thinning resulting from wear. Inspection frequencies and corrective measures are based on examination results and wear rate projection and trending, which ensures that tube wall thickness is maintained above established acceptance criteria. The program is implemented in accordance with the guidance in NRC Bulletin 88-09.

### A.2.1.17 Fuel Oil Chemistry

The Fuel Oil Chemistry Program manages aging effects on the internal surfaces of fuel oil tanks and associated fuel oil system components. Fuel oil quality is monitored for water and contaminants in accordance with Technical Specification requirements and select American Society for Testing Materials (ASTM) Standards. Additionally, exposure to fuel oil contaminants, such as water and microbiological organisms, is minimized by verifying the quality of new oil before its introduction into the diesel-generator fuel oil storage tanks.

### A.2.1.18 Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

The Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program manages the aging effects of inaccessible medium-voltage cables that are not subject to the environmental qualification requirements of 10 CFR 50.49 and are exposed to adverse localized environments. All in-scope, medium-voltage cables exposed to significant moisture and significant voltage will be tested at least once every ten years to provide an indication of the condition of the conductor insulation. Periodic maintenance activities are also conducted to minimize or prevent the exposure of in-scope cables to significant moisture or standing water. The program also includes acceptance criteria, evaluation of unsatisfactory results, and appropriate corrective actions.

### A.2.1.19 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program manages the effects of general corrosion, wear, and cracking on the crane and trolley structural components for cranes within the scope of license renewal. Routine visual inspections are performed on crane rails and structural components to detect degradation and assure reliability. Functional tests are also performed to assure their integrity. Inspection requirements for overhead heavy load cranes are consistent with the guidance provided by BVPS response to NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants".

### A.2.1.20 Metal Fatigue of Reactor Coolant Pressure Boundary

The Metal Fatigue of Reactor Coolant Pressure Boundary Program monitors thermal and pressure transients that cause cyclic strains and significant fatigue usage for the reactor coolant pressure boundary. The program manages metal fatigue through cycle counting of plant transients as outlined in WCAP 16173-P. This guidance incorporates the consideration of NUREG/CR-6260 and outlines critical BVPS fatigue monitoring locations, as listed in Table 4.3-2 of the License Renewal Application. The program also manages Environmentally Assisted Fatigue (EAF) for locations, with usage factors greater than 1.0, through an inspection process. Acceptance criteria involve maintaining the fatigue usage factors below the allowable limits. Fatigue of in-scope components is evaluated as a Time-Limited Aging Analysis (TLAA) for license renewal.

### A.2.1.21 Nickel-Alloy Nozzles and Penetrations

The Nickel-Alloy Nozzles and Penetrations Program manages nickel-alloy components in a reactor coolant environment that are susceptible to primary water stress corrosion cracking (PWSCC). The program addresses industry concerns and operating experience and will assess component susceptibility to PWSCC. The program will facilitate any necessary augmented inspections based on the assessment results.

### A.2.1.22 One-Time Inspection

The One-Time Inspection Program is used to confirm the absence of age related degradation. The program intent is primarily focused on aging effects that meet the following criteria:

a. Aging effects are not expected to occur, but insufficient data exists to confirm this premise.
b. Aging effects have long incubation periods or are predicted to be progressing very slowly.
c. Aging effects are not adequately managed by an existing program or other program.

Appropriate inspections and NDE examination methods are performed on sample populations of components that are susceptible to age related degradation mechanisms. This sampling approach will be used to assess the aging of the remaining susceptible components.

The One-Time Inspection Program includes aging management activities for NUREG-1801 Aging Management Programs (AMP) Section XI.M35 (Draft AMP provided in Interim Staff Guidance (ISG)-12), "One-Time Inspection of Small Bore Piping", and Section XI.M33, "Selective Leaching of Materials."

### A.2.1.23 Open-Cycle Cooling Water System

The Open-Cycle Cooling Water System Program manages aging of system components for open-cycle cooling water systems. Program activities include monitoring and control of biofouling in raw water systems, visual inspections of system internal surfaces, flow testing of infrequently used cooling loops, and microbiologically influenced corrosion (MIC) reduction strategies. Safety related heat exchangers are cleaned and inspected, and tested for thermal performance as determined necessary, in accordance with GL 89-13. The program also monitors and trends pipe wall thickness to evaluate system corrosion and erosion rates.

### A.2.1.24 Periodic Surveillance and Preventive Maintenance

The Periodic Surveillance and Preventive Maintenance Program provides aging management for various in-scope SSCs and component aging groups. Periodic preventive and corrective maintenance activities and surveillance and test procedures perform visual inspections and tests that detect age related degradation and reinforce equipment reliability. The program includes acceptance criteria, evaluation of inspection and test results, trending for appropriate frequencies, and appropriate corrective actions.

### A.2.1.25 PWR Vessel Internals

The PWR Vessel Internals (RVI) Program supplements the inspection requirements of ASME Section XI, IWB Category B-N-3. The program manages the evaluation and inspection of wrought and cast austenitic stainless steel reactor vessel internals components that are subject to cracking due to stress corrosion cracking (SCC), irradiation assisted stress corrosion cracking (IASCC), loss of fracture toughness due to neutron embrittlement and void swelling, loss of preload due to stress relaxation, and change in dimensions due to void swelling. Additionally, for cast austenitic stainless steel (CASS) components only, the program manages evaluations and inspections for loss of fracture toughness due to thermal aging and neutron embrittlement. The program will include susceptibility evaluations to identify bounding locations for each degradation mechanism based on neutron fluence and stress. The susceptibility evaluations will aid in determining the population of locations or components of the RVI that require enhanced inspections. The program will also determine inspection techniques and inspection schedules for the enhanced inspections. Enhanced inspections will use visual or volumetric techniques based on the flaw size that must be detected and component accessibility. Acceptance criteria for

enhanced inspections will be based on flaw tolerance evaluations consistent with ASME Section XI.

FENOC supports development of improved industry data, models, and inspection methodologies through active participation in the EPRI Materials Reliability Program Reactor Vessel Internals Issue Task Group and the Westinghouse Owners Group.

### A.2.1.26 Reactor Head Closure Studs

The Reactor Head Closure Studs Program addresses the inservice inspection requirements for reactor vessel closure bolting, including inservice inspections to detect aging effects and Regulatory Guide (RG) 1.65 preventive measures to mitigate cracking. The program also details approved lubricants that minimize the potential for cracking.

### A.2.1.27 Reactor Vessel Surveillance

(*UFSAR wording for Unit 1*)

The Reactor Vessel Surveillance Program (RVSP) manages the aging of the reactor vessel. The program predicts changes in reactor vessel beltline material fracture toughness as described in Section 4.5.1.2, Irradiation Surveillance Program.

(*UFSAR wording for Unit 2*)

The Reactor Vessel Surveillance Program (RVSP) manages the aging of the reactor vessel. The program predicts changes in reactor vessel beltline material fracture toughness as described in Section 5.3.1.6, Material Surveillance.

### A.2.1.28 Settlement Monitoring Program (Unit 2 Only)

The Settlement Monitoring Program manages adverse piping stresses and deflections by monitoring the settlement of safety-related (Category 1) structures. The program monitors structure settling through field surveys of benchmarks and settlement markers located on structures within the program. Resulting data is evaluated and compared to original design assumptions, which are based on 40-year settlement values. This settlement, and associated piping deflections and imposed stresses, constitutes a time-limited aging analysis (TLAA) for license renewal (LR) at Unit 2. The program maintains settlement data and plots for selected plant structures throughout their design lifetime and will continue to verify that settlement, and the resulting pipe stress calculations, remain valid and within the projected design values. Corrective actions include reanalyzing pipe stresses and/or physical piping or structure modifications to arrest the settlement.

### A.2.1.29 Steam Generator Tube Integrity

The Steam Generator Tube Integrity Program manages loss of material, cracking, and other degradation mechanisms associated with steam generator tubes and other primary and secondary steam generator components. The program includes preventive measures, degradation assessments, inspections with established acceptance criteria, foreign material exclusion

practices, plugging and repair activities, and leakage monitoring of pressure boundaries. Monitoring and control of primary and secondary water chemistry is relied upon to mitigate material degradation. The program is based on the industry guidance in NEI 97-06, "Steam Generator Guidelines."

### A.2.1.30 Structures Monitoring

The Structures Monitoring Program manages age-related degradation of in-scope structures and structural components. The program assesses the condition of structures and structural components through detailed visual inspections that use established acceptance criteria. Groundwater chemistry is also monitored to ensure aggressive environments are not present for below ground structures. The program is based on the requirements and guidance set forth in 10 CFR 50.65 and includes structures and structural components that are within the scope of the Maintenance Rule and those additional structures identified to be within the scope of license renewal. The program also follows the guidance of Regulatory Guide (RG) 1.160 and NUMARC 93-01.

The program also manages the degradation of masonry block walls through detailed visual inspections using established acceptance criteria. The scope includes those walls credited for the evaluation basis developed in response to NRC IEB 80-11 and those walls identified to be within the scope of license renewal. The program is aligned with the guidance in NRC Information Notice (IN) 87-67.

### A.2.1.31 System Monitoring

The System Monitoring Program identifies age-related degradation through visual inspections of normally accessible, external surfaces of piping, tanks, and other components and equipment. The program also provides for timely detection of adverse conditions, or conditions that can lead to an aggressive environments, for components and equipment within the scope of license renewal. Inspection results are documented, evaluated, trended, and corrective actions implemented.

### A.2.1.32 Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)

The Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program manages thermal aging embrittlement of CASS components. The program relies on a 60-year Leak Before Break (LBB) analysis to assess and confirm that sufficient residual fracture toughness exists for the period of extended operation in thermally aged, CASS reactor coolant system components. The program also includes non-RCS CASS components that will be screened for susceptibility. If the material is found to be susceptible, the program will outline corrective actions and management options that include flaw tolerance evaluations, augmented inspections, or component replacement.

### A.2.1.33 Water Chemistry

The Water Chemistry Program mitigates the effects of aging by monitoring and controlling primary and secondary water chemistry, and other auxiliary system chemistry, within limits that are optimized in accordance with the guidelines in EPRI TR-105714 and TR-102134. These limits maintain detrimental contaminants and impurities, such as chlorides, fluorides, dissolved oxygen and sulfates, at concentrations below those which are known to result in loss of material and crack initiation and growth. The program includes specifications for chemical species, sampling and analysis frequencies, and corrective actions.

## A.2.2 Evaluation of Time-Limited Aging Analyses

### A.2.2.1 Reactor Vessel Neutron Embrittlement

There are four analyses affected by irradiation embrittlement that have been identified as TLAAs for BVPS:

Pressurized Thermal Shock (PTS)
Reactor Vessel Upper Shelf Energy
Pressure/Temperatures (P/T) Curves
Low Temperature Overpressure Protection (LTOP) Power Operated Relief Valve (PORV) Setpoints

This group of TLAAs concerns the effects of neutron embrittlement and how this mechanism affects analyses, limits, and programs that provide operating restrictions or support regulatory requirements for the reactor plant.

#### A.2.2.1.1 Pressurized Thermal Shock (PTS) Analysis

For PWRs, 10 CFR 50.61 requires that the reference temperature $RT_{PTS}$ for reactor vessel beltline materials be less than the stated PTS screening criteria at the expiration date of the operating license. The PTS screening criteria are 270 deg F for plates, forgings, and axial weld materials, and 300 deg F for circumferential weld materials. The regulations require updating of the PTS assessment upon a request for a change in the expiration date of a facility's operating license. Therefore, the $RT_{PTS}$ value must be calculated for the entire life of the facility, including the license renewal period of extended operation.

**BVPS Unit 1**

The $RT_{PTS}$ values and Beltline Material Chemistry Factor Values for BVPS Unit 1 have been calculated for 44.18 Effective Full Power Years (EFPY) in accordance with Regulatory Guide 1.99, Revision 2, Position 1.1 and Position 2.1, considering the end of the period of extended operation, and an uprated power condition. All projected $RT_{PTS}$ values are below the PTS screening criteria, with the exception of Lower Shell Plate B6903-1, which slightly exceeds the criterion. Several different options are available to

reduce the neutron fluence for plate B6903-1, thus preventing the plate from exceeding the PTS screening criteria. BVPS will select one or more options that will constitute a fluence management plan by 2007. Therefore, the PTS analysis for BVPS Unit 1 is demonstrated to be projected to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii), with the exception of Lower Shell Plate B6903-1, for which the effects of aging on the intended function will be adequately managed for the period of extended operation per 10 CFR 54.21(c)(1)(iii).

**BVPS Unit 2**

The $RT_{PTS}$ values and Beltline Material Chemistry Factor Values for BVPS Unit 2 have been calculated for 48 EFPY in accordance with Regulatory Guide 1.99, Revision 2, Position 1.1 and Position 2.1, considering the end of the period of extended operation, and the uprated power condition. All projected $RT_{PTS}$ values are below the PTS screening criteria. Therefore, the Pressurized Thermal Shock Analysis for BVPS Unit 2 is demonstrated to be projected to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii).

#### A.2.2.1.2 Upper Shelf Energy (USE) Analysis

Reactor vessel beltline materials must have Charpy upper-shelf energy, in the transverse direction for base material and along the weld for weld material according to the ASME Code, of no less than 75 ft-lb initially and must maintain Charpy upper-shelf energy throughout the life of the vessel, including the period of extended operation of no less than 50 ft-lb, unless it can be demonstrated that the lower values of USE provide margins of safety against fracture equivalent to those required by Appendix G of Section XI of the ASME Code.

**BVPS Unit 1**

The USE values for BVPS Unit 1 have been calculated for 44.18 Effective Full Power Years (EFPY), the end of the period of extended operation. All projected End of License Extension (EOLE) USE values are above 50 ft-lb. Therefore, the Upper Shelf Energy Analysis for BVPS Unit 1 is demonstrated to be projected to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii).

**BVPS Unit** 2

The USE values for BVPS Unit 2 have been calculated for 48 EFPY, the end of the period of extended operation. All projected EOLE USE values are above 50 ft-lb. Therefore, the Upper Shelf Energy Analysis for BVPS Unit 2 is demonstrated to be projected to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii).

#### A.2.2.1.3 Pressure Temperature Curves Analysis

These curves are established to the requirements of 10 CFR 50 Appendix G to assure that brittle fracture of the reactor vessel is prevented. Periodically, P-T curves are modified to account for irradiation embrittlement effects based on the methods of Regulatory Guide 1.99, Revision 2. The P-T Curves for both BVPS Units will be projected into the period of extended operation as appropriate to allow continued operation of the plant. Therefore, the P-T Curves for both BVPS Units will be demonstrated to be projected to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii).

#### A.2.2.1.4 Low Temperature Overpressure Protection (LTOP) Power Operated Relief Valve (PORV) Setpoints

Low temperature overpressure protection (LTOP) limits are considered as part of the calculation of pressure/temperature curves. Therefore, the analyses for both BVPS Units will be demonstrated to be projected to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii).

### A.2.2.2 Metal Fatigue Analysis

There are six distinct issues considered separately under the TLAA for Metal Fatigue:

- ASME Fatigue Analysis
- Environmentally Assisted Fatigue
- Pressurizer Surge Line Thermal Stratification
- Reactor Vessel Underclad Cracking, and
- ANSI B31.1 and ASME Section III Class 2 and 3 Criteria
- Motor Operated Valve Fatigue

#### A.2.2.2.1 ASME Fatigue Analysis

The Reactor Coolant System (RCS) and components for BVPS are designed in accordance with Section III of the ASME Boiler and Pressure Vessel Code for Nuclear Vessels, except for the BVPS Unit 1 piping, which is analyzed under ANSI B31.1.

The RCS components designed to the criteria of ASME III are:

- Reactor Vessels (RV)
- Steam Generators (SG)
- Reactor Coolant Pumps (RCP)
- Pressurizers
- BVPS Unit 2 Safety and Relief Valves (SRV)
- Loop Stop Valves (LSV)
- Control Rod Drive Mechanisms (CRDM)

The ASME code requires a design by analysis approach to evaluate whether the components can sustain the prescribed steady state pressure and thermal loadings and the cyclic applications of these loadings. In WCAP-16173, Westinghouse projected the original 40 year life plant NSSS design transients. For BVPS Unit 1, the scope of the evaluation included ASME Section III Class 1 components, ANSI B31.1 reactor coolant system piping and auxiliary Safety Class 1 piping, and other ANSI B31.1 auxiliary piping integral to the reactor coolant system. For BVPS Unit 2, the scope of the evaluation included ASME Section III Class 1 components and piping, (including RCS and some integral auxiliary piping), and portions of non-ASME Section III Class 1 piping (either ASME Section III Class 2 and 3 or ANSI B31.1) integral to the RCS.

FENOC has reverified the existing cycle counts for the current design/licensing basis transient set for each unit as of 10/15/2003 and documented the results in WCAP 16173. The results were projected to the end of the period of extended operation. Based on these projections, the current fatigue evaluations/conclusions will remain valid for 60 years. To confirm these projections, BVPS will incorporate cycle counting activities into the Fatigue Monitoring Program. A fatigue analysis of the pressurizer lower head was performed to consider the effects of insurge, outsurge, and thermal stratification for the pressurizer vessel. Due to the complexity of these loading conditions, the lower head and related piping have been identified as locations that need to be included in activities separate from the cycle counting described above. WCAPs 15351, 16173 and 15352 demonstrate acceptable operation for the current Licensing Basis (CLB), however, due to the complexity of the issue, fatigue monitoring will be instituted for the period of extended operations. Therefore, for the ASME Fatigue analysis for the BVPS Units, it is demonstrated that the effects of aging on the intended function will be adequately managed for the period of extended operation per 10 CFR 54.21(c)(1)(iii).

#### A.2.2.2.2 Environmentally Assisted Fatigue Analysis

GSI-190, "Fatigue Evaluation of Metal Components for 60-year Plant Life," was established to address the residual concerns of GSI-78 and GSI-166 regarding the environmental effects on fatigue of pressure boundary components for 60 years of plant operation. As part of the closure of GSI-190, NRC concluded that licensees who apply for license renewal should address the effects of coolant environment on component fatigue life as part of their aging management programs.

FENOC has performed a plant-specific evaluation of reactor water environmental effects for the reactor coolant system (RCS) components identified within NUREG/CR-6260 for the older Westinghouse plant for BVPS Unit 1 and the RCS components identified within NUREG/CR-6260 for the newer Westinghouse plant for BVPS Unit 2. These calculations have utilized the appropriate $F_{en}$ relationships from NUREG/CR-6583 (for carbon/low alloy steels) and NUREG/CR-5704 (for stainless steels), as appropriate for the material for each location.

For components found to have cumulative usage factors less than 1.0, these evaluations address the NRC requirements concerning environmental fatigue as related to nuclear

plant license renewal by showing that adequate margin exists within the current fatigue analyses to account for environmental effects during operation of BVPS for the 60-year operating period resulting from license renewal.

The locations evaluated with projected cumulative usage factors greater than 1.0 require further evaluation for the period of extended operation. For BVPS Unit 1, these locations are the surge line hot leg nozzle safe end and the charging nozzle to loop 2. For BVPS Unit 2, these locations are the surge line hot leg nozzle, charging system nozzle to loop 22, and the RHR line inlet transition. FENOC has selected aging management to address these locations during the period of extended operation, in lieu of performing additional analyses to refine the fatigue usage factors. The expected approach is to manage these effects through the use of an inspection program that has been reviewed and approved by the NRC. The program would be expected to include, for example, appropriate non-destructive examinations and NRC acceptable inspection periods. The necessity of any potential repair or replacement activities would be based upon the inspection results. Inspection details such as scope, qualification, method, and frequency will be provided to the NRC prior to entering the period of extended operation.

#### A.2.2.2.3 Pressurizer Surge Line Thermal Stratification Analysis

Thermal stratification in the Pressurizer Surge Line is the direct result of differences in density between the pressurizer water and the generally cooler hot leg water. The pressurizer surge line has been qualified for the cyclical effects of thermal stratification in conjunction with the established design transients. FENOC has reverified the existing cycle counts for the current design/licensing basis transient set for each unit and projected these results to the end of the period of extended operation.

Based on these projections, the pressurizer surge line thermal stratification evaluations conclusions will remain valid for 60 years. To confirm these projections, BVPS will incorporate cycle counting activities into the Fatigue Monitoring Program. Also, due to the complexity of the loads caused by thermal stratification, the pressurizer surge line will undergo additional evaluation and/or monitoring to augment the cycle counting to demonstrate long-term structural acceptability (see section 4.3.1 for additional information). Therefore, for the pressurizer surge line thermal stratification analysis for the BVPS Units, it is demonstrated that the effects of aging on the intended function will be adequately managed for the period of extended operation per 10 CFR 54.21(c)(1)(iii).

#### A.2.2.2.4 Reactor Vessel Underclad Cracking

Underclad cracking is the development of defects or cracks under the clad in the base metal/clad heat-affected-zone. A generic fracture mechanics analyses for Westinghouse plants completed in 1971 concluded that fatigue growth of potential underclad flaws in reactor vessel base metal over a 40-year period would be insignificant and the structural integrity of the reactor vessels had not been compromised for their intended use for a 40-year period.

A re-evaluation of the underclad cracking issue for 60 years of plant operation has been perfomed, which concluded that underclad cracking in a reactor vessel is of no concern relative to the structural integrity of the vessel for continued plant operation, even through 60 years of operation. The NRC has concluded that the evaluation is acceptable for referencing in a license renewal application to disposition this TLAA. Therefore, for the underclad cracking analysis for the BVPS Units, it has been demonstrated to be projected for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

#### A.2.2.2.5 Cyclic Stress Criteria for B31.1 and ASME Section III Class 2 and 3 Systems/Components

The design code for the Reactor Coolant System (RCS) and other piping at BVPS Unit 1 is ANSI B31.1 and for Unit 2 is ASME III. Additionally, BVPS Unit 2 has some piping designed to ASME Section III, Class 2 or Class 3, and ANSI B31.1 requirements. ANSI B31.1 and ASME Section III Class 2 and 3 account for fatigue by means of conservatively determined stress range reduction factors that vary based on the expected number of full-range thermal cycles. For up to 7000 equivalent full-range thermal cycles, the applicable stress range reduction factor is 1.0.

While no explicit calculations or analyses meeting the definition of a TLAA were identified for this issue, the fatigue of these components will conservatively be treated as a TLAA. The 7000 cycle limit could only be reached if the piping system endured the equivalent of a full temperature cycle approximately once every 3 days.

Practical experience with plant operation has demonstrated that the design cycle limit will generally not be reached during the period of extended operation. In addition, WCAP - 16173 determined the number of cycles accumulated as of 10/15/2003 for portions of several BVPS piping systems designed to B31.1 or ASME Section III Class 2 or 3, and projected these cycles for a 60-year operating life. All the systems with the exception of the BVPS Unit 1 CVCS system charging and letdown lines were projected to accumulate less than 7000 cycles for a 60-year operating life. The BVPS Unit 1 CVCS charging and letdown lines current cycle count exceeds 7000 cycles. The CVCS system has been included in the fatigue monitoring program as indicated in Table 4.3-1.

The analyses existing as of 10/15/2004 will remain valid through the period of extended operation for all applicable systems, with the exception of the CVCS charging and letdown lines. Therefore, for the ANSI B31.1 and ASME Section III Class 2 and 3 analyses for the BVPS systems, with the noted exception, it is demonstrated that the analyses remain valid for the period of extended operation per 10 CFR 54.21(c)(1)(i). For the BVPS Unit 1 CVCS charging and letdown lines, the effects of fatigue will be adequately managed during the period of extended operation per 10 CFR 54.21 (c)(1)(iii).

#### A.2.2.2.6 Motor Operated Valve Fatigue

Calculations have been performed for certain Motor Operated Valves (MOV) at both Units to validate desired operational thrust load requirements. These calculations involve fatigue analyses. The valve components evaluated include; valve stem, valve

disc and valve yoke. The calculations for these valve component parts evaluate the desired thrust loading, and then determine the allowable mechanical cycles for the applicable material from the ASME Section III Code design fatigue S-N curve for the resultant alternating stress. A Cumulative Usage Factor (CUF) was then calculated to assess the subject valve components projected life. For the calculations associated with the Unit 1 fatigue analyses, a conservative number of valve cycles was used based on the projected operation of the valve over a 40-year plant life. These Unit 1 calculations are considered to qualify as TLAAs. For the calculations associated with the Unit 2 fatigue analyses, the number of operational cycles was not dependent upon the 40-year life of the plant. These Unit 2 motor operated valves are subjected to a managed program for monitoring and implementing required maintenance activities based on actual operational cycles. These Unit 2 motor operated valves are considered to not qualify as TLAAs. BVPS will update the Unit 1 calculations, which are currently evaluated for the 40-year life of the plant, to consider the projected cycles for a 60-year plant life, prior to the period of extended operation. The original methodology will be used in the re-analyses to evaluate the component parts for the 60-year life of the plant. In the event calculational results are not acceptable, BVPS will replace the affected components prior to the period of extended operation. Therefore, the MOV Fatigue calculations for BVPS Unit 1 will be demonstrated to be projected to the end of the period of extended operation per 10CFR54.21(c)(1)(ii), or the effects of cyclic operation on the intended function(s) will be adequately managed for the period of extended operation.

### A.2.2.3 Environmental Qualification (EQ) of Electrical Equipment

The BVPS Environmental Qualification (EQ) manages the effects of aging for Class 1E equipment located in harsh or potentially harsh areas due to temperature, pressure, humidity, radiation, operation, chemicals, or submergence, including consideration of synergistic effects based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ equipment not qualified throughout the current operating license term are to be refurbished, replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation.

10 CFR 50.49 requires that certain safety related and non-safety related electrical equipment remain functional during and after identified Design Basis Events (DBEs). For the period of extended operation, EQ is a TLAA affecting all equipment in the scope of the EQ program with a qualified life equal to or longer than the original license period, whether active or passive.

As part of the CLB, the EQ program will provide for extension of the qualification, as required, to the end of the period of extended operation. Program revisions will be made as appropriate to accommodate changes to the licensing basis, regulatory requirements, and resolutions of generic safety issues. Therefore, the effects of aging on components included in the Environmental Qualification program will be adequately managed in accordance with 10 CFR 54.21 (c)(1)(iii).

### A.2.2.4 Concrete Containment Tendon Prestress Analysis

The BVPS Containments do not make use of prestressing tendons; therefore, there are no TLAAs pertaining to this section.

### A.2.2.5 Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analysis

There are three distinct issues considered seperately regarding containments and penetrations:

- Containment Liner Plate Fatigue
- Containment Liner Test Channel Corrosion Analysis
- Fuel Transfer Tube Bellows

#### A.2.2.5.1 Containment Liner Plate Fatigue

Fatigue of the liner plates is considered in the containment design, based on an assumed number of loading cycles for the current operating term. There are two load combinations analyzed for the containment liner plate for which a certain number of cycles are anticipated based on the current operating term. The actual numbers of cycles used in the design analysis for the liner plate are 1000 and 4000, respectively, for the pressure and temperature transients.

For the temperature transient, since it is defined by the NSSS operational transient, the actual cycles will be bounded by the two hundred cycles of heatups and cooldowns for the NSSS. The pressure transient is not defined, however, in relation to the NSSS operational transient, but since Technical Specifications require shutting down if the containment partial pressure approaches atmospheric, the pressure transient can be considered bounded, because the actual number of occurances (less than or equal to 200) is within the margin allowed by the much higher number of design pressure cycles (1000). Therefore, for the Containment Liner Fatigue analysis for the BVPS Units, it is demonstrated that the analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

#### A.2.2.5.2 Containment Liner Test Channels Corrosion Analysis

The design of the reactor containment includes the placement of leak test channels over most liner seam welds, which are inaccessible after construction, and penetration-liner welds. A condition involving missing vent plugs on the test channels was evaluated, and the predicted corrosion rate of the containment liner over the life of the plant was calculated.

After further evaluation, it was concluded that the evaluations contained some non-conservative assumptions with regard to the effect of electrolyte oxygen concentration on the corrosion rates in the test channels. Therefore, BVPS took corrective action to arrest

the corrosion rate in the affected test channels, including inerting and sealing the test channels. This significantly reduced the theoretical corrosion rates in the channels. Projecting the revised corrosion rates in a simple linear fashion for the period of extended operation would result in remaining liner plate thickness within the calculated liner minimum wall thickness. Therefore, for the test channels corrosion analysis, it is demonstrated that the analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

#### A.2.2.5.3 Fuel Transfer Tube Bellows

The BVPS Unit 1 fuel transfer tube bellows assemblies are designed in accordance with ANSI B31.1. B31.1 accounts for fatigue by means of conservatively determined stress range reduction factors that vary based on the expected number of full-range thermal cycles. For up to 7000 equivalent full-range thermal cycles, the applicable stress range reduction factor is 1.0. The 7000 cycle limit could only be exceeded if the bellows assemblies endured the equivalent of a full cycle approximately once every 3 days. Since these assemblies are typically cycled during refueling operations, they will see pressure and temperature cycles much more infrequently than this over a plant life extending to 60 years. Therefore, for the Unit 1 fuel transfer tube bellows assemblies, it is demonstrated that the analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

The BVPS Unit 2 fuel transfer tube bellows assemblies are designed, fabricated, and code stamped ASME III, Class MC. Design calculations indicate that the fatigue limit was determined to be "> 7000 cycles." The 7000 cycle limit could only be exceeded if the bellows assemblies endured the equivalent of a full cycle approximately once every 3 days. Since these assemblies are typically cycled during refueling operations, they will see pressure and temperature cycles much more infrequently than this over a plant life extending to 60 years. Therefore, for the Unit 2 fuel transfer tube bellows assemblies, it is demonstrated that the analyses remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

### A.2.2.6 Plant Specific TLAAs

This section deals with the following plant-specific safety analyses that are time-limited aging analyses (TLAAs):

- Crane Fatigue
  - Polar Crane
  - Fuel Handling Crane
  - Spent Fuel Pool Crane
- Reactor Coolant Pump Flywheel
- Leak Before Break (LBB) and Thermal Aging Embrittlement of Cast Austenitic Stainless Steel
- Settlement of Structures

### A.2.2.6.1 Crane Fatigue

*(UFSAR wording for Unit 1)*

The design of plant cranes within the scope of license renewal was evaluated. The Unit 1 Polar Crane was designed in accordance with The Electric Overhead Crane Institute, Incorporated, "Specification for Electric Overhead Traveling Cranes – E.O.C.I No. 61," which does not address fatigue failure; therefore, a fatigue analysis is not required for license renewal purposes. However, the Fuel Handling Moveable Platform and the Fuel Cask Crane were designed in accordance with Crane Manufacturers Association of America Specification 70 (CMAA-70). CMAA-70 provides guidance with respect to fatigue failure.

The most limiting number of load cycles to be assumed in the crane design required by CMAA-70 is 100,000 cycles. The load cycles for the Fuel Handling Moveable Platform and the Fuel Cask Crane were evaluated for the period of extended operation. For each crane, the expected usage over the projected life through the period of extended operation will result in fewer cycles than identified as limiting in CMAA-70. The analyses of the cranes will continue to be bounded by the design specification for the period of extended operation.

Therefore, the fatigue analyses of the above cranes was demonstrated to remain valid for the period of extended operation in accordance with 10 CFR 54.21 (c)(1)(i).

*(UFSAR wording for Unit 2)*

The design of plant cranes within the scope of license renewal was evaluated. The Polar Crane, Motor-Driven Platform Crane and the Spent Fuel Cask Trolley were designed in accordance with Crane Manufacturers Association of America Specification 70 (CMAA-70). CMAA-70 provides guidance with respect to fatigue failure.

The most limiting number of load cycles to be assumed in the crane design required by CMAA-70 is 100,000 cycles. The load cycles for the Polar Crane, the Motor-Driven Platform Crane and the Spent Fuel Cask Trolley were evaluated for the period of extended operation. For each crane, the expected usage over the projected life through the period of extended operation will result in fewer cycles than identified as limiting in CMAA-70. The analyses of the cranes will continue to be bounded by the design specification for the period of extended operation.

Therefore, the fatigue analyses of the above cranes was demonstrated to remain valid for the period of extended operation in accordance with 10 CFR 54.21 (c)(1)(i).

### A.2.2.6.2 Reactor Coolant Pump Flywheel Analysis

During normal operation, the RCP flywheel possesses sufficient kinetic energy to produce high energy missiles in the event of a failure. As consequence, Regulatory Guide 1.14 recommends regular inservice inspections of flywheels.

Flywheels are subject to an inservice inspection program in accordance with the requirements of Section XI of the ASME Code, but the requirements have been relaxed based on the conclusions of WCAP-14535A**.**

The WCAP-14535A 60 year analysis is an extension of the original 40 year failure analysis. Since WCAP-14535A has extended the analysis from 40 to 60 years it can be concluded that the TLAA for the Reactor Coolant Pump Flywheel analysis has been demonstrated to be projected for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

#### A.2.2.6.3 Leak Before Break Analysis and Thermal Aging Embrittlement of Cast Austenitic Stainless Steel

The concept of testing and analyzing crack growth to eliminate consideration of primary loop pipe breaks from plant design bases is termed "leak-before-break" (LBB). The focus of the evaluation is whether or not a postulated crack which is assumed to appear instantaneously in plant piping will become unstable and lead to a full circumferential break when subjected to the worst possible combinations of plant loading. A similar evaluation is performed to qualify reactor coolant pump casings to ASME Code Case N-481, to allow alternative inspection requirements. There are two TLAA aspects to LBB, crack growth and thermal aging embrittlement of cast austenitic stainless steel. The original analyses for the BVPS Units are based on the current license period.

BVPS has reevaluated the plant specific LBB piping analyses for both Units considering the period of extended operation. In addition, the LBB analysis to qualify both BVPS Units' reactor coolant pumps for Code Case N-481 for the period of extended operation has been documented in WCAP-16243. These evaluations considered both a 60-year fatigue life and thermal aging embrittlement effects of the CASS. The LBB conditions remain satisfied for both BVPS Units for the period of extended operation. Therefore, the LBB analyses and Thermal Aging Embrittlement of Cast Austenitic Stainless Steel for both BVPS Units have been demonstrated to be projected to the end of the period of extended operation per 10 CFR 54.21(c)(1)(ii).

#### A.2.2.6.4 Settlement of Structures

Predicted settlement values of plant structures are utilized in the design analysis to account for the resulting stresses induced in plant piping. Settlement assumptions based on projected 40 year settlement values constitute a TLAA. Settlement at BVPS Unit 1 has essentially halted and is no longer a concern. Also, several Unit 2 settlement monitoring points have been discontinued due to the fact that settlement has essentially

stopped and the value is less than predicted. However, there are other areas that continue to settle.

BVPS will continue the Settlement Monitoring Program on Unit 2 to verify that settlement, and the resulting pipe stress calculation assumptions, remain within the projected values. If the monitored settling continues such that the projected values may be exceeded, corrective actions such as reanalyzing the pipe stress, or physical modifications to arrest the settlement or reconfigure the pipe, will be evaluated. Therefore, the effects of aging on components affected by assumptions derived from the Settlement Monitoring Program will be adequately managed for the period of extended operation in accordance with 10 CFR 54.21 (c)(1)(iii).

## B.1 Appendix B – Aging Management Programs and Activities

A listing of the acronyms used in this application is provided in Section 1.12.

### B.1.1 Introduction

License renewal aging management program descriptions are provided in this appendix for each program credited for managing aging effects based upon the aging management review results provided in Sections 3.1 through 3.6 of this application.

Each aging management program described in this section has ten elements, which are consistent with the definitions in Appendix A.1, "Aging Management Review - Generic," Table A.1-1, "Elements of an Aging Management Program for License Renewal," of NUREG-1800. The ten element detail is only provided when the program is plant specific. See [Section B.1.2] below.

### B.1.2 Format of Program Discussions

For those aging management programs that are consistent with the assumptions made in Sections X and XI of NUREG-1801, or are consistent with exceptions, each program discussion is presented in the following format:

- A Program Description abstract of the overall program is provided.
- A Program Consistency statement is made about the program.
- Exceptions to the NUREG-1801 program are outlined and a justification is provided.
- Enhancements to ensure consistency with NUREG-1801 or additions to the NUREG-1801 program to manage aging for additional components with aging effects not assumed in NUREG-1801 for the NUREG-1801 program are outlined and explained. All enhancements will be implemented prior to the period of extended operation unless otherwise noted.
- Operating Experience information specific to the program is provided.
- A Conclusion section provides a statement of reasonable assurance that the program is effective, or will be effective, once enhanced.

For those programs that are plant specific, the above form is generally followed with the additional discussion of each of the ten elements.

All new programs will be implemented prior to the period of extended operation unless otherwise noted.

### B.1.3 Corrective Actions, Confirmation Process and Administrative Controls

The BVPS Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Appendix A.2 of NUREG-1800. The Quality Assurance Program is applicable to the safety-related and non-safety-related systems, structures, and components that are subject to aging management review.

Three of the ten AMP elements are generally common to all aging management programs. Discussion of these elements is presented below. Because they apply generically, unless program-specific information exists, these three elements are not detailed in the individual programs.

**Corrective Actions:**

A single corrective actions process is applied regardless of the safety classification of the structure or component. Corrective actions are implemented through the initiation of a condition report (CR) in accordance with plant procedures established in response to 10 CFR 50, Appendix B. Plant procedures require the initiation of a CR for actual or potential problems, including unexpected plant equipment degradation, damage, failure, malfunction or loss. Site documents that implement aging management activities for license renewal will direct that a CR be prepared in accordance with those procedures whenever non-conforming conditions are found (i.e., the acceptance criteria are not met).

Equipment deficiencies are corrected through the initiation of a work order (recently titled "Notification") in accordance with plant procedures. Although equipment deficiencies may initially be documented by a notification, the corrective action process (CAP) specifies that a CR also be initiated if required.

**Confirmation Process:**

The focus of the confirmation process is on the follow-up actions that must be taken to verify effective implementation of corrective actions. The measure of effectiveness is in terms of correcting the adverse condition and precluding repetition of significant conditions adverse to quality. Plant procedures include provisions for timely evaluation of adverse conditions and implementation of any corrective actions required, including root cause determinations and prevention of recurrence where appropriate (e.g., significant conditions adverse to quality). These procedures provide for tracking, coordinating, monitoring, reviewing, verifying, validating, and approving corrective actions to ensure effective corrective actions are taken. The CR process is also monitored for potentially adverse trends. The existence of an adverse trend due to recurring or repetitive adverse conditions will result in the initiation of a CR. The aging management activities required for license renewal would also uncover any unsatisfactory condition due to ineffective corrective action.

Since the same 10 CFR 50, Appendix B corrective actions and confirmation process is applied for nonconforming SR and NSR structures and components subject to an Aging

Management Review (AMR) for license renewal, the corrective action program is consistent with the NUREG-1801 elements.

**Administrative Controls:**

Administrative controls procedures provide information on procedures and other forms of administrative control documents, as well as guidance on classifying documents into the proper document type.

Administrative controls are consistent with NUREG-1801.

### B.1.4 Operating Experience

Industry operating experience was incorporated into the license renewal process through a review of industry documents to identify aging effects and mechanisms that could challenge the intended function of systems and structures within the scope of license renewal. Review of plant specific operating experience was performed to identify aging effects experienced. The review of plant specific operating experience involved electronic database searches of plant information. In addition, discussions with system engineers and long-time company employees were conducted, and identified some additional aging concerns.

Operating experience of the program/activity, including past corrective actions resulting in program enhancements, was considered. This information provides objective evidence that the effects of aging have been, and will continue to be, adequately managed.

### B.1.5 Aging Management Programs

The following aging management programs are described in the sections listed in this appendix. The programs are either discussed in NUREG -1801 or are plant specific. Plant specific programs are listed at the end of the table in Section B.2. Programs are identified as either existing or new.

1. 10 CFR 50, Appendix J [Section B.2.1.1] [existing]
2. ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD [Section B.2.1.2] [existing]
3. ASME Section XI, Subsection IWE [Section B.2.1.3] [existing]
4. ASME Section XI, Subsection IWL [Section B.2.1.4] [existing]
5. Bolting Integrity [Section B.2.1.5] [new]
6. Boric Acid Corrosion [Section B.2.1.6] [existing]
7. Buried Piping and Tanks Inspection [Section B.2.1.7] [new]
8. Closed-Cycle Cooling Water System [Section B.2.1.8] [existing]

9. Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements [Section B.2.1.9] [new]
10. Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits [Section B.2.1.10] [existing]
11. Electrical Transmission Tower Inspection [Section B.2.1.11] [new]
12. Environmental Qualification (EQ) of Electric Components [Section B.2.1.12] [existing]
13. Fire Protection [Section B.2.1.13] [existing]
14. Fire Water System [Section B.2.1.14] [existing]
15. Flow-Accelerated Corrosion [Section B.2.1.15] [existing]
16. Flux Thimble Tube Examination Program [Section B.2.1.16] [existing]
17. Fuel Oil Chemistry Program [Section B.2.1.17] [existing]
18. Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements [Section B.2.1.18] [new]
19. Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program [Section B.2.1.19] [existing]
20. Metal Fatigue of Reactor Coolant Pressure Boundary [Section B.2.1.20] [existing]
21. Nickel-Alloy Nozzles and Penetrations [Section B.2.1.21] [new]
22. One-Time Inspection [Section B.2.1.22] [new]
23. Open-Cycle Cooling Water System [Section B.2.1.23] [existing]
24. Periodic Surveillance and Preventive Maintenance [Section B.2.1.24] [existing]
25. PWR Vessel Internals [Section B.2.1.25] [new]
26. Reactor Head Closure Studs [Section B.2.1.26] [existing]
27. Reactor Vessel Surveillance [Section B.2.1.27] [existing]
28. Settlement Monitoring Program (Unit 2 Only) [Section B.2.1.28] [existing]
29. Steam Generator Tube Integrity [Section B.2.1.29] [existing]
30. Structures Monitoring Program [Section B.2.1.30] [existing]
31. System Monitoring [Section B.2.1.31] [new]
32. Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) [Section B.2.1.32] [new]
33. Water Chemistry [Section B.2.1.33] [existing]

### B.1.6 Time Limited Aging Analyses Aging Management Programs:

1. Environmental Qualification (EQ) of Electric Components [Section B.2.1.12] [existing]

2. Metal Fatigue of Reactor Coolant Pressure Boundary [Section B.2.1.20] [existing]
3. Settlement Monitoring (Unit 2 Only) [Section B.2.1.28] [existing]

## B.2 AGING MANAGEMENT PROGRAMS

The correlation between NUREG-1801 (Generic Aging Lessons Learned (GALL) programs and BVPS programs is shown below. For the BVPS programs, links to appropriate sections of this appendix are provided.

**Table B-1**
**Correlation with NUREG-1801 Aging Management Programs**

| NUREG-1801 NUMBER | NUREG-1801 PROGRAM | BVPS PROGRAM |
|---|---|---|
| X.M1 | Metal Fatigue of Reactor Coolant Pressure Boundary | Metal Fatigue of Reactor Coolant Pressure Boundary [Section B.2.1.20] |
| X.E1 | Environmental Qualification (EQ) of Electrical Components | Environmental Qualification (EQ) of Electric Components [Section B.2.1.12] |
| X.S1 | Concrete Containment Tendon Prestress | Not applicable to BVPS. BVPS design does not include Containment Building tendons. |
| XI.M1 | ASME Section XI Inservice Inspection, Subsections IWB, IWC, & IWD | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD [Section B.2.1.2] |
| XI.M2 | Water Chemistry | Water Chemistry [Section B.2.1.33] |
| XI.M3 | Reactor Head Closure Studs | Reactor Head Closure Studs [Section B.2.1.26] |
| XI.M4 | BWR Vessel ID Attachment Welds | Not Applicable, BVPS is a PWR. |
| XI.M5 | BWR Feedwater Nozzle | Not Applicable, BVPS is a PWR. |
| XI.M6 | BWR Control Rod Drive Return Line Nozzle | Not Applicable, BVPS is a PWR. |
| XI.M7 | BWR Stress Corrosion Cracking | Not Applicable, BVPS is a PWR. |
| XI.M8 | BWR Penetrations | Not Applicable, BVPS is a PWR. |
| XI.M9 | BWR Vessel Internals | Not Applicable, BVPS is a PWR. |
| XI.M10 | Boric Acid Corrosion | Boric Acid Corrosion [Section B.2.1.6] |
| XI.M11 | Nickel-Alloy Nozzles and Penetrations | Nickel-Alloy Nozzles and Penetrations [Section B.2.1.21] |
| XI.M12 | Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) | Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) [Section B.2.1.32] |
| XI.M13 | Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) | PWR Vessel Internals [Section B.2.1.25] |
| XI.M14 | Loose Parts Monitoring | Not credited for aging management in the BVPS results. Reactor vessel internals inspections were determined to be adequate to manage identified aging effects. |
| XI.M15 | Neutron Noise Monitoring | Not credited for aging management in the BVPS results. Reactor vessel internals inspections were determined to be adequate to manage identified aging effects. |

**Table B-1**
**Correlation with NUREG-1801 Aging Management Programs**

| NUREG-1801 NUMBER | NUREG-1801 PROGRAM | BVPS PROGRAM |
|---|---|---|
| XI.M16 | PWR Vessel Internals | PWR Vessel Internals [Section B.2.1.25] |
| XI.M17 | Flow-Accelerated Corrosion | Flow-Accelerated Corrosion [Section B.2.1.15] |
| XI.M18 | Bolting Integrity | Bolting Integrity [Section B.2.1.5] |
| XI.M19 | Steam Generator Tube Integrity | Steam Generator Tube Integrity [Section B.2.1.29] |
| XI.M20 | Open-Cycle Cooling Water System | Open-Cycle Cooling Water System [Section B.2.1.23] |
| XI.M21 | Closed-Cycle Cooling Water System | Closed-Cycle Cooling Water System [Section B.2.1.8] |
| XI.M22 | Boraflex Monitoring | Boraflex is installed in the Unit 2 fuel racks, but is not credited. |
| XI.M23 | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems | Inspection of Overhead Heavy Load and Light Load (related to Refueling) Handling Systems [Section B.2.1.19] |
| XI.M24 | Compressed Air Monitoring | Not credited for aging management in the BVPS results. |
| XI.M25 | BWR Reactor Water Cleanup System | Not Applicable, BVPS is a PWR. |
| XI.M26 | Fire Protection | Fire Protection [Section B.2.1.13] |
| XI.M27 | Fire Water System | Fire Water System [Section B.1.2.14] |
| XI.M28 | Buried Piping and Tanks Surveillance | Not credited for aging management in the BVPS results. BVPS does not credit cathodic protection for managing aging effects. NUREG-1801 XI.M34 was credited for aging management of aging effects involving buried piping and tanks. |
| XI.M29 | Aboveground Carbon Steel Tanks | Not credited for aging management in the BVPS results. Carbon steel tanks are included in the One-Time Inspection Program and the System Monitoring for aging management of internal and external aging effects. |
| XI.M30 | Fuel Oil Chemistry Program | Fuel Oil Chemistry Program [Section B.2.1.17] |
| XI.M31 | Reactor Vessel Surveillance | Reactor Vessel Surveillance [Section B.2.1.27] |
| XI.M32 | One-Time Inspection | One-Time Inspection [Section B.2.1.22] |
| XI.M33 | Selective Leaching of Materials | One-Time Inspection [Section B.2.1.22] |
| XI.M34 | Buried Piping and Tanks Inspection | Buried Piping and Tanks Inspection [Section B.2.1.7] |
| XI.M35 | One-Time Inspection of Small-Bore Piping | One-Time Inspection [Section B.2.1.22] |

| Table B-1<br>Correlation with NUREG-1801 Aging Management Programs | | |
|---|---|---|
| **NUREG-1801 NUMBER** | **NUREG-1801 PROGRAM** | **BVPS PROGRAM** |
| XI.E1 | Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements | Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements [Section B.2.1.9] |
| XI.E2 | Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits | Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits [Section B.2.1.10] |
| XI.E3 | Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements | Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements [Section B.2.1.18] |
| XI.S1 | ASME Section XI, Subsection IWE | ASME Section XI, Subsection IWE [Section B.2.1.3] |
| XI.S2 | ASME Section XI, Subsection IWL | ASME Section XI, Subsection IWL [Section B.2.1.4] |
| XI.S3 | ASME Section XI, Subsection IWF | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD [Section B.2.1.2] |
| XI.S4 | 10 CFR 50, Appendix J | 10 CFR 50, Appendix J [Section B.2.1.1] |
| XI.S5 | Masonry Wall Program | Structures Monitoring Program [Section B.2.1.30] |
| XI.S6 | Structures Monitoring Program | Structures Monitoring Program [Section B.2.1.30] |
| XI.S7 | RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants | Not credited for aging management in the BVPS results. |
| XI.S8 | Protective Coating Monitoring and Maintenance | Not credited for aging management in the BVPS results. |
| Plant-Specific Programs | | |
| N/A | Plant Specific Program | Electrical Transmission Tower Inspection [Section B.2.1.11] |
| N/A | Plant Specific Program | Flux Thimble Tube Examination Program [Section B.2.1.16] |
| N/A | Plant Specific Program | Periodic Surveillance and Preventive Maintenance [Section B.2.1.24] |
| N/A | Plant Specific Program | Settlement Monitoring Program (Unit 2 Only) [Section B.2.1.28] |
| N/A | Plant Specific Program | System Monitoring [Section B.2.1.31] |

## B.2.1 Aging Management Programs

### B.2.1.1 10 CFR 50 Appendix J

**Program Description**

The 10 CFR 50, Appendix J Program is credited with managing age-related degradation of the primary containment pressure boundary. The program monitors leakage rates through the containment pressure boundary, including penetrations, fittings, seals, gaskets, and bolted connections. Containment leak rate tests are performed in accordance with the regulations in 10 CFR 50.54(o) and 10 CFR 50 Appendix J (Option B), as modified by approved exceptions. Also, the program is in accordance with the guidance in Regulatory Guide 1.163, "Performance-Based Containment Leak-Testing Program." Test frequencies for Type A, B, and C testing are defined in NEI 94-01, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50 Appendix J." Program procedures, administrative controls, and corrective actions ensure that age-related degradation is effectively managed and intended function(s) are maintained during the period of extended operation.

**Program Consistency**

The 10 CFR 50 Appendix J program is an existing program that is consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.S4, "10 CFR 50 Appendix J."

**Operating Experience**

Plant-specific condition reports, and Appendix J Program performance results from unit outages were reviewed. The results showed that the program has been effective in finding and correcting degradation attributable to aging effects requiring management.

**Conclusion**

The continuation of the existing 10 CFR 50, Appendix J Program ensures that the effects of aging associated with the in-scope structures and components will be adequately managed. The program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

### B.2.1.2 ASME Section XI Inservice Inspection, Subsections IWB, IWC, IWD

**Program Description**

The ASME Section XI Inservice Inspection, Subsections IWB, IWC, IWD Program includes inservice inspection, repair and replacement requirements for Class 1, 2 and 3 components. The program also includes similar requirements associated with component supports, as provided in ASME Section XI, Subsection IWF.

**Program Consistency**

The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD portion of the program is an existing program that is consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD", with the following exception:

a.) Inservice Inspection of BV1 and BV2 Class 1 and 2 piping welds will be performed in accordance with the RI-ISI methodology of WCAP 14572, Rev. 1-NP-A, Addenda 1. The RI-ISI program was developed and will be maintained in accordance with this WCAP and the associated guidance documents. The RI-ISI program supercedes the ASME XI exam selection requirements of Examination Categories B-F, B-J, C-F-1 and C-F-2. The applicable aspects of the ASME XI Code not affected by the RI-ISI program will be retained. The RI-ISI approach was approved for use at BVPS by a NRC Safety Evaluation Report (SER), dated 4/9/04.

The ASME Section XI, Subsection IWF portion of the program is an existing program that is consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.S3, "ASME Section XI, Subsection IWF."

**Operating Experience**

The ASME Code is a consensus document that has been widely used over a long period and has been shown to be generally effective in managing aging effects in Class 1, 2, and 3 components and component supports in light-water cooled power plants. Some specific examples of industry operating experience of component degradation are included in NUREG-1801.

The plant condition reports and the outage inspection results from the plant ASME Section XI, Inservice Inspection Program were reviewed. The results showed that the program has been effective in finding and correcting degradation attributable to aging effects requiring management.

**Conclusion**

The continuation of the existing ASME Section XI, Inservice Inspection, Subsections IWB, IWC, IWD Program ensures that the effects of aging associated with Class 1, 2 and 3

components and component supports will be adequately managed. The program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

### B.2.1.3 ASME Section XI, Subsection IWE

**Program Description**

The ASME Section XI, Subsection IWE program is credited with managing age-related degradation of materials associated with steel liners for concrete containments and their integral attachments, containment hatches and airlocks, seals, gaskets and moisture barriers and pressure-retaining bolting. The program includes visual and augmented inspections. Certain steel and stainless steel penetration components subject to thermal fatigue are also inspected for cracking. Elastomeric components, such as gaskets and seals, are visually inspected for evidence of degradation, such as cracking or shrinkage. The program also credits leak rate inspection and testing activities performed in accordance with 10 CFR 50 Appendix J. The program is implemented in accordance with 10 CFR 50.55a(g). Program procedures, administrative controls, and corrective actions ensure that the containment's intended functions are maintained during the period of extended operation.

**Program Consistency**

The ASME Section XI, Subsection IWE Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.S1, "ASME Section XI, Subsection IWE."

**Enhancements to Meet XI.S1**

**Enhancement 1:** Include guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) for unsatisfactory inspection results or conditions adverse to quality.

<u>Program Elements Affected</u>

- **Corrective Actions**

  The NUREG-1801 program attribute states that the requirements of 10 CFR 50, Appendix B, are acceptable in addressing corrective actions. Program administrative procedures do not address the use of the CR process. Therefore, the program will be enhanced to explicitly direct generation of a Condition Report (CR) for unsatisfactory inspection results or conditions adverse to quality.

**Enhancement 2:** Include industry operating experience identified by the GALL within the program.

The program does not currently include reference to the following industry operating experience documents: NRC Information Notices (IN) 86-99, 89-79, and 97-10, where two document corrosion of steel containments (IN 86-99 and 89-79) and one documenting liner plate corrosion in concrete containments (IN 97-10).

Program Elements Affected

- **Operating Experience**

  The NUREG-1801 program attribute details industry operating experience that is related to the IWE program. Several of the noted NRC issued documents related to industry operating experience are not referenced in the program. Therefore, the program will be enhanced to reference these GALL identified documents.

**Operating Experience**

The ASME Code is a consensus document that has been widely used over a long period and has been shown to be generally effective in managing aging effects in light-water cooled power plants. Some specific examples of industry operating experience of component degradation are included in NUREG-1801.

Plant-specific condition reports, and ASME Section XI Inservice Inspection, Subsections IWE Program performance results from unit outages were reviewed. The results showed that the program has been effective in finding and correcting degradation attributable to aging effects requiring management. In addition, NRC Information Notice (IN) 97-10 documented containment liner degradation found at BVPS-1 as well as several other nuclear sites. The BVPS-1 degradation consisted of peeling coating and corrosion spots and was characterized as benign from a safety standpoint.

**Conclusion**

The continuation of the existing ASME Section XI, Subsection IWE Program, together with the enhancement of the program prior to the period of extended operation, will ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program will provide reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

### B.2.1.4 ASME Section XI, Subsection IWL

**Program Description**

The ASME Section XI, Subsection IWL Program is credited with managing containment concrete degradation, such as cracking, spalling, or evidence of reinforcing steel corrosion in the containment structures at BVPS. The program includes ASME inspection requirements for reinforced concrete of Class CC containments, which relies primarily on visual examinations to assess the condition of the concrete portions of the containment structure. The program also credits leak rate inspection and testing activities performed in accordance with 10 CFR 50 Appendix J. The program is implemented in accordance with 10 CFR 50.55a(g). Program procedures, administrative controls, and corrective actions ensure that the containment's intended functions are maintained during the period of extended operation.

**Program Consistency**

The ASME Section XI, Subsection IWL Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.S2, "ASME Section XI, Subsection IWL."

**Enhancements to Meet XI.S2**

**Enhancement 1:** Correct the reference to 10 CFR 50.55a in the program.

The 10 CFR 50.55a references will be corrected in the implementing documents in which they appear.

<u>Program Elements Affected</u>

- **Scope of Program**

  The NUREG-1801 program attribute states that 10 CFR 50.55a(b)(2)(viii) specifies additional requirements for inaccessible areas. The current program reference is not accurate. Therefore, the program will be enhanced to reference the correct 10 CFR 50.55 section.

**Enhancement 2:** Include the option to apply the acceptance criteria in ACI 349.3R.

The program will be enhanced to give the responsible engineer the option to apply the acceptance criteria in Chapter 5 of ACI 349.3R, when evaluating as-found conditions.

Program Elements Affected

- **Acceptance Criteria**

  The NUREG-1801 program attribute states that acceptance criteria provided in Chapter 5 of ACI 349.3R may be used to augment the qualitative assessment of the responsible engineer. The current program does not reference this criteria. Therefore, the program will be enhanced to give the responsible engineer the option to apply the acceptance criteria in Chapter 5 of ACI 349.3R.

**Enhancement 3:** Include guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) for unsatisfactory inspection results or conditions adverse to quality.

Program Elements Affected

- **Corrective Actions**

  The NUREG-1801 program attribute states that the requirements of 10 CFR 50, Appendix B, are acceptable in addressing corrective actions. Program administrative procedures do not address the use of the CR process. Therefore, the program will be enhanced to explicitly direct generation of a Condition Report (CR) for unsatisfactory inspection results or conditions adverse to quality.

**Operating Experience**

The ASME Code is a consensus document that has been widely used over a long period and has been shown to be generally effective in managing aging effects in light-water cooled power plants. Some specific examples of industry operating experience of component degradation are included in NUREG-1801.

Plant-specific condition reports, and ASME Section XI Inservice Inspection, Subsection IWL Program examination results were reviewed. The results showed that the program has been effective in finding and correcting degradation attributable to aging effects requiring management. IWL inspections have not revealed any concrete degradation that threatens the structural integrity or leak tightness of the containment buildings. Minor degradation has been observed including spalling and cracking of cover concrete and minor rust stains, but no main reinforcing steel degradation has been found.

**Conclusion**

The continuation of the existing ASME Section XI, Subsection IWL Program, together with the enhancement of the program prior to the period of extended operation, will ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will

be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.5 Bolting Integrity

### Program Description

The Bolting Integrity Program is credited with managing age related degradation of all bolting within the scope of license renewal; including safety-related bolting, bolting for NSSS component supports, bolting for other pressure retaining components, and structural bolting. The program provides administrative guidance on bolting inspection techniques, material selection, strength and hardness properties, installation, lubrication and sealant selection, and corrosion considerations in the selection and installation of pressure retaining bolting for nuclear applications. Aging management of pressure retaining and structural bolting is accomplished through routine inspections that are administered in other license renewal defined aging management programs. These programs include the following: ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD (includes ASME Section XI Inservice Inspection, Subsection IWF); Boric Acid Corrosion; System Monitoring; Structures Monitoring and the Periodic Surveillance and Preventive Maintenance Program. The program is implemented in accordance with the guidance contained in NUREG-1339 and EPRI NP-5769 (with exceptions noted in NUREG-1339). Additionally, the program incorporates the guidance for pressure retaining bolting and structural bolting contained in EPRI TR-104213. Program procedures, administrative controls, and corrective actions ensure that loss of material is effectively managed and intended function(s) are effectively maintained during the period of extended operation.

### Program Consistency

The Bolting Integrity Program is a new program that will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M18, "Bolting Integrity", with the following exception:

a.) Stress corrosion cracking is not identified as an aging effect for high strength bolting in plant indoor air. Thus, the high strength bolting used in NSSS component supports is not inspected to the requirements for Class 1 components, examination category B-G-1, as stated in the GALL. Instead, structural bolting is inspected using the requirements of ASME Section XI, Subsection IWF.

### Operating Experience

A review of industry experience revealed numerous instances of primary pressure boundary degradation. There have been various NRC communications including Information Notices, Bulletins, and Generic Letters on bolting degradation. Most instances of degradation fall into two categories: boric acid corrosion caused by leakage at mechanical joints and degradation of bolting caused by stress corrosion cracking of high strength bolts. General corrosion of bolting and fasteners has occurred for structural bolting located in a humid environment.

Plant specific operating experience was reviewed and it revealed that bolting degradation occurred due to boric acid leakage at bolted joints, valve bonnets, or packing glands. General

corrosion was also found on structural steel bolting. The review also indicated that there was no loss of intended function of a component or system due to bolting or fastener degradation.

Both plant and industry operating experience will continually be gathered as a part of the Bolting Integrity Program. Appropriate corrective actions will be administered to issues raised by the condition report process.

**Conclusion**

The new Bolting Integrity Program will ensure that the effects of aging associated with the in-scope components will be adequately managed so that there is reasonable assurance that their intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.6 Boric Acid Corrosion

### Program Description

The Boric Acid Corrosion Program is credited with preventing unacceptable corrosive attack and degradation of pressure boundary components or other potentially affected structures, systems, or components. The program provides identification, trending, and remediation of borated fluid leakage and implements the plant-specific commitments made in response to Nuclear Regulatory Commission (NRC) Generic Letter (GL) 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants." Program procedures, administrative controls, and corrective actions ensure that degradation is effectively managed and intended function(s) are maintained during the period of extended operation.

### Program Consistency

The Boric Acid Corrosion Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M10, "Boric Acid Corrosion."

### Enhancements to Meet XI.M10

**Enhancement 1:** Declare in the program administrative procedure the borated plant systems included within the scope of the program. This program scope shall bound those systems identified to be within the scope of license renewal.

The program does not identify those borated systems that are within the scope of the program. This change will clarify the scope of the walkdown inspections performed outside containment.

<u>Program Elements Affected</u>

- **Scope of Program**

  The NUREG-1801 program attribute states that the program shall provide for a determination of the principle locations of leakage and examination requirements and procedures for locating small leaks. The program does not identify the scope of systems, or portions of systems, that are within the program scope. Therefore, the program will be enhanced to identify those borated systems identified to be within the scope of program.

**Enhancement 2:** Include boric acid inspection criteria and corrective action guidance within the new System Monitoring Program.

This enhancement will include guidance on visual inspections for boric acid residue or evidence of leakage of borated fluids. Additionally, the program enhancement will include guidance to document the residue/leakage in a condition report and to contact supervision or the Boric Acid Corrosion Engineer.

Program Elements Affected

- **Detection of Aging Effects**

  The NUREG-1801 program attribute directs frequent monitoring of locations where potential leakage could occur. This enhancement to the Boric Acid Corrosion Program will direct that the System Monitoring Program be enhanced to include visual inspections for boric acid residue or evidence of leakage of borated fluids. Therefore, the System Monitoring Program will be enhanced to include this inspection guidance.

- **Corrective Actions**

  The NUREG-1801 program attribute states that corrective actions are implemented in conformance with the Boric Acid Corrosion Program. Therefore, the System Monitoring Program will be enhanced to include guidance to document identification of residue/leakage in a condition report and direct notification of the Boric Acid Corrosion Engineer.

**Enhancement 3:** Include the fuel pool cooling and purification pumps areas and the RWST areas in the list of areas to be periodically inspected.

The fuel pool pump areas and the RWST areas are currently inspected for boric acid leakage during Operator, Radiation Protection and System Engineer tours. This enhancement includes these areas in the program's periodic inspection procedures.

Program Elements Affected

- **Scope of Program**

  The NUREG-1801 program attribute states that the program shall provide for a determination of the principle locations of leakage and examination requirements and procedures for locating small leaks. The fuel pool pump area and the RWST areas are not included in the periodic inspection procedures. Therefore, the program will be enhanced to include these areas.

**Operating Experience**

Various site sources were searched for boric acid leaks that have been identified through the implementation of the Boric Acid Corrosion Program. The majority of the leaks were identified as inactive with only evidence of past leakage. Corrective actions included cleaning the area around the leak and either tightening bolted closures or containing the leak. The frequencies of inspections have been demonstrated to be adequate to identify leaks before any loss of material is a concern, and thus before loss of component intended function(s).

## Conclusion

The continuation of the existing Boric Acid Corrosion Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

### B.2.1.7 Buried Piping and Tanks Inspection

**Program Description**

The Buried Piping and Tanks Inspection Program is credited with managing material degradation of the external surfaces of buried piping and tanks. The program includes visual inspections to verify the integrity of coatings and wrappings, which if damaged, could lead to corrosive attack and damage of the external surfaces of buried components. Buried piping and tanks will be inspected when they are excavated for any reason. An engineering evaluation conducted five years prior to the period of extended operation will determine the need for additional inspections of in-scope piping and tank external surfaces. The sample size and inspection periodicity will be adjusted based on inspection results, operating experience, susceptibility, and environments to provide reasonable assurance that intended functions are maintained for the period of extended operation. Program procedures, administrative controls, and corrective actions ensure that intended functions are effectively maintained during the period of extended operation.

**Program Consistency**

The Buried Piping and Tanks Inspection Program is a new program that will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M34, "Buried Piping and Tanks Inspection."

**Operating Experience**

The Buried Piping and Tanks Inspection Program is a new program; however, a review of site operating experience produced several instances of degraded buried fire protection piping and a recent failure of Unit 2 service water piping (non safety-related). Damaged pipe protective wrap permitted exposure of external pipe surfaces to aggressive soil environments. BVPS replaced degraded sections of pipe and proactively replaced fire protection piping where potential vulnerabilities existed.

**Conclusion**

The new Buried Piping and Tanks Inspection Program will ensure that the effects of aging associated with the in-scope components will be adequately managed so that there is reasonable assurance that their intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.8 Closed-Cycle Cooling Water System

### Program Description

The Closed-Cycle Cooling Water System Program manages the aging effects in closed-cycle cooling water systems by maintaining corrosion inhibitor concentrations and other chemistry parameters within specified limits. EPRI TR-107396 is used as guidance for establishing chemistry limits and monitored parameters. Heat exchanger and pump performance data is periodically monitored and trended and opportune visual inspections of system internal surfaces are performed. These activities are used to assess the effectiveness of chemistry controls and to evaluate system and component performance in accordance with the EPRI guidance. Program procedures, administrative controls, and corrective actions ensure that intended functions are effectively maintained during the period of extended operation.

### Program Consistency

The Closed-Cycle Cooling Water System Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M21, "Closed-Cycle Cooling Water System."

### Enhancements to Meet XI.M21

**Enhancement 1:** Clarify program elements and guidance that is contained in EPRI TR-107396.

The program does not identify specific program elements that are detailed in EPRI TR-107396.

<u>Program Elements Affected</u>

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that the program monitors the effects of corrosion by surveillance testing and inspection in accordance with standards in EPRI TR-107396 to evaluate system and component performance. The program does not clearly define specific program elements that are detailed in the EPRI guidance and related to testing and inspection. Therefore, the program will be enhanced to clarify the following program elements: performance monitoring (chemical treatment and diagnostic parameters, corrosion and corrosion monitoring techniques, fouling, MIC, trending, trouble shooting, and corrective actions); heat exchanger and pump performance testing; and an integrated monitoring and inspection program to evaluate and trend corrosion rates and degradation in the in-scope systems.

**Enhancement 2:** Align the program with Revision 1 of EPRI TR-107396.

The program is currently aligned with EPRI TR-107396, Revision 0, October 1997. Revision 1 to EPRI TR-107396 was issued in April 2004.

Program Elements Affected

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that the program monitors the effects of corrosion by surveillance testing and inspection in accordance with standards in EPRI TR-107396 to evaluate system and component performance. Updated guidance on testing and inspection is provided in Revision 1 of the EPRI guidance. Therefore, the program and program supporting procedures will be enhanced to incorporate this guidance.

- **Corrective Actions**

  The NUREG-1801 program attribute states that corrosion inhibitor concentrations outside the allowable limits are returned to the acceptable range within the time period specified in the EPRI guidelines. The current program does not include action levels and allowable periods for out of range parameters. This information is detailed in Revision 1 of EPRI TR-107396. Additionally, the recent EPRI release includes guidance for allowable limits and acceptable ranges (Control and Diagnostic), allowable limits for out of range parameters, and corrective action guidance (Action Levels). Therefore, the program and program supporting procedures will be enhanced to detail and align the program and supporting program procedures with the Revision 1 release of EPRI TR-107396.

**Enhancement 3:** Detail program management deviations from the industry guidance in EPRI TR-107396.

The program does not detail its optimization or management deviations from the industry guidance in EPRI TR-107396.

Program Elements Affected

- **Corrective Actions**

  The NUREG-1801 program attribute states that corrosion inhibitor concentrations outside the allowable limits are returned to the acceptable range within the time period specified in the EPRI guidelines. The current program does not detail its alignment with and deviations from the allowable limits and acceptable ranges and time periods specified in the EPRI guidance. Therefore, the program will be enhanced to detail the optimization and management deviations from the industry guidance in EPRI TR-107396.

**Enhancement 4:** Include guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) for unsatisfactory or nonconforming conditions, or conditions adverse to quality.

Program Elements Affected

- **Corrective Actions**

  The NUREG-1801 program attribute states that the requirements of 10 CFR 50, Appendix B, are acceptable in addressing corrective actions. Program administrative procedures do not address the use of the CR process. Therefore, the program and program supporting procedures will be enhanced to explicitly direct generation of a Condition Report (CR) for unsatisfactory or nonconforming conditions, or conditions adverse to quality.

**Enhancement 5:** Include guidance to review closed-cycle cooling water system related industry documents received by FENOC for applicability to BVPS. Those affecting, or thought to affect BVPS, shall be entered into the CAP for resolution.

The program does not detail the review of industry correspondence (bulletins, letters, notices, OE reports, advisories) related to closed-cycle cooling water systems.

Program Elements Affected

- **Operating Experience**

  The NUREG-1801 program attribute details industry correspondence and operating experience related to the program. The program does not detail this review of industry correspondence and operating experience. Therefore, the program will be enhanced to direct a review of all industry correspondence (bulletins, letters, notices, OE reports, advisories) related to closed-cycle cooling water systems. Those documents that affect, or are thought to affect BVPS, shall be entered into the site CAP for resolution

**Enhancement 6:** Modify site maintenance procedures to include guidance to contact the program or system engineer for any breach of a closed-cycle cooling water system that is within the scope of license renewal.

The program does not detail guidance for inspections of system and component internal conditions and environments.

Program Elements Affected

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that the program monitors the effects of corrosion by surveillance testing and inspection in accordance with standards in EPRI TR-107396 to evaluate system and component performance. The program does not detail guidance for inspections of system and component internal conditions and environments. Therefore, the program supporting documents will be enhanced to direct that the program or system engineer be contacted for any breach of an in-scope closed-cycle cooling water system. This notification will allow the engineer to perform inspections, as necessary, of internal conditions. These inspections will be used to assess the effectiveness of chemistry controls and to evaluate system and component performance in accordance with the EPRI guidance.

**Enhancement 7:** Create a new program supporting activity for monitoring of closed-cycle cooling water heat exchanger thermal performance characteristics.

The program does not detail guidance for performance testing or monitoring of heat exchangers for reduced performance or fouling.

Program Elements Affected

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that the program monitors the effects of corrosion by surveillance testing and inspection in accordance with standards in EPRI TR-107396 to evaluate system and component performance. The program does not detail guidance for performance testing or monitoring of heat exchangers for reduced performance or fouling. Therefore, the program will be enhanced to detail a new supporting activity that records heat exchanger thermal performance characteristics and trends data for in-scope heat exchangers. The activity will target detecting reduced performance caused by degradation or fouling. Acceptance criteria shall be established and abnormal values entered into the Condition Report (CR) process for evaluation and resolution.

## Operating Experience

The operating experience review for the Closed-Cycle Cooling Water System Program identified many condition reports that documented chemistry parameters outside of specified limits. In these cases, prompt corrective actions were taken to restore water chemistry parameters within acceptable limits. Also, many condition reports identified missed sampling requirements, where corrective actions in a recent condition report were comprehensive and intended to prevent repeat occurrences. The results of self-assessments have been incorporated into the program and

have resulted in improvements in water chemistry clarifications, techniques, and sample scheduling.

## Conclusion

The continuation of the existing Closed-Cycle Cooling Water System Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.9 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

### Program Description

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is credited with managing the aging of cable and connection insulation materials within the scope of license renewal and not included in the EQ Program. The program provides reasonable assurance that the intended functions of in-scope electrical cables and connections that are not subject to environmental qualification requirements of 10 CFR 50.49 and are exposed to adverse localized environments will be maintained consistent with the current licensing basis. The program includes activities utilizing EPRI guidance (EPRI TR-109619, "Guideline for the Management of Adverse Localized Equipment Environments", June 1999) to determine the principle locations where accessible cables and connections within the scope of license renewal are installed in adverse localized environments caused by heat or radiation in the presence of oxygen. If an adverse localized environment is identified, a visual examination of a representative sample of accessible cables and connections in the adverse localized environment will be conducted. If an unacceptable condition or situation is identified for a cable or connection in the inspection sample, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connections. An adverse localized environment is a condition in a limited plant area caused by heat, radiation or moisture that is significantly more severe than the specified service condition for the electrical cable or connection. Program procedures, administrative controls, and corrective actions ensure that intended functions are maintained during the period of extended operation.

### Program Consistency

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new program that will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

### Operating Experience

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new program with no operating experience associated with this program is available.

Industry operating experience has shown that adverse localized environments caused by heat or radiation may exist next to or above (within three feet of) steam generators, pressurizers or hot process pipes, such as feedwater lines. These adverse localized environments have been found to cause degradation of the insulation materials on electrical cables and connections that is visually observable, such as color changes or surface cracking.

## Conclusion

The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program will adequately manage the effects of aging associated with insulation materials for in-scope cables and connections so that there is reasonable assurance that their intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.10 Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits

### Program Description

The Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program is credited with managing the aging of sensitive high voltage, low-level signal cables, such as nuclear instrumentation (but not subject to the environmental qualification requirements of 10 CFR 50.49), installed in adverse localized environments (heat, radiation, or moisture). The program includes a proven cable test for detecting deterioration of the insulation system (such as insulation resistance tests, time domain reflectometry tests, or other testing judged to be effective in determining cable insulation condition). Program procedures, administrative controls, and corrective actions ensure that degradation of the in-scope conductor insulation is effectively managed and intended function(s) are effectively maintained during the period of extended operation.

### Program Consistency

The Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.E2, "Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits," as modified in draft NRC ISG-15.

### Enhancements to Meet XI.E2

**Enhancement 1:** Declare that the program includes high voltage, low signal instrumentation cables that are located in adverse environments.

The program does not identify in-scope cables that are subject to aging management and are located in adverse environments.

<u>Program Elements Affected</u>

- **Program Description**

  Draft ISG-15 states that an adverse localized environment is significantly more severe than the specified service environment for the cable. Therefore, the program will be enhanced to declare that the program testing procedure includes high voltage, low signal instrumentation cables that are located in adverse environments and subject to aging management for license renewal.

**Enhancement 2:** Include reference of industry guidance documents.

The program does not include applicable guidance and reference to several industry guidance documents.

Program Elements Affected

- **Program Description**

  Draft ISG-15 states that the program considers the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205, SAND96-0344, and EPRI TR-109619. The program does not include reference to these documents. Therefore, the program will be enhanced to reference and include applicable guidance from NUREG/CR-5643, IEEE Std. P1205, SAND96-0344, and EPRI TR-109619.

- **Detection of Aging Effects**

  Draft ISG-15 states that a proven cable system test for detecting deterioration of the insulation system (such as insulation resistance tests, time domain reflectometry tests, or other testing judged to be effective in determining cable insulation condition) will be performed. Therefore, the program will be enhanced to reference and include the applicable guidance from Westinghouse guide RRS-VICO-02-326.

**Enhancement 3:** Clarify the program testing frequency.

The existing program activity does not specify a testing frequency.

Program Elements Affected

- **Detection of Aging Effects**

  Draft ISG-15 states that the test frequency of the in-scope cables shall be deteremined by the applicant and be based on an engineering evaluation, but shall not exceed ten years. Therefore, the credited procedure will be enhanced to specify the test frequency will be determined by engineering evaluation and not exceed ten years. Additionally, the test will be performed prior to the end of the initial 40-year license.

**Enhancement 4:** Include a commitment to review and consider industry guidance.

The program does not detail the review of industry guidance related to electrical cables used in instrumentation circuits.

Program Elements Affected

- **Detection of Aging Effects**

Draft ISG-15 states that a proven cable test for detecting deterioration of the insulation system (such as insulation resistance tests, time domain reflectometry tests, or other testing judged to be effective in determining cable insulation condition) will be performed. Therefore, the program will be enhanced to include a commitment to review and consider emerging industry issues and/or new industry guidance (NEI, NRC, vendor, etc.), including the industry guidance provided in EPRI License Renewal Electrical Handbook 1003057, Final Report, December 2001.

**Enhancement 5:** Detail the program's retention and disposition of testing records.

The program does not currently provide details to specify the retention or disposition of testing records.

Program Elements Affected

- **Monitoring and Trending**

  Draft ISG-15 states that trending actions are not included as part of this program because the ability to trend test results is dependent on the specific type of test chosen. Although not a requirement, test results that are trendable provide additional information on the rate of degradation. The credited activity does not provide guidance for trending previous testing results to detect the rate of degradation of the instrument cables. Therefore, the program will be enhanced to detail and specify the retention or disposition of the testing records, which could be helpful in evaluating or trending test results.

**Enhancement 6:** Detail in the program any values or indications that require investigation and/or corrective actions.

The program does clearly define the evaluation of the test results and acceptance criteria.

Program Elements Affected

- **Acceptance Criteria**

  Draft ISG-15 states that cable test results are to be within the acceptance criteria, as set out in the procedures. The program does not clearly outline values, indications, or trends that require investigation and/or corrective action. Therefore, the program will be enhanced to include guidance on testing values, indications, and/or degrading trends that require investigation or corrective actions.

**Enhancement 7:** Detail in the program the requirements for Personnel Qualification and Training.

The program does not detail the personnel qualification and/or training requirements for those performing the testing activities.

Program Elements Affected

- **Acceptance Criteria**

  Draft ISG-15 states that cable test results are to be within the acceptance criteria, as set out in the procedures. The program does not provide personnel qualification and/or training requirements. Therefore, the program will be enhanced to detail the personnel qualification and/or training requirements of those performing the testing.

**Enhancement 8:** Include guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) when test values deviate from typical values or when other material degradation or unsatisfactory test data are identified.

Program Elements Affected

- **Corrective Actions**

  Draft ISG-15 states that an engineering evaluation is performed when the test acceptance criteria are not met in order to ensure that the intended functions of the electrical cables can be maintained consistent with the current licensing basis. The procedure does not address the use of the CR process. Therefore, the program will be enhanced to explicitly direct generation of a CR when result values deviate from the typical values or when other material degradation or unsatisfactory test data are identified.

**Operating Experience**

A review of plant operating experience shows few instances of cable or connection degradation. These occurrences show the method and procedures to be effective and adequate in identifying cable degradation prior to loss of intended function.

Industry operating experience has shown that exposure to heat, radiation, and moisture results in degradation of insulating materials.

**Conclusion**

The existing Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used In Instrumentation Circuits Program with the enhancements will ensure that

the effects of aging associated with in-scope cables and connections will be adequately managed. The enhanced program provides reasonable assurance that the cable and connection intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.11 Electrical Transmission Tower Inspection

### Program Description

The Electrical Transmission Tower Inspection Program is credited with managing the aging of electrical transmission towers that are in-scope for license renewal. The program consists of inspections of steel (lattice towers and poles) and wooden pole transmission structures. The steel lattice tower and pole inspections include visual inspections of the foundation, structure, cross-members, insulators and attachment hardware. The wooden pole inspections include visual inspections of the structure, cross-members, insulators, and attachment hardware, pole sounding, and pole boring, below ground inspection, treatments, and other criteria. These monitoring and inspection activities ensure that in-scope structures retain their intended functions between inspection cycles. Program procedures, administrative controls, and corrective actions ensure that loss of material is effectively managed and intended function(s) are effectively maintained during the period of extended operation.

### Program Consistency

The Electrical Transmission Tower Inspection Program is a new program that will be consistent with the analogous AMP described in NUREG-1800, Appendix A.1, Position A1.2.3, "Aging Management Program Elements."

### Aging Management Program Elements

1. Scope of Program

   Transmission towers have been identified to be within the scope of LR and subject to aging management review. The aging management program will carry out the appropriate aging management to ensure there is not a loss of intended function of the subject poles. Specifically, the program shall consist of steel lattice tower and pole visual inspections of the foundations, structures, cross-members, insulators and attachment hardware. The wooden pole inspections shall consist of visual inspections of the structure, cross-members, insulators, and attachment hardware, pole sounding and boring, below ground inspection, treatments, and other criteria.

2. Preventive Actions

   The Electrical Transmission Tower Inspection is a condition monitoring program as described in NUREG-1800, Appendix A.1, Section A.1.1. The program provides for timely detection of aging effects and does not support preventive or mitigating actions.

3. Parameters Monitored/Inspected

Steel Lattice Towers and Poles
The program shall outline and detail inspections required to ensure steel lattice tower and pole integrity. The inspections shall include guidance for visual inspections of the foundations, steel structure, cross-members, insulators, and attachment hardware.

Wooden Poles
The program shall outline and detail the inspections required to ensure wooden pole integrity. The inspections shall include guidance for visual inspections of the entire exposed portions of the pole for physical or mechanical damage that can limit/affect the life of the pole, sounding of the pole to detect for internal decay or hollow areas, boring and excavation below ground level for cleaning, inspection (including measuring the effective circumference), and treatment.

The program shall detail inspections for various applicable treatments in the guidance. This shall include and detail issues such as pesticide and preservative application.

4. Detection of Aging Effects

The inspections outlined in the new activity shall be completed on the in scope components within five (5) years of the current license expiration date. These inspections will detect degradation and deficiencies before there is a loss of intended function(s). It is also noted in the inspection guidance that all inspections will provide the level of detail and examination to ensure that intended functions are preserved through the subsequent inspection cycle (performed every ten-years).

The program manages the aging for the electrical transmission towers within scope of LR and includes direction on 'when', 'where', and 'how.' Specifically, the program will schedule visual inspections and testing for the electrical transmission towers every ten (10) years ('when'). The program shall outline the scope of components to be inspected, including those identified within the scope of LR ('where'). Finally, as stated in the other attributes, the program shall provide inspection guidance such as visual, effective circumference, sounding, boring, and excavation ('how').

5. Monitoring and Trending

The program shall detail the retention of all previous inspection results and records. These records shall be incorporated into the program activity (as an attachment) or identified as plant records and available for review during the subsequent inspection cycle. Reviews of previous inspection results will provide for trending of long-term degradation or deterioration. This information could also help in evaluating the potential for electrical transmission tower degradation during the period before the next inspection cycle.

Additionally, the program shall provide direction for appropriate engineering reviews (structural/qualified engineer, electrical engineer, supervisor, etc.) of the completed electrical transmission tower inspection results. Although the inspections may be performed by an outside vendor or contractor or by BVPS personnel, in-house reviews of the results shall be performed to confirm that the electrical transmission tower is capable of continuing to perform its intended function through the next inspection cycle. These reviews shall be performed on all inspection documentation, pictures, evaluation forms, or other documents provided by the inspecting group (vendor, structural group, etc.).

6. Acceptance Criteria

The program shall detail the inspection and acceptance/rejection criteria for the electrical transmission towers. Also, the program shall address poles that may require reinforcement or structural (steel or fiberglass) support.

The program will detail the qualification and experience requirements for personnel performing the inspections.

7. Corrective Actions

See Section B.1.3 for a discussion of this element.

8. Confirmation Process

See Section B.1.3 for a discussion of this element.

9. Administrative Controls

See Section B.1.3 for a discussion of this element.

10. Operating Experience

The program is defined and implemented for LR, thus no plant specific operating experience currently exists. A review of the corrective action process reports yielded no reports applicable to electrical transmission tower aging or degradation. Inspection scheduling and performance, as discussed in the other NUREG-1800 attributes, will provide plant-specific inspection data and experience prior to the end of the current operating license. These results and the AMP experience, along with industry experience, will provide timely awareness of emerging aging issues as well as provide a basis for evaluating the program effectiveness and the need for program adjustments.

**Conclusion**

The new Electrical Transmission Tower Inspection Program will ensure that the effects of aging associated with the in-scope components will be adequately managed so that there is reasonable

assurance that their intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.12 Environmental Qualification (EQ) of Electric Components

### Program Description

The Environmental Qualification (EQ) of Electrical Components Program is credited with managing the aging effects of certain electrical components important to safety. The program manages component thermal, radiation, and cyclical aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. The components located in harsh plant environments (those plant areas that could be subject to loss of coolant accident [LOCA], high energy line break [HELB] or post-LOCA radiation) are qualified to perform their safety function in those harsh environments after the effects of in-service aging. The following program activities are defined by 10 CFR 50.49; the scope of components to be included, requires the preparation and maintenance of a list of in-scope components, and requires the preparation and maintenance of a qualification file that includes component performance specifications, electrical characteristics, and the environmental conditions to which the components could be subjected. EQ components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the age limits established in the evaluation. Aging evaluations for EQ components that specify a qualification of at least 40 years are considered time-limited aging analysis (TLAAs) for license renewal. Program procedures and administrative controls define preventative maintenance and surveillance activities, the monitoring of normal ambient conditions, and corrective actions, which ensure that aging is managed and intended functions are maintained during the period of extended operation.

### Program Consistency

The Environmental Qualification of Electrical Components Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section X.E1, "Environmental Qualification (EQ) of Electrical Components."

### Enhancements to meet X.E1

**Enhancement 1:** Include a definition of component types (active and passive)

The program does not provide a definition of component types.

<u>Program Elements Affected</u>

- **Program Description**

  NUREG-1801 states that certain electrical components located in harsh environments are qualified to perform their safety function in those harsh environments. The program does not provide a definition of component types. Therefore, the program will be enhanced to provide a definition of component types (active and passive).

**Enhancement 2:** Clarify and/or define the BVPS position on the EQ upgrade clause.

The program does not provide clear guidance on the site position for ongoing elimination of lesser NUREG-0588/DOR guideline qualification standard as applicable equipment fails.

Program Elements Affected

- **Program Description**

  NUREG-1801 states that all operating plants must meet the requirements of 10 CFR 50.49 for certain electrical components important to safety. The program does not provide clear guidance on the site position for ongoing elimination of lesser NUREG-0588/DOR guideline qualification standard as applicable equipment fails. Therefore, the program will be enhanced to include guidance that replacement equipment will be qualified in accordance with the provisions of paragraphs (a) through (j) of the EQ Rule, 10 CFR 50.49.

**Enhancement 3:** Include a definition of important to safety.

The program does not provide a definition of important to safety.

Program Elements Affected

- **Program Description**

  NUREG-1801 states that all operating plants must meet the requirements of 10 CFR 50.49 for certain electrical components important to safety. The program does not provide a definition of important to safety. Therefore, the program will be enhanced to include a definition of important to safety.

**Enhancement 4:** Include a discussion of the License Renewal (LR) 60-year equipment qualification requirements, including the review and update of all program and equipment qualification documents (EQP, MAPs, etc.)

The program documents do not discuss the License Renewal (LR) 60-year equipment qualification requirement.

Program Elements Affected

- **Program Description**

  NUREG-1801 states aging evaluations for EQ components that specify a qualification of at least 40 years are considered time limited aging analysis (TLAAs) for license renewal. The program documents do not discuss the License Renewal (LR) 60-year equipment qualification requirement. Therefore, the program will be enhanced to

discuss the License Renewal (LR) 60-year equipment qualification requirements, including the review and update of all program and equipment qualification documents (EQP, MAPs, etc.).

**Enhancement 5:** Include the reanalysis methodology for license renewal.

The program does not currently clearly define EQ component reanalysis.

Program Elements Affected

- **Program Description**

  NUREG-1801 provides a detailed summary of the EQ Component Reanalysis Attributes. The administrative procedure does not currently provide adequate details of the component reanalysis process. Therefore, the program will be enhanced to include the EQ Component Reanalysis Attributes from GALL X.E1 Environmental Qualification (EQ) of Electrical Components.

**Enhancement 6:** Include reference of guidance in RIS 2003-09

The program does not include the guidance provided in RIS 2003-09 for requalification of cables.

Program Elements Affected

- **Program Description**

  NUREG-1801 states that an applicant is to address GSI-168 in its application for staff review. The program does not include the guidance provided in RIS 2003-09 for requalification of cables. Therefore, the program will be enhanced to state that for license renewal, a reanalysis (based on the Arrhenius methodology) to extend the life of the cables by using the available margin based on a knowledge of the actual operating environment, coupled with observations of the condition of the cables during walkdowns will be utilized for requalification of cables as deemed acceptable by RIS 2003-09.

**Enhancement 7:** Review and incorporate Generic Letter (GL) 86-15

The program does not detail the review and incorporation of Generic Letter (GL) 86-15.

Program Elements Affected

- **Program Description**

  NUREG-1801 states "When unexpected adverse conditions are identified during operational or maintenance activities that affect the normal operating environment of a

qualified component, the affected EQ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions." The program does not detail the guidance in Generic Letter (GL) 86-15. When potential deficiencies in the environmental qualification of equipment are identified, a prompt determination of operability is made and immediate steps are taken to establish a plan, with a reasonable schedule, to correct the deficiency. Additionally, written justification for continued operation shall be prepared. Therefore, the program will be enhanced to review and incorporate GL 86-15.

**Enhancement 8:** Include a commitment to supplements 1, 2, and 3 of Bulletin No. 79-01B.

The program makes a commitment to Bulletin No. 79-01B; however, the commitment does not make reference to the supplements.

Program Elements Affected

- **Scope of Program**

  NUREG-1801 states that the EQ program applies to certain electrical components that are important to safety and could be exposed to harsh environment accident conditions, as defined in 10 CFR 50.49. The program makes a commitment to Bulletin No. 79-01B; however, the commitment does not make reference to the supplements. Therefore, the program will be enhanced to commit to the supplements 1, 2, and 3 of Bulletin No. 79-01B.

**Enhancement 9:** Include the guidance provided in Regulatory Guide 1.89 Rev. 1.

The program does not include the guidance provided in Regulatory Guide 1.89 Rev. 1.

Program Elements Affected

- **Parameters Monitored/Inspected**

  NUREG-1801 states that pursuant to Regulatory Guide 1.89, Rev. 1, such monitoring programs are an acceptable basis to modify a qualified life through reanalysis. The program does not include the guidance provide in Regulatory Guide 1.89, Rev. 1. Therefore, the program will be enhanced to include Regulatory Guide 1.89, Rev. 1 for monitoring programs which are an acceptable basis for modifying a component qualified life through reanalysis.

**Enhancement 10:** Include acceptance criteria for using monitoring to modify component qualified life.

The program does not establish acceptance criteria for using monitoring to modify component qualified life.

Program Elements Affected

- **Acceptance Criteria**

  NUREG-1801 states that when monitoring is used to modify a component qualified life, plant-specific acceptance criteria are established based on applicable 10 CFR 50.49(f) qualification methods. The program does not establish acceptance criteria for using monitoring to modify component qualified life. Therefore, the program will be enhanced to establish acceptable acceptance criteria for using monitoring to modify component qualified life. The acceptance criteria are plant specific and based upon applicable 10 CFR 50.49(f) qualification methods.

**Enhancement 11:** Include guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) for conditions adverse to quality.

Program Elements Affected

- **Corrective Actions**

  The NUREG-1801 program attributes states that the requirements of 10 CFR 50, Appendix B, are acceptable in addressing corrective actions. Program administrative procedures do not address the use of the CR process. Therefore, the program will be enhanced to explicitly direct generation of a Condition Report (CR) for conditions adverse to quality.

**Enhancement 12:** Include guidance to review environmental qualification of electrical components related industry documents received by FENOC for applicability to BVPS. Those affecting, or thought to affect BVPS, shall be entered into the CAP for resolution.

The program does not detail the review of industry correspondence (bulletins, letters, notices, OE reports, advisories) related to environmental qualification of electrical components.

Program Elements Affected

- **Operating Experience**

  The NUREG-1801 program attribute details industry correspondence and operating experience related to the program. The program does not detail this review of industry correspondence and operating experience. Therefore, the program will be enhanced to direct a review of industry correspondence (bulletins, letters, notices, OE reports,

advisories) related to environmental qualification of electrical components. Those that affect, or are thought to affect BVPS, shall be entered into the site CAP for resolution.

**Operating Experience**

A review of the documented corrective action reports and other site OE shows that the site is sensitive and aware of EQ program related issues and the need to document such issues. The program continues to be effective and implemented in accordance with CLB commitments. Plant operating experience demonstrates that the program is effective in documenting, mitigating, and correcting EQ related issues.

BVPS will continue to review the EQ Program as revised industry guidance is being released. Applicable guidelines and requirements have been incorporated into the EQ program and implementing procedures.

**Conclusion**

The continuation of the existing Environmental Qualification (EQ) of Electric Components Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.13 Fire Protection

### Program Description

The Fire Protection Program is credited with managing age related degradation of fire barriers and penetration seals, fire dampers and doors, halon and carbon dioxide fire suppression systems, and the engine-driven fire pump fuel oil supply line. Visual inspections are relied on to detect degradation of fire seals, fire barriers, fire doors and dampers. Additionally, the program relies on performance testing of the engine driven fire pump to ensure reliability the fuel oil supply line. Functional tests and inspections are performed on the halon and carbon dioxide fire suppression systems to detect and correct degradation. Program procedures, administrative controls, and corrective actions ensure that unacceptable degradation is effectively managed and intended function(s) are maintained during the period of extended operation.

### Program Consistency

The Fire Protection Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M26, "Fire Protection" as revised in NRC Interim Staff Guidance (ISG)-04, with the following exception:

BVPS performs functional testing and visual inspections of Halon and Carbon Dioxide fire suppression systems consistent with the GALL; however, they are performed every 18-months. This frequency is not consistent with the 6-month GALL requirement.

### Exceptions to XI.M26

**Exception 1:** The frequency of Halon/Carbon Dioxide fire suppression system functional testing and inspections are not consistent with NUREG-1801.

BVPS performs functional tests and visual inspections of halon/carbon dioxide fire suppression systems every 18-months, which is not consistent with NUREG-1801.

<u>Program Elements Affected</u>

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that periodic visual inspections and functional tests at least once every six months examines the signs of degradation of the systems. BVPS performs visual inspections and functional test of Halon and Carbon Dioxide fire suppression systems every 18-months. This frequency is not consistent with the 6-month GALL requirement. Site operating experience shows no historic deficiencies related to degradation of the CO2 and Halon systems. The 18-month frequency is considered acceptable based on the plant's experience.

**Enhancements to Meet XI.M26**

**Enhancement 1:** Include applicable references in the program.

The program does not provide reference to site administrative procedure 1/2-ADM-0407. Additionally, the program does not provide reference to industry correspondence that is identified by NUREG-1801, which includes NRC Information Notice (IN) 88-56, IN 94-28, IN 97-70, IN 91-47, Bulletin 92-01 (including Supplement 1), and Generic Letter (GL) 92-08.

Program Elements Affected

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that the inspections shall examine any sign of degradation. The program does not reference the administrative procedure for installation and inspection of permanent and temporary penetration seals. Therefore, the program procedures will be enhanced to reference 1/2-ADM-0407, where applicable. This procedure describes the necessary actions and documentation requirements when inspecting the installation of permanent or temporary penetration seals in safety related or Category F structures

- **Operating Experience**

  The NUREG-1801 program attribute identifies several examples of industry operating experience that is applicable to the Fire Protection Program. The program does not reference the industry operating experience and correspondence that is identified in NUREG-1801. Therefore, the program procedures will be enhanced to provide reference to NRC Information Notice (IN) 88-56, IN 94-28, IN 97-70, IN 91-47, Bulletin 92-01 (including Supplement 1), and Generic Letter (GL) 92-08.

**Enhancement 2:** Resolve the program disparity with inspection criteria for silicone foam seals.

The program provides conflicting inspection criteria for foam seals in two program procedures.

Program Elements Affected

- **Operating Experience**

  The NUREG-1801 program attribute states that silicone foam barrier penetration seals have experienced splits, shrinkage, voids, lack of fill, and other failure modes. The inspection guidance in program procedures is not consistent. Therefore, the inspection guidance will be aligned and incorporated into applicable procedures.

**Enhancement 3:** Include degradation mechanisms for concrete fire barriers.

The program inspection guidance does not include concrete degradation descriptions for cracking, spalling, and loss of material.

Program Elements Affected

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that visual inspections of fire barriers examine for signs of degradation such as cracking, spalling, and loss of material. The inspection guidance does not include these aging examples. Therefore, the program guidance will be enhanced to identify these concrete degradation examples.

**Enhancement 4:** Include inspection guidance for the diesel-driven fire pump fuel oil supply line.

The fire pump maintenance activity does not include guidance for fuel oil supply line inspection.

Program Elements Affected

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that the diesel-driven fire pump is under observation during performance testing to detect any degradation of the fuel oil supply line. The maintenance activity does not detail inspections. Therefore, the procedure will be enhanced to provide guidance to inspect accessible portions of the fuel oil supply line for corrosion or physical damage.

**Enhancement 5:** Include inspection guidance for nozzles, accessible piping/headers, valves, and halon system pilot hoses in halon and carbon dioxide fire suppression systems.

The program inspection procedures do not detail inspections of nozzles, accessible piping/headers, valves, and halon system pilot hoses for physical damage, corrosion, or integrity.

Program Elements Affected

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that material conditions that may affect the performance of the system are observed during functional tests. The inspection activities do not detail inspections of nozzles, accessible piping/headers, valves, and halon system pilot hoses for physical damage, corrosion, or integrity. Therefore, the procedures will be enhanced to include these inspections.

**Enhancement 6:** Enhance testing procedure sections to detail the activity's scope.

Procedure sections do not clearly identify the testing scope in its discussion section. The missing scope is required to be aligned with the guidance of NUREG-1801.

Program Elements Affected

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that material conditions that may affect the performance of the system are observed during functional tests. The carbon dioxide testing procedure does not fully discuss the activity scope in its discussion section. The tasks that are not included are necessary to be aligned with NUREG-1801. Therefore, the procedure sections will be enhanced to identify that testing and verification of the operability of the dampers by visual inspection is performed by the activity.

**Enhancement 7:** Include guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) for unsatisfactory inspection or testing results, or conditions adverse to quality.

Program Elements Affected

- **Corrective Actions**

  The NUREG-1801 program attribute states that the requirements of 10 CFR 50, Appendix B, are acceptable in addressing corrective actions. Program administrative procedures do not address the use of the CR process. Therefore, the program will be enhanced to explicitly direct generation of a Condition Report (CR) for unsatisfactory inspection or testing results, or conditions adverse to quality.

**Enhancement 8:** Include guidance to review fire protection related industry documents received by FENOC for applicability to BVPS. Those affecting, or thought to affect BVPS, shall be entered into the CAP for resolution.

The program does not detail the review of industry correspondence (bulletins, letters, notices, OE reports, advisories) related to fire protection.

Program Elements Affected

- **Operating Experience**

  The NUREG-1801 program attribute details industry correspondence and operating experience related to the program. The program does not detail this review of industry correspondence and operating experience. Therefore, the program will be enhanced to

direct a review of all industry correspondence (bulletins, letters, notices, OE reports, advisories) related to fire protection. Those documents that affect, or are thought to affect BVPS, shall be entered into the site CAP for resolution.

## Operating Experience

The Fire Protection Program and its associated surveillance activities are effective at managing the aging of fire penetrations and seals, fire doors and dampers, fire barrier walls, ceilings, and floors, halon/carbon dioxide fire suppression system, and the diesel driven fire pump fuel oil supply line.

A review of the CAP shows a number of Condition Reports (CR) that document deficiencies related to missing or non-conforming fire penetration seals. As-built comparisons and inspections continue to identify discrepancies. The site is aware of such discrepancies and continues to inspect areas and conditions to validate all fire rated penetration seals. Fire barrier walls, ceilings, and floors appear to be effectively managed. There are few condition reports noting problems or deficiencies with these components. The operating experience related to fire doors appears adequate to provide for timely detection of operability problems. Although site awareness of these requirements was noted as deficient in some condition reports, there is now increased sensitivity and site awareness as a result of CR corrective actions. No previous operating experience with degradation/corrosion of the fuel oil supply line, the diesel fire pump casing, or the Halon/CO2 systems has been identified. There have been many occurrences of fire damper deficiencies (operable and inoperable) that have been documented. This experience shows a long-term problem associated with the degradation of the CO2 fire dampers, which have been shown to be prone to operational problems. Corrective actions were implemented and the site will continue to inspect and test the dampers.

## Conclusion

The continuation of the existing Fire Protection Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.14 Fire Water System

### Program Description

The Fire Water System Program is credited with managing age related degradation of water-based fire protection system components, such as sprinkler suppression systems, hydrants and hose stations, strainers, pumps, and aboveground and underground piping and valves. The program includes flow testing and system performance testing in accordance with applicable NFPA codes and insurance carrier requirements to maintain operability and manage aging. The NFPA codes were used as guidelines in testing procedures. The Fire Water System and associated components are maintained at required system pressure and monitored so that leakage or a loss of system pressure is immediately detected and corrective actions initiated.

Periodic NDE volumetric examinations on predetermined system locations provide data for monitoring and trending of pipe wall thinning and system corrosion rates. Additionally, periodic chemical treatments of pre-determined piping sections are made to control and minimize MIC type corrosion. Silting and biofouling is managed by monitoring and control of system water quality during program surveillance activities and chemical treatment of system branches when determined necessary. Internal inspections are also performed and documented when the system is breached for maintenance or repair. Program procedures, administrative controls, and corrective actions ensure that unacceptable degradation is effectively managed and intended function(s) are maintained during the period of extended operation.

### Program Consistency

The Fire Water System Program is an existing program, that with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M27, "Fire Water System" as revised in NRC Interim Staff Guidance (ISG)-04.

### Enhancements to Meet XI.M27

**Enhancement 1:** Develop a listing of applicable NFPA codes.

The program documentation does not detail a comprehensive listing of NFPA codes that are applicable to BVPS.

<u>Program Elements Affected</u>

- **Program Description**

  The NUREG-1801 program attribute states that the aging management program applies to water-based fire protection systems that are tested in accordance with NFPA codes and standards. The program does not identify or reference the applicability of many significant NFPA codes, including those outlined in NUREG-1801. Therefore, the

program will be enhanced to provide reference to, or include a listing of the NFPA codes, their applicability to BVPS, and any relative justifications or applicability details.

**Enhancement 2:** Incorporate the NFPA guidance for sprinkler heads that have been in service for 50 years.

The program does not provide guidance for sprinkler heads that have been in place for 50 years.

Program Elements Affected

- **Program Description**

  The NUREG-1801 program attribute states that a sample of sprinkler heads is to be inspected by using the guidance in NFPA 25. The NFPA code requires that where sprinklers have been in place for 50 years, they shall be replaced or a representative sample from one or more sample areas be submitted for testing. Therefore, the program will be enhanced to detail the requirements of NFPA 25 for these sprinkler heads.

**Enhancement 3:** Expand the current NDE volumetric examination scope to include sprinkler systems and limiting locations that bound the entire fire water system (including inaccessible or buried portions).

The volumetric examination scope does not include limiting locations so that all system portions, including the inaccessible or buried portions and sprinkler systems, are bounded by the periodic pipe wall thickness measurements and/or internal visual inspections.

Program Elements Affected

- **Program Description**

  The NUREG-1801 program attribute states that the sprinkler system piping is to be subjected to a full flow test or evaluated for pipe wall thickness to ensure aging effects are managed. The current volumetric examination scope does not bound the sprinkler system piping. Therefore, the program will schedule and perform comprehensive baseline UT testing of the fire protection water system piping and the sprinkler system piping to ensure that corrosion and aging effects are managed. These baseline inspections, and/or visual inspections, shall address and bound the entire fire protection system.

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that periodic flow testing using the guidance of NFPA 25 at the maximum design flow or performance of wall thickness evaluations are performed to ensure that the system maintains its intended function. The current volumetric examination scope does not bound all system areas, including the sprinkler portions. Therefore, the program will schedule and perform comprehensive baseline UT

testing of the fire protection water system piping and the sprinkler system piping to ensure that corrosion and aging effects are managed. These baseline inspections, and/or visual inspections, shall address and bound the entire fire protection system, including inaccessible or buried piping portions and sprinkler piping.

**Enhancement 4:** Modify site maintenance procedures to include guidance to contact the program or system engineer for any breach of a fire water system.

The program does not detail guidance for inspections of system and component internal conditions and environments during a system breach for maintenance, repair, or other reason.

Program Elements Affected

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that periodic flow testing using the guidance of NFPA 25 at the maximum design flow or performance of wall thickness evaluations are performed to ensure that the system maintains its intended function. The program and the administrative maintenance procedure do not detail system internal inspections when breached for maintenance, repair, or other reason. Therefore, the maintenance administrative procedure will be enhanced to direct that the program or system engineer be contacted for any breach of the fire water system. This notification will allow the engineer to perform inspections, as necessary, of internal conditions. These inspections will be used to assess the effectiveness of chemistry controls, material conditions, and to evaluate system and component performance.

**Enhancement 5:** Enhance the program to detail inspections for evidence of clams or mussels during system flushing activities.

The program does not detail guidance to observe for evidence of clams or mussels during system flushing or during FP surveillance tests (such as fire hydrant, strainer flush tests, and sprinkler drain testing).

Program Elements Affected

- **Preventive Actions**

  The NUREG-1801 program attribute states that periodic flushing, system performance testing, and inspections may be conducted to ensure no significant corrosion, MIC, or biofouling has occurred. The program does not provide guidance to monitor flushing activities for evidence of biofouling. Therefore, the program will be enhanced to detail observing for evidence of biofouling, including clams and mussels, during all system flushing activities (such as fire hydrant, strainer flush tests, and sprinkler drain testing).

**Enhancement 6:** Include in the program reference to the "Pipe Management Plan".

The program does not detail reference to the "Pipe Management Plan", which was detailed as corrective actions from Condition Reports (CR) 02-04780 and 02-01098.

Program Elements Affected

- **Operating Experience**

  The NUREG-1801 program attribute states that water-based fire protection systems designed, tested, and maintained in accordance with the NFPA minimum standards have demonstrated reliable performance. Corrective actions from several CRs has developed and implemented the "Pipe Management Plan", which targets improved system reliability. The program does not reference or detail this management plan. Therefore, the program will be enhanced to outline and provide guidance on the plan. This shall include plan elements such as MIC control, periodic sampling for biological activity, estimating corrosion rates, UT examinations (19 points currently monitored), periodic (annual) chemical treatment of pre-determined piping sections, and continuing evaluation of welds and pipe wall thickness of system piping.

**Operating Experience**

A review of Condition Reports (CR) shows several piping failures resulting from MIC related corrosion. Additionally, pipe wall thinning is identified as the cause of several piping failures. As a result, select portions of the system are currently being monitored using UT examination methods. These examinations are intended to establish baseline UT examination data that is representative and bounds all water-based system portions. Enhancements to the program will expand the scope to include the sprinkler piping.

Portions of cast iron piping have been shown to be susceptible to de-alloying (graphitic) corrosion. Several failures are noted in the operating experience, which have been attributed to this mechanism. Large portions of susceptible underground piping in the East and West fire headers have been replaced as a result of recurring failures. Management of components susceptible to de-alloying type corrosion for License Renewal will be in the One-Time Inspection Program.

The current site direction for addressing the problems with MIC attack is considered a practical approach and stems from CR corrective actions. Development of a "Piping Management Plan" was undertaken to address the MIC problem. This plan includes evaluations of operating experience and industry MIC practices (EPRI guidelines), periodically sampling for biological activity, estimating corrosion rates, UT examinations (19 points currently monitored), periodic (annual) chemical treatment of pre-determined piping sections, and continuing evaluation of results. This plan was developed using industry guidance and experience by documenting a benchmarking of the MIC control options employed at other utilities.

## Conclusion

The continuation of the existing Fire Water System Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.15 Flow-Accelerated Corrosion

### Program Description

The Flow Accelerated Corrosion (FAC) Program is credited with managing loss of material in carbon steel and low-alloy steel piping systems that results from flow accelerated corrosion. Program activities include analyses to determine susceptible locations, performance of baseline inspections for wall thickness, detection of wall-thinning, scheduling follow-up inspections, corrective actions, wear rate trending, and predictive modeling techniques. Program procedures, administrative controls, and corrective actions ensure that loss of material is effectively managed and intended function(s) are maintained during the period of extended operation.

### Program Consistency

The Flow Accelerated Corrosion (FAC) Program is an existing program that, with the following enhancements, is consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M17, "Flow-Accelerated Corrosion."

### Enhancements to Meet XI.M17

**Enhancement 1:** Align and implement the FAC program in accordance with NSAC-202L-R2.

The FAC program does not currently declare that it is implemented in accordance with Revision 2 of the EPRI NSAC guidance.

<u>Program Elements Affected</u>

- **Scope of Program**

  The NUREG-1801 program attribute states that the FAC program relies on the implementation of the EPRI guidance in NSAC-202L-R2. The FAC program currently provides reference to Revision 1 of the EPRI NSAC-202L guidance. Therefore, the program will be enhanced to declare that it is implemented in accordance with the EPRI guidance in NSAC-202L-R2, "Recommendations for an Effective Flow-Accelerated Corrosion Program".

**Enhancement 2:** Clarify the program's approach to non-modeled, susceptible piping and components.

The FAC Program will be enhanced to provide guidance for susceptible non-modeled lines and components within analyzed lines (Section 4.4.1.3 and 4.5.2 of NSAC-202L-R2)

Program Elements Affected

- **Scope of Program**

  The NUREG-1801 program attribute states that the FAC program shall assure the structural integrity of all carbon steel lines containing high-energy fluids (two phase as well as single phase). The program does not address susceptible systems or portions of systems with varying conditions that are not modeled. Additionally, the selection of inspection locations in these areas is not detailed in the program. Therefore, the program will be enhanced to detail the susceptible non-modeled lines that are within the program scope.

**Enhancement 3:** Include reference to the initial susceptibility assessment performed to determine the FAC susceptible plant systems.

The program does not currently reference the initial susceptibility assessment that was performed to determine the plant systems that required management for FAC related degradation (ALTRAN calculation #98113-TR-01).

Program Elements Affected

- **Scope of Program**

  The NUREG-1801 program attribute states that the program shall include an analysis to determine critical locations. The current program does not reference the initial susceptibility assessment. Therefore, the FAC program document will be enhanced to include this reference.

**Enhancement 4:** Detail the program's approach to the qualification of a back-up FAC Program Engineer (Section 2.5 of NSAC-202L-R2).

The program does not detail the qualification of a back-up FAC Program Engineer as provided in the NSAC-202L-R2 guidance.

Program Elements Affected

- **Preventive Actions**

  The NUREG-1801 program attribute states that NSAC-202L-R2 provides general guidelines for the FAC program. The current program does not detail this program aspect, as provided in Section 2.5 of NSAC-202L-R2. Therefore, the program will be enhanced to provide the appropriate details concerning the qualification of a back-up FAC Program Engineer.

**Enhancement 5:** Detail the program's long-term FAC reduction strategies (Section 2.0 and 5.0 of NSAC-202L-R2).

The program discusses several aspects of FAC reduction; however, does not detail the BVPS reduction strategy.

Program Elements Affected

- **Preventive Actions**

  The NUREG-1801 program attribute states that NSAC-202L-R2 provides general guidelines for the FAC program. The program discusses chemistry factors that affect FAC; however, as detailed in Section 2.0 of EPRI NSAC-202L-R2, the program must detail a long-term strategy for reducing FAC. Section 5.0 of the NSAC document further details guidance on development of a long-term strategy. Therefore, the program will be enhanced to outline and detail the program position and strategy.

**Enhancement 6:** Detail the program comparison of actual results to predicted data in evaluating remaining life, including the use of inspection results as input to the predictive code (Pass 2 analysis).

The program does not currently detail the comparison of actual results to the predicted data, as well as the use of inspection results as input to the predictive code to calculate the remaining component life.

Program Elements Affected

- **Acceptance Criteria**

  The NUREG-1801 program attribute states that inspection results are used as input to a predictive code to calculate the remaining life. Results from the BV inspections are used to update and enhance the predictions in CHECWORKS software; however, the program does not specifically detail this aspect. Therefore, the program will be enhanced to detail this comparison and the calculation of the remaining component life.

**Enhancement 7:** Include guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) for unsatisfactory inspection results or conditions adverse to quality.

Program Elements Affected

- **Corrective Actions**

  The NUREG-1801 program attribute states that the requirements of 10 CFR 50, Appendix B, are acceptable in addressing corrective actions. Program administrative

procedures do not address the use of the CR process. Therefore, the program will be enhanced to explicitly direct generation of a Condition Report (CR) for unsatisfactory inspection results or conditions adverse to quality.

**Enhancement 8:** Include industry operating experience identified by the GALL within the program.

The program does not currently include reference to the following industry operating experience documents: feedwater and condensate system problems (NRC Information Notices (IN) 81-28, 92-35, 95-11), problems in two-phase piping in extraction steam lines (NRC INs 89-53, 97-84), and moisture separation reheater and feedwater heater drains problems (NRC INs 89-53, 91-18, 93-21, 97-84).

Program Elements Affected

- **Operating Experience**

  The NUREG-1801 program attribute details industry operating experience that is related to the FAC program. Several of the noted NRC issued documents are related to industry operating experience that are not referenced in the program. These historical documents have contributed to the development of the NSAC guidance and to site FAC programs. Therefore, the program will be enhanced to reference these GALL identified documents.

**Enhancement 9:** Include guidance to review FAC related industry documents received by FENOC for applicability to BVPS. Those affecting, or thought to affect BVPS, shall be entered into the CAP for resolution.

The program does not detail the review of industry correspondence (bulletins, letters, notices, OE reports, advisories) related to FAC.

Program Elements Affected

- **Operating Experience**

  The NUREG-1801 program attribute details industry correspondence and operating experience related to the program. The program does not detail this review of industry correspondence and operating experience. Therefore, the program will be enhanced to direct a review of all industry correspondence (bulletins, letters, notices, OE reports, and advisories) related to FAC. Those documents that affect, or are thought to affect BVPS, shall be entered into the site CAP for resolution.

## Operating Experience

A review of the plant condition reports shows several instances of flow accelerated corrosion occurring at the plant. Some are located in areas previously identified as susceptible to FAC and some are located in new areas. This operating experience demonstrates that a properly implemented FAC Program is effective in managing loss of material in high-energy carbon steel piping and components, thus ensuring their intended functions.

BVPS has evaluated numerous applicable information notices. Applicable guidelines and requirements have been incorporated into the Flow Accelerated Corrosion procedures. All FAC related documents (e.g., bulletins, letters, notices, OE reports, advisories) received by FENOC will be reviewed for applicability and those affecting, or thought to be affecting, BVPS will be entered into the condition report process for resolution.

## Conclusion

The continuation of the existing Flow-Accelerated Corrosion Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

### B.2.1.16 Flux Thimble Tube Examination Program

**Program Description**

The Flux Thimble Tube Examination Program is credited with managing loss of material in the in-core flux thimble tubes through detection, trending, and monitoring of wall thinning resulting from wear. Inspection frequencies and corrective measures are based on examination results and wear rate projection and trending, which ensures that tube wall thickness is maintained above established acceptance criteria. The program is implemented in accordance with the guidance in NRC Bulletin 88-09. Program procedures, administrative controls, and corrective actions ensure that intended functions are effectively maintained during the period of extended operation.

**Program Consistency**

The Thimble Tube Inspection Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1800, Standard Review Plan Appendix A, Position A.1.2.3, "Aging Management Program Elements."

**Enhancements to Meet NUREG-1800**

**Enhancement 1:** Detail the program commitment to NRC Bulletin 88-09.

The program does not identify the commitment made to the NRC in response to NRC Bulletin 88-09.

<u>Program Elements Affected</u>

- **Scope of Program**

  NUREG-1800 states that the specific program necessary for license renewal should be identified. The program does not include reference to the commitment letters made to the NRC for implementing a program in accordance with NRC Bulletin 88-09. Therefore, the program will be enhanced to identify this program commitment.

**Enhancement 2:** Declare the program requirement for establishing an inspection frequency and the justification substantiating the frequency.

The program does not clearly identify the inspection frequency and the justification substantiating the frequency, as required in NRC Bulletin 88-09.

Program Elements Affected

- **Detection of Aging Effects**

  NUREG-1800 states that detection of aging effects should occur before there is a loss of intended function. Additionally, NRC Bulletin 88-09 directs that an appropriate inspection frequency be established to monitor thimble tube performance. Therefore, the program will be enhanced to detail the inspection frequencies at Unit 1 and Unit 2 and the justification substantiating the frequency.

**Enhancement 3:** Detail program wear rate trending and life projection activities.

The program does not detail wear rate trending or guidance for estimating and projecting remaining tube life.

Program Elements Affected

- **Monitoring and Trending**

  NUREG-1800 states that monitoring and trending activities should be described, and that they should provide predictability of the extent of degradation. The program does not detail wear rate trending or guidance for estimating and projecting remaining tube life. Also, the program does not detail evaluations of worn tubes and their ability to maintain minimum wall thickness through subsequent operational periods and to the next inspection cycle. Therefore, the program will be enhanced to detail these wear rate trending and life projection activities.

**Enhancement 4:** Detail the tube acceptance evaluations, wear acceptance criteria, and the technical justification for acceptance criteria in the program.

The program does not declare the wear acceptance criteria and the tube acceptance evaluations, including permitted allowances for inspection methodology and wear scar geometry uncertainties. Additionally, the program does not identify the technical justification for the selected acceptance criterion, as required by NRC Bulletin 88-09.

Program Elements Affected

- **Acceptance Criteria**

  NUREG-1800 states that acceptance criteria and its basis should be described. Additionally, NRC Bulletin 88-09 directs that tube wear acceptance criterion, with technical justification, be established to evaluate volumetric testing results. Also, the program does not detail the allowance permitted for inspection methodology and wear scar geometry uncertainties. Therefore, the program will be enhanced to detail this information.

**Enhancement 5:** Include guidance to review flux thimble tube related industry documents received by FENOC for applicability to BVPS. Those affecting, or thought to affect BVPS, shall be entered into the CAP for resolution.

The program does not detail the review of industry correspondence (bulletins, letters, notices, OE reports, advisories) related to flux thimble tubes.

Program Elements Affected

- **Operating Experience**

  The NUREG-1801 program attribute details industry correspondence and operating experience related to the program. The program does not detail this review of industry correspondence and operating experience. Therefore, the program will be enhanced to direct a review of all industry correspondence (bulletins, letters, notices, OE reports, advisories) related to flux thimble tubes. Those documents that affect, or are thought to affect BVPS, shall be entered into the site CAP for resolution

**Aging Management Program Elements**

1. Scope of Program

   BVPS is committed under the CLB to establish a program to monitor thimble tube performance as mandated in NRC Bulletin 88-09, "Thimble Tube Thinning in Westinghouse Reactors." Additionally, BVPS' correspondence provides further details of the wear acceptance criterion concerns, inspection frequency, and inspection methodology utilized during the initial inspection of the Unit 1 thimble tubes.

2. Preventive Actions

   The Thimble Tube Inspection Program is a condition monitoring program as described in Appendix A of NUREG-1800, A.1.1, Background. The program provides for timely detection of aging effects and does not support preventive or mitigating actions.

3. Parameters Monitored/Inspected

   BVPS is committed under the CLB to establish a program to monitor thimble tube performance as mandated in NRC Bulletin 88-09, "Thimble Tube Thinning in Westinghouse Reactors." The program includes volumetric examination techniques, which are capable of detecting and quantifying thimble tube wall thinning (wear).

4. Detection of Aging Effects

NRC Bulletin 88-09 specifically directs that an appropriate inspection frequency be established to monitor the thimble tube performance. This NRC Bulletin specifically directs that an inspection methodology capable of detecting wear (wall thinning) of the thimble tubes (such as eddy current testing) be established in the program.

The activity outlines eddy current testing requirements using the bobbin coil method for detecting wall thinning in the thimble tubes. The results from the bobbin coil examinations will be used to determine the percent through-wall degradation of the thimble tubes. This detection will detect and monitor wall thinning in the thimble tubes, thus ensuring intended functions are maintained.

5. Monitoring and Trending

NRC Bulletin 88-09 specifically directs that inspection methodology capable of detecting wear (wall thinning) of the thimble tubes (such as eddy current testing) be established. It also requires that tube wear acceptance criterion be established (for example, percent through-wall loss) to evaluate each tube's eddy current results.

The program outlines the eddy current testing requirements using the bobbin coil method for detecting and quantifying wall thinning. The eddy current results are compared to acceptance criteria established by the program (quantified as % wall loss). Trending and predicting wear rates of worn tubes and their ability to maintain their intended function through the next inspection cycle will be incorporated as a program enhancement. Site specific OE supports this practice by showing the re-positioning of tubes that are identified as substantially worn and those that are trended as not capable of maintaining the minimum wall thickness through the operational period to the next inspection cycle.

6. Acceptance Criteria

The program outlines the eddy current testing requirements using the bobbin coil method for detecting and quantifying wall thinning. The eddy current results are compared to acceptance criteria established by the program (quantified as % wall loss) to evaluate the acceptability of the tube. Program enhancements will detail acceptance criterion and tube acceptance evaluations, as well as the technical justification for the selected acceptance criterion.

7. Corrective Actions

See Section B.1.3 for a discussion of this element.

8. Confirmation Process

See Section B.1.3 for a discussion of this element.

9. Administrative Controls

   See Section B.1.3 for a discussion of this element.

10. Operating Experience

    Based on IE Bulletin 88-09, "Thimble Tube Thinning in Westinghouse Reactors," the NRC requested that licensees implement a flux detector thimble tube inspection program. BVPS committed to the bulletin and has implemented the Flux Thimble Tube Examination Program.

    A review of plant operating experience has shown that some leakage and degradation of the seal table area has been noted; however, no thimble tube leaks have occurred. The corrective action process has been effective in identifying anomalies, implementing appropriate corrective actions, and trending and projecting degradation rates.

    BVPS has evaluated applicable information notices. Applicable guidelines and requirements have been incorporated into the Thimble Tube Inspection program. All related documents (e.g., bulletins, letters, notices, OE reports, advisories) received by FENOC will be reviewed for applicability and those affecting, or thought to be affecting, BVPS will be entered into the condition report process for resolution.

**Conclusion**

The continuation of the existing Thimble Tube Inspection Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.17 Fuel Oil Chemistry Program

### Program Description

The Fuel Oil Chemistry Program is credited with managing the aging of the internal surfaces of fuel oil tanks and associated fuel oil system components. The program manages loss of material from the emergency diesel fuel oil system components. Fuel oil quality is monitored for water and contaminants in accordance with Technical Specification requirements and select American Society for Testing Materials (ASTM) Standards. Exposure to fuel oil contaminants, such as water and microbiological organisms, is minimized by verifying the quality of new oil before its introduction into the diesel-generator fuel oil storage tanks. Water contamination is managed through periodic monitoring and draining from in-scope fuel oil tanks. Tank internal inspections monitor for material degradation and evaluate wall thinning through UT examinations (or equivalent) when determined necessary to preserve tank intended functions. Program procedures, administrative controls, and corrective actions ensure that loss of material is effectively managed and intended function(s) maintained during the period of extended operation.

### Program Consistency

The Fuel Oil Chemistry Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M30, "Fuel Oil Chemistry," with the following exceptions:

(a) Biocides are not added to the fuel oil at BVPS.
(b) Stabilizers and corrosion inhibitors are not added to the fuel oil at BVPS.
(c) As required by BVPS Technical Specifications, ASTM Standard D 1796, and not D 2709, is utilized for the determination of water and sediment contamination in diesel fuel oil.
(d) BVPS utilizes unmodified ASTM D 2276, Method A2 for the determination of fuel oil particulate concentration instead of the modified ASTM D 2276, Method A.

### Exceptions to XI.M30

**Exception 1:** The Addition of Biocides is not Included in the Fuel Oil Chemistry Program.

Biocides are not added to the fuel oil at BVPS.

<u>Program Elements Affected</u>

- **Preventive Actions**

  The NUREG-1801 program attribute states that the quality of fuel oil is maintained by additions of biocides to minimize biological activity. BVPS does not add biocides to the site fuel oil. There is no significant operating experience showing biological activity is a

problem at BVPS. Minor biological activity has been identified. Additionally, a recent review of the possibility of using fuel oil additives at BVPS determined that additives were not recommended for use.

**Exception 2:** The Addition of Stabilizers and Corrosion Inhibitors is not included in the Fuel Oil Chemistry Program.

Stabilizers and corrosion inhibitors are not added to the fuel oil at BVPS.

Program Elements Affected

- **Preventive Actions**

  The NUREG-1801 program attribute states that stabilizers to prevent biological breakdown of the fuel are used. BVPS does not currently add fuel stabilizers and corrosion inhibitors to prevent the biological breakdown of the diesel fuel and to mitigate corrosion. Particulate testing will provide indication of the presence of corrosion byproducts and microbiological growth. A recent review of the possibility of using fuel oil additives at BVPS determined that additives were not recommended for use at BVPS.

**Exception 3:** Technical Specifications require the use of specific ASTM Standards.

As required by BVPS Technical Specifications, ASTM Standard D 1796, and not D 2709, is utilized for the determination of water and sediment contamination in diesel fuel oil.

Program Elements Affected

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that ASTM D 1796 and D 2709 are used for determination of water and sediment contamination in diesel fuel oil. The BVPS CLB defines ASTM D 1796, and not D 2709, for the determination of water and sediment contamination.

**Exception 4:** Unmodified ASTM D 2276, Method A2 is utilized for the determination of fuel oil particulate concentration.

Modified ASTM D 2276, Method A is not used at BVPS for the determination of particulates.

Program Elements Affected

- **Parameters Monitored/Inspected**

The NUREG-1801 program attribute states that ASTM D 2276, Method A, is used for the determination of particulate concentrations. BVPS utilizes unmodified ASTM D 2276, Method A2, for the determination of fuel oil particulate concentrations.

**Enhancements to Meet XI.M30**

**Enhancement 1:** Detail the sampling of Security Diesel Generator Day Tank [1NHS-TK-2] and applicable ASTM standards.

The program does not provide sampling instructions and acceptance criteria for the Security Diesel Generator Day Tank.

Program Elements Affected

- **Scope of Program**

  The NUREG-1801 program attribute states that the program is focused on managing the conditions that cause general, pitting, and microbiologically influenced corrosion (MIC) of the diesel fuel tank internal surfaces. The current program does not provide a procedure for sampling the Security Diesel Generator Day Tank [1NHS-TK-2]. Therefore, a new chemistry procedure will be created to provide sampling guidance and acceptance criteria for the day tank. This procedure will detail the sampling frequencies and monitoring (at least quarterly) of accumulated water, total particulate contamination, water and sediment, and kinematic viscosity along with other parameters in accordance with ASTM standards. The activity shall also specify monitoring for accumulated water, total particulate contamination, water and sediment, and kinematic viscosity in accordance with ASTM Standards D1796, D 2276, and D 4057.

**Enhancement 2:** Detail the ERFS Diesel Generator Day Tank [1RGF-TK-2] sampling frequencies for accumulated water, total particulate contamination, water and sediment, and kinematic viscosity.

The program does not provide sampling frequencies for these parameters.

Program Elements Affected

- **Scope of Program**

  The NUREG-1801 program attribute states that water and biological activity or particulate contamination concentrations are monitored and trended at least quarterly. The program does not detail sampling frequencies for accumulated water, total particulate contamination, water and sediment, and kinematic viscosity in the ERFS Diesel Generator Day Tank [1RGF-TK-2]. Therefore, the program activity will be enhanced to declare these frequencies.

**Enhancement 3:** Detail in program procedures that fuel oil quality is monitored and maintained in accordance with ASTM Standards D 1796, D2276, and D 4057.

The procedure does not reference or identify these ASTM standards as applicable to maintaining fuel oil quality.

Program Elements Affected

- **Program Description**

  The NUREG-1801 program attribute states that fuel oil quality is maintained and monitored in accordance with the guidelines of ASTM D1796, D2276, and D4057. Program procedures do not identify this industry guidance. Therefore, the procedures will be enhanced to declare that fuel oil quality is monitored and maintained in accordance with the noted ASTM standards.

- **Parameters Monitored/Inspected**

  The NUREG-1801 program attribute states that ASTM Standard D 4057 is used for guidance on oil sampling. It further states that ASTM Standards D 1796 and D 2709 are used for determination of water and sediment contamination in diesel fuel and ASTM D 2276 for determination of particulates. Program procedures do not identify this industry guidance. Therefore, the procedures will be enhanced to declare that fuel oil quality is monitored and maintained in accordance with the noted ASTM standards.

**Enhancement 4:** Include guidance for visual inspections in the fuel oil tank cleaning procedure.

Visual inspections are not directed for internal surfaces after tank cleanings.

Program Elements Affected

- **Preventive Actions**

  The NUREG-1801 program attribute states that periodic cleaning of a tank allows for removal of sediment, which aids in mitigating corrosion inside the tanks. The tank cleaning activity does not detail a visual inspection of the tank internal surfaces after cleaning activities are complete. Therefore, the procedure will be enhanced to provide guidance for visual inspections that shall check for the presence or evidence of corrosions such as general, pitting, cracking, or MIC.

**Enhancement 5:** Include guidance for UT examinations in the fuel oil tank cleaning procedure

The tank cleaning procedure does not detail the use of UT type examinations of tank walls and bottoms to verify integrity.

Program Elements Affected

- **Detection of Aging Effects**

  The NUREG-1801 program attribute states that an ultrasonic thickness measurement of the tank bottom surface can ensure that significant degradation is not occurring. The tank cleaning activity does not detail UT type examinations. Therefore, the tank cleaning procedure will be enhanced to provide guidance for using UT examinations for above ground fuel oil tanks to verify that significant degradation is not occurring for tanks that cannot be internally inspected, corrosion discovered during internal visual inspections, or has unknown/inaccessible surfaces.

**Enhancement 6:** Detail the tank cleaning frequencies.

Tank cleaning frequencies are not identified in the procedure.

Program Elements Affected

- **Preventive Actions**

  The NUREG-1801 program attribute states that periodic cleaning of a tank allows for removal of sediment, which aids in mitigating corrosion inside the tanks. The tank cleaning activity does not declare cleaning frequencies. Therefore, the tank cleaning procedure will be enhanced to identify the cleaning frequency of tanks within its scope.

**Enhancement 7:** Expand the program scope.

The scope of the fuel oil chemistry program does not currently include components that have been determined to be within the scope of License Renewal and credited to the program for aging management.

Program Elements Affected

- **Scope of Program**

  The NUREG-1801 program is credited with managing fuel oil tanks that are not currently within the program scope. Therefore, the program will be enhanced to include those components within the scope of License Renewal and credited to the program for aging management.

**Enhancement 8:** Include guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) for unsatisfactory fuel oil sampling or tank inspection results, or conditions adverse to quality.

Program Elements Affected

- **Corrective Actions**

  The NUREG-1801 program attribute states that the requirements of 10 CFR 50, Appendix B, are acceptable in addressing corrective actions. Program administrative procedures do not address the use of the CR process. Therefore, the program will be enhanced to explicitly direct generation of a Condition Report (CR) for unsatisfactory fuel oil sampling or tank inspection results, or conditions adverse to quality.

**Operating Experience**

A review of the plant operating experience supports the BVPS position of not adding biocides, stabilizers, or corrosion inhibitors to the fuel oil. Several condition reports were created for issues including particulate contamination, cleaning of internal tanks, and missed sampling requirements.

The operating experience review shows BVPS' emphasis and sensitivity to proper and effective procedures and accurate analytical sample methods. Additionally, corrective actions that target eliminating missed sample requirements appear to have strengthened this program weakness. Corrective actions to address recurrence of elevated particulates in the Unit 2 diesel fuel oil tanks has improved program effectiveness.

**Conclusion**

The continuation of the existing Fuel Oil Chemistry Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.18 Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

### Program Description

The Inaccessible Medium-Voltage Cable Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is credited with managing aging effects through periodic maintenance activities that minimize or prevent the exposure of in-scope cables to significant moisture or standing water. Program activities include periodic inspections of cable manholes for water collection and draining as needed. Additionally, in-scope medium-voltage cables exposed to significant moisture and significant voltage are tested to provide an indication of the condition of the conductor insulation. Significant moisture is defined as periodic exposure to moisture that lasts more than a few days (e.g., cables in standing water). Periodic exposures to moisture that last less than a few days (i.e. normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time. The moisture and voltage exposures described as significant in these definitions, which are based on operating experience and engineering judgment, are not significant for medium-voltage cables that are designed for these conditions (e.g., continuous wetting and continuous energization is not significant for submarine cables). The specific type of test performed will be determined prior to the initial test, and is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state-of-the-art at the time the test is performed. Program procedures, administrative controls, and corrective actions ensure that intended functions are maintained during the period of extended operation.

### Program Consistency

The Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new program that will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.E3, "Inaccessible Medium-Voltage Cables not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

### Operating Experience

The new Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new program with no operating experience history. Effective and proven testing techniques will be used for this new program. In addition to industry operating experience, BVPS investigated the operating history for in-scope inaccessible medium-voltage cables and connections using condition report (CR) searches and found no incidents of degraded cable or connection insulation related to exposure to significant moisture.

## Conclusion

The new Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program ensures that the effects of aging associated with the in-scope components will be adequately managed so that there is reasonable assurance that their intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.19 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program

### Program Description

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program is credited with managing the effects of corrosion, wear, and cracking on the crane and trolley structural components. Routine visual inspections are performed on crane rails and structural components to detect degradation and assure reliability of the cranes identified within the scope of license renewal. Functional tests are also performed to assure their integrity. The program evaluates the effectiveness of the maintenance monitoring program and the effects of past and future usage on the structural reliability of cranes. Inspection requirements for overhead heavy load cranes are consistent with the guidance provided by NUREG-0612, "Control of Heavy Loads at Nuclear power Plants". Program procedures, administrative controls, and corrective actions ensure that degradation is effectively managed and intended function(s) are maintained during the period of extended operation.

### Program Consistency

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems."

### Enhancements to Meet XI.M23

**Enhancement 1:** Detail the program's inspection requirements for general corrosion, wear and cracking.

The program does not consistently provide guidance for inspecting for general corrosion, wear, and cracking (where applicable).

<u>Program Elements Affected</u>

- **Scope of Program**

  NUREG-1801 states that the program manages the effects of general corrosion on the crane and trolley structural components and the effects of wear on the rails in the rail system. The program procedures do not explicitly require inspections for general corrosion, wear, and cracking. Therefore, the program implementing documents will be enhanced to include inspection guidance for the effects of general corrosion/loss of material, wear on the rail systems, and cracking (where applicable).

**Enhancement 2:** Include Guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) for unsatisfactory inspection or testing results, or conditions adverse to quality.

Program Elements Affected

- **Corrective Actions**

  The NUREG-1801 Program attribute states that the requirements of 10 CFR 50, Appendix B, are acceptable in addressing corrective actions. Program administrative procedures do not address the use of the CR process. Therefore, the program will be enhanced to explicitly direct generation of a Condition Report (CR) for unsatisfactory inspection or testing results, or conditions adverse to quality.

**Enhancement 3:** Include guidance to review overhead heavy load and light load handling system related industry documents received by FENOC for applicability to BVPS. Those affecting, or thought to affect BVPS, shall be entered into the CAP for resolution.

The program does not detail the review of industry correspondence (bulletins, letters, OE reports, advisories) related to overhead heavy load and light load handling systems.

Program Elements Affected

- **Operating Experience**

  The NUREG-1801 program attribute details industry correspondence and operating experience related to the program. The program does not detail this review of industry correspondence and operating experience. Therefore, the program will be enhanced to direct a review of all industry correspondence (bulletins, letters, notices, OE reports, advisories) related to overhead heavy load and light load handling systems. Those documents that affect, or are thought to affect BVPS, shall be entered into the site CAP for resolution.

**Operating Experience**

The operating experience review found no examples of significant degradation of the crane bridge and trolley structural girders and beams, or the crane rails and support girders. Minor wear was identified on the rails for the fuel pool crane. A bowed south rail caused the wear and repairs are currently being managed through the work management system.

**Conclusion**

The continuation of the existing Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, together with the enhancement of the program prior to

the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.20 Metal Fatigue of Reactor Coolant Pressure Boundary

### Program Description

The Metal Fatigue of Reactor Coolant Pressure Boundary Program monitors thermal and pressure transients that cause cyclic strains and significant fatigue usage for the reactor coolant pressure boundary. The program manages metal fatigue through cycle counting of plant transient as outlined in WCAP 16173-P. This guidance incorporates the industry consideration of NUREG/CR-6260 and outlines critical BVPS fatigue monitoring locations, as listed in Table 4.3-2 of the License Renewal Application. The transient cycle counting process focuses on three major activities: surveillance activities to identify possible transients, data collection and retention to classify and analyze possible transients, and periodic review of possible transients for classification and analysis. The results of these evaluations will be used to confirm that the original design assumptions regarding fatigue remain valid for the period of extended operation.

The cumulative usage factor (CUF) for all locations will be maintained less than the design limit of 1.0, excluding the effects of Environmentally Assisted Fatigue (EAF). When EAF is considered, some locations exceed a CUF of 1.0. This program manages EAF for those locations with a CUF of greater than 1.0 through an inspection process. Details on this process, such as scope, qualification, method and frequency will be provided to the NRC prior to entering the period of extended operation. Specific locations at BVPS Unit 1 and Unit 2 were identified with CUFs greater than 1.0 that will be managed by the program. Formulas for calculating the environmental life correction factors are contained in NUREG/CR-6583 for carbon and low-alloy steels and in NUREG/CR-5704 for austenitic stainless steels.

Acceptance criteria involve maintaining the fatigue usage factors below the allowable limits. Metal fatigue of in-scope components is evaluated as a Time-Limited Aging Analysis (TLAA) for license renewal (Section 4.3). Program procedures, administrative controls, and corrective actions ensure that fatigue usage is effectively managed and intended function(s) are maintained during the period of extended operation.

### Program Consistency

The Metal Fatigue of Reactor Coolant Pressure Boundary Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section X.M1, "Metal fatigue of Reactor Coolant Pressure Boundary."

### Enhancements to Meet X.M1

**Enhancement 1:** Include in the program administrative procedure a reference to WCAP-16173

The administrative procedure does not reference WCAP-16173, which provides the design basis transient analysis for major NSSS equipment for 60 years.

Program Elements Affected

- Scope of Program

  NUREG-1801 states that the program includes preventive measures to mitigate fatigue cracking of metal components of the reactor coolant pressure boundary caused by anticipated cyclic strains in the material. The administrative procedure does not reference WCAP-16713-P, which provides the design basis transient analysis for major NSSS equipment for 60 years. Therefore, the administrative procedure will be enhanced to manage fatigue through cycle counting of transients (as identified in WCAP 16173-P) and implement fatigue monitoring for the locations identified in Table 4.3-2 of the License Renewal application.

**Enhancement 2:** Include in the program administrative procedure a reference to Condition Report (CR) 02-08930.

The program administrative procedure does not reference CR 02-08930.

Program Elements Affected

- **Scope of Program**

  NUREG-1801 states that the program includes preventive measures to mitigate fatigue cracking of metal components of the reactor coolant pressure boundary caused by anticipated cyclic strains in the material. The administrative procedure does not reference CR 02-08930, which requires the designation of a program owner/engineer for the transient/cycle fatigue program. Therefore, the administrative procedure will be enhanced to include a reference to CR 02-08930 and associated corrective actions.

**Enhancement 3**: Include in the program administrative procedure the information provided in the environmentally assisted fatigue (EAF) Analysis.

The Administrative procedure does not include the EAF evaluation for reactor pressure vessel and piping locations specified in NUREG/CR-6260.

Program Elements Affected

- **Preventive Actions**

  NUREG-1801 states that maintaining the fatigue usage factor below the design code limit and considering the effect of the reactor water environment, as described under the program description, will provide adequate margin against cracking of reactor coolant system components due to anticipated cyclic strains. The administrative procedure does not include the environmentally assisted fatigue (EAF) analysis. Therefore, the administrative procedure will be enhanced to include the evaluation of environmentally

assisted fatigue (EAF) at BVPS Unit-1 and Unit-2 for the RPV, locations with a CUF greater than 1.0, and piping locations specified in NUREG/CR-6260, as contained in ECP-03-0449, Structural Integrity Associates (SIA) letter #JDC-04-001. The preliminary program approach will be through the use of an inspection program that has been reviewed and approved by the NRC. Inspection details such as scope, qualification, method and frequency will be provided to the NRC prior to entering the period of extended operation.

- **Detection of Aging Effects**

  NUREG-1801 states that the program provides for periodic update of the fatigue usage calculations. The administrative procedure does not include the guidance and corrective actions for locations provided in the environmentally assisted fatigue analysis. Therefore, the administrative procedure will be enhanced to include the guidance and corrective actions for the locations identified in the environmentally assisted fatigue analysis performed by Structural Integrity Associates (SIA) (ECP-03-0449, SIA #JDC-04-001) where the environmental usage factors exceeded design limitations.

**Enhancement 4**: Include in the administrative procedure reference to NUREG/CR-6260, NUREG/CR-5999, NUREG/CR-6583, and NUREG/CR-5704

The administrative procedure does not include reference to guidance provide in NUREG/CR-6260, NUREG/CR-5999, NUREG/CR-6583, and NUREG/CR-5704

<u>Program Elements Affected</u>

- **Preventive Actions**

  NUREG-1801 states that maintaining the fatigue usage factor below the design code limit and considering the effect of the reactor water environment, as described under the program description, will provide adequate margin against cracking of reactor coolant system components due to anticipated cyclic strains. The administrative procedure does not include reference to guidance provide in NUREG/CR-6260, NUREG/CR-5999, NUREG/CR-6583, and NUREG/CR-5704. Therefore, the administrative procedure will be enhanced to include reference to these documents.

**Enhancement 5**: Include in the program that details of the management of environmentally assisted fatigue be provided to the NRC prior to the period of extended operation.

The administrative procedure does not include the guidance to provide the management of environmentally assisted fatigue to the NRC prior to the period of extended operation.

Program Elements Affected

- **Detection of Aging Effects**

  NUREG-1801 states that the program provides for periodic update of the fatigue usage calculations. The administrative procedure does not include the guidance to provide the management of environmentally assisted fatigue to the NRC prior to the period of extended operation. Therefore, the administrative procedure will be enhanced to include guidance to provide details of the management of environmentally assisted fatigue to the NRC prior to the period of extended operation.

**Enhancement 6**: Include guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) to document any adverse or nonconforming conditions.

Program Elements Affected

- **Corrective Actions**

  The NUREG-1801 attribute states the program provides for corrective actions to prevent the usage factor from exceeding the design code limit during the period of extended operation. The program does not explicitly direct generation of a Condition Report (CR) to document any adverse or nonconforming conditions. Therefore, the program will be enhanced to explicitly direct generation of a Condition Report (CR) to document any adverse or nonconforming conditions.

**Enhancement 7**: Include guidance to review metal fatigue of reactor coolant pressure boundary related industry documents received by FENOC for applicability to BVPS. Those affecting, or thought to affect BVPS, shall be entered into the CAP for resolution.

The program does not detail the review of industry correspondence (bulletins, letters, notices, OE reports, advisories) related to reactor coolant pressure boundary.

Program Elements Affected

- **Operating Experience**

  The NUREG-1801 program attribute details industry experience regarding fatigue cracking. The program does not detail this review of industry operating experience. Therefore, the program will be enhanced to include a review of industry correspondence (bulletins, letters, notices, OE reports, advisories) related to reactor coolant pressure boundary fatigue.

## Operating Experience

Operating experience shows several condition reports, which identify concerns with heat-up and/or cool-down rate on the pressurizer surge lines. This transient issue is further evaluated in consultation with Westinghouse for the evaluation of Pressurizer In-Surge/Out-Surge transients and an on-line fatigue monitoring system was installed that was successfully integrated (hardware and Software) with the IPC and PCS Plant Computer systems.

Several Condition Reports (CR) identify weaknesses with the past program. Corrective actions direct the conversion and upgrade of the current program to incorporate responsibilities of the program owner and to assure appropriate guidance is provided for documentation of transients. Additionally, this corrective action is scheduled to incorporate the information provided in WCAP-16173, "Beaver Valley Units 1 and 2 Design Basis Transient Evaluation for License Renewal", dated March 2004.

The transient and cycle monitoring program shows a continuing concern with several aspects of fatigue management. The incorporation of the information contained in WCAP-16173 will strengthen the program. With the procedure upgrade to include the 60-year information, and the recent emphasis on upgrading transient monitoring, the program shows responsiveness to continuing concern with accurate transient and cycle counting in accordance with the CLB. The scheduled upgrade of the procedure in CA 02-08930-02 will provide the necessary incorporation of the 60-year data for license renewal that was generated by Westinghouse in WCAP-16173. Additionally, the analysis performed by SIA for the environmentally assisted fatigue locations in NUREG/CR-6260 must be included and managed in the program. The analysis shows several components/locations that exceed usage factor limitations for the 60-year operating term that will be managed during the period of extended operation.

## Conclusion

The continuation of the existing Metal Fatigue of Reactor Coolant Pressure Boundary Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.21 Nickel-Alloy Nozzles and Penetrations

### Program Description

The Nickel-Alloy Nozzles and Penetrations Program is credited with managing nickel-alloy components in a reactor coolant environment that are susceptible to primary water stress corrosion cracking (PWSCC). The program addresses industry concerns and operating experience and will assess component susceptibility to PWSCC. Inspections normally accomplished under the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program and the Boric Acid Corrosion Program may be augmented or enhanced as a result of the nickel-alloy component assessments. Program procedures, administrative controls, and corrective actions ensure that intended functions are maintained during the period of extended operation.

### Program Consistency

The Nickel-Alloy Nozzles and Penetrations Program is a new program that will be consistent with current NRC directives, which include, but supersede, the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M11, "Nickel-Alloy Nozzles and Penetrations." The AMP assessment differences are briefly described as follows:

Industry events since July 2001 have resulted in changes to NRC generic guidance compared to the NUREG-1801 Nickel-Alloy Nozzles and Penetrations. The program description for the NUREG-1801 Nickel-Alloy Nozzles and Penetrations program relies heavily on Generic Letter 97-01. Generic Letter 97-01 allowed plants to participate in an integrated industry program in which only the most susceptible plants would initially perform supplemental inspections. However, NRC Order EA-03-009 (for reactor vessel head penetrations) and Bulletin 2003-02 (for reactor pressure vessel bottom mounted instrumentation nozzles) contain the most recent NRC generic guidance on Alloy 600. Order EA-03-009 requires supplemental volumetric or surface examinations of reactor vessel head penetrations, in addition to enhanced visual examinations, for plants based on effective full power years normalized to a standard temperature (600 deg F). Bulletin 2003-02 requires enhanced visual examinations of reactor vessel bottom mounted instrumentation nozzles. Although this is a change from the program described in NUREG-1801, the program will meet the intent of NUREG-1801 because it utilizes the latest NRC approved susceptibility model and follows the latest NRC generic guidance on Alloy 600 PWSCC. The aspect of the program dealing with preventive actions (water chemistry program) is unchanged and meets the GALL requirements.

### Operating Experience

The Nickel-Alloy Nozzles and Penetrations Program is a new program with no operating experience history. However, effective and proven testing techniques will be used for this new program.

BVPS has been monitoring industry experience relevant to Alloy 600 aging through participation in the EPRI Material Reliability Program Issue Task Group on Alloy 600 and the Westinghouse

Owner's Group (WOG). The Alloy 600 program will assure the continuing monitoring and evaluation of industry experience relevant to Alloy 600.

Bare metal visual examinations of the reactor vessel top head penetrations and the reactor vessel head were performed during September 2001 for BVPS 1 and February 2002 for BVPS 2, as committed to in the response to NRC Bulletin 2001-01, and reported in the response to NRC Bulletin 2002-01. No indication of leakage due to PWSCC was detected. Visual and volumetric examinations meeting the requirements of Order EA-03-009 were performed during 1R15 for BVPS 1 and 2R10 for BVPS 2. The BVPS 1 examinations found four penetrations with crack indications in the base metal. The cracks were repaired using an embedded flaw technique. The BVPS 2 examinations performed per the order revealed no evidence of degradation. In accordance with the BVPS response to Bulletin 2003-02, a bare metal visual examination of the BVPS 2 bottom head penetrations was performed during 2R10 in 2003, revealing no evidence of leakage.

Current inspection requirements and component/material screening for susceptibility shows the site is actively addressing the noted industry problems with related materials and components. This will be a new program, where site specific operating experience will be maintained and the program will be committed to reviewing and implementing applicable industry experience and guidance.

**Conclusion**

The new Nickel-Alloy Nozzles and Penetrations Program will ensure that the effects of aging associated with the in-scope components will be adequately managed so that there is reasonable assurance that their intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.22 One-Time Inspection Program

### Program Description

The One-Time Inspection Program is used to confirm the absence of age related degradation. The program intent is primarily focused on aging effects that meet the following criteria:

(a) Aging effects are not expected to occur, but insufficient data exists to confirm this premise.
(b) Aging effects have long incubation periods or are predicted to be progressing very slowly.
(c) Aging effects are not adequately managed by an existing program or other program.

Appropriate inspections and NDE examination methods are performed on sample populations of components that are susceptible to age related degradation mechanisms. This sampling approach will be used to assess the aging of the remaining susceptible components.

The One-Time Inspection Program includes aging management activities for NUREG-1801 Aging Management Programs (AMP) Section XI.M35 (Interim Staff Guidance (ISG)-12), "One-Time Inspection of Small Bore Piping", and Section XI.M33 AMP, "Selective Leaching of Materials." The two AMPs are further clarified below:

All Class 1 piping less than four inches nominal pipe size (including pipes, fittings, and branch connections) evaluated in the aging management reviews to have aging affects requiring management (crack initiation and growth due to stress corrosion cracking (SCC), and/or fatigue) are within the scope of this program. The program includes inspections to detect service-induced weld cracking in small bore, Class 1 piping resulting from SCC, or fatigue.

Components identified in the aging management reviews with aging effects requiring management (loss of material (LOM)) due to the aging mechanism selective leaching (SL) will be inspected in the program. The program will determine the acceptability of components susceptible to selective leaching, primarily through visual inspections. Destructive examination of a sample of components, or hardness testing, may be used in select cases.

Program procedures, administrative controls, and corrective actions ensure that aging is effectively managed and intended function(s) are effectively maintained during the period of extended operation.

### Program Consistency

The One-Time Inspection Program is a new program that will be consistent with the analogous AMPs described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M32, "One-Time Inspection."

The One-Time Inspection Program is a new program that will also be consistent with the analogous AMPs described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M33, "Selective Leaching of Materials," with the following exception:

(a) Field hardness testing will generally not be used for detection of selective leaching.

The One-Time Inspection Program is a new program that will also be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Sections XI.M35, "Small Bore, Class 1 Piping Inspection."

## Operating Experience

The One-Time Inspection Program, which includes small bore piping and selective leaching, is a new program. Therefore, there is no operating experience specific to this program. However, a search of relevant operating experience found several documents related to small bore piping and selective leaching. Small bore pipe operating experience includes fatigue, thermal stratification, or stress corrosion cracking of small bore piping. In particular, correspondence related to NRC Bulletin 88-08 provides documentation of examinations and evaluations for fatigue cracking caused by thermal stratification and cyclic loads. With the addition of a requirement to monitor industry and BVPS operating experience related to inspection of small-bore piping in the One-Time Inspection Program, and adjust the program accordingly, operating experience related to small-bore piping will be effectively addressed during the period of extended operation.

Although BVPS has heretofore had no formal program addressing selective leaching, several condition reports have documented degradation due to selective leaching. Review of these condition reports has shown the condition report process effective in documenting and correcting any issues. With the addition of a requirement to monitor industry and BVPS operating experience related to selective leaching in the One-Time Inspection Program, and adjust the program accordingly, operating experience related to selective leaching will be effectively addressed during the period of extended operation.

## Conclusion

The new One-Time Inspection Program will ensure that the effects of aging associated with the in-scope components will be adequately managed so that there is reasonable assurance that their intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.23 Open-Cycle Cooling Water System

### Program Description

The Open-Cycle Cooling Water System Program is credited with managing the aging of system components for open-cycle cooling water systems. Program activities include monitoring and control of biofouling in raw water systems, visual inspections of system internal surfaces, flow testing of infrequently used cooling loops, and microbiologically influenced corrosion (MIC) reduction strategies. Safety related heat exchangers are cleaned and inspected, and tested for thermal performance as determined necessary, in accordance with GL 89-13. The program also monitors and trends pipe wall thickness to evaluate system corrosion and erosion rates. Program procedures, administrative controls, and corrective actions ensure that degradation is effectively managed and intended function(s) maintained during the period of extended operation.

### Program Consistency

The Open-Cycle Cooling Water System Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M20, "Open-Cycle Cooling Water System."

### Enhancements to Meet XI.M20

**Enhancement 1:** Include reference to the Generic Letter (GL) 89-13 commitment in the program.

The program does not include reference to the NRC commitment documents that apply to the development and implementation of the program in accordance with GL 89-13.

<u>Program Elements Affected</u>

- **Program Description**

  The NUREG-1801 program attribute states that the program relies on the recommendations of NRC GL 89-13 to ensure that the effects of aging are managed. The program does not currently include reference to the BVPS commitment letters to the NRC for the program. Therefore, the program will be enhanced to include this reference.

**Enhancement 2:** Include guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) for unsatisfactory test results or conditions adverse to quality.

Program Elements Affected

- **Corrective Actions**

  The NUREG-1801 program attribute states that the requirements of 10 CFR 50, Appendix B, are acceptable in addressing corrective actions. Program administrative procedures do not address the use of the CR process. Therefore, the program will be enhanced to explicitly direct generation of a Condition Report for unsatisfactory test results or conditions adverse to quality.

**Enhancement 3:** Include guidance to review open-cycle cooling water related industry documents received by FENOC for applicability to BVPS. Those affecting, or thought to affect BVPS, shall be entered into the CAP for resolution.

The program does not detail the review of industry correspondence (bulletins, letters, notices, OE reports, advisories) related to open-cycle cooling water.

Program Elements Affected

- **Operating Experience**

  The NUREG-1801 program attribute details industry correspondence and operating experience related to the program. The program does not detail this review of industry correspondence and operating experience. Therefore, the program will be enhanced to direct a review of all industry correspondence related to open-cycle cooling water. Those documents that affect, or are thought to affect BVPS, shall be entered into the site CAP for resolution.

**Enhancement 4:** Modify site maintenance procedures to include guidance to contact the program or system engineer for any breach of an open-cycle cooling water system that is within the scope of license renewal.

The program does not detail guidance for inspections of system and component internal conditions and environments.

Program Elements Affected

- **Detection of Aging Effects**

  The NUREG-1801 program attribute states that inspections for biofouling, damaged coatings, and degraded material conditions are conducted. The program does not detail guidance for inspections of system and component internal conditions and environments. Therefore, the program supporting documents will be enhanced to direct that the program or system engineer be contacted for any breach of an in-scope open-cycle cooling water system. This notification will allow the engineer to perform inspections, as necessary, of

internal conditions. These inspections will be used to assess the effectiveness of chemistry controls and to evaluate system and component material conditions.

**Operating Experience**

Site operating experience shows corrective actions to be effective in capturing deficiencies within the OCCW program. The operating experience review shows BVPS to be sensitive to proper chemical treatments of the system, including infrequently used portions. Several condition reports identify missed or low concentrations of treatment chemicals.

Despite chemical treatment of the system, several reports show biofouling of components and the system. Biofouling that has affected SR components is also identified, where several reports have been identified relating to the CCP/CCR heat exchangers and the emergency diesel generators. This fouling has resulted in component operational failures or difficulties resulting in CAP use.

Operating experience also shows that piping and components subject to wall thinning have been discovered before any piping or component failure.

**Conclusion**

The continuation of the existing Open-Cycle Cooling Water System Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.24 Periodic Surveillance and Preventive Maintenance

### Program Description

The Periodic Surveillance and Preventive Maintenance (PSPM) Program is an existing, site specific program that provides aging management for various in-scope commodities and SSCs through inspections and testing during periodic preventive and corrective maintenance and surveillance and test procedures. The program also includes acceptance criteria, evaluation of results, and appropriate corrective actions.

### Program Consistency

The Periodic Surveillance and Preventive Maintenance Program is an existing program that is consistent with the analogous AMP described in NUREG-1800, Standard Review Plan, Appendix A, Position A.1.2.3, "Aging Management Program Elements."

### Aging Management Program Elements

1. Scope of Program

   The scope of the PSPM Program for LR will only include PMs and Surveillance tasks that are determined to manage aging effects for SSCs within the scope of LR and not associated with other AMPs evaluated for LR. Specifically, credited PM tasks shall define inspection or monitoring methodology, periodicity, and acceptance criteria that provide reasonable assurance that intended functions will not be compromised prior to the next scheduled performance. The PSPM Program is extensive and not considered to be desirable in its entirety for LR aging management. Thus, individual preventive maintenance activities for specific systems and components will be credited for managing the effects of aging.

2. Preventive Actions

   The PSPM Program is mainly considered to be a condition monitoring program as described in Appendix A of the SRP, A.1.1, Background. Some activities within the program may be considered preventive; however, there are no preventive measures associated with the program for license renewal. The program provides for timely detection of the presence and extent of aging. Specifically, visual inspection and surface examinations of selected components and leak inspections of piping and components on specified frequencies, are intended to identify and quantify the extent to which aging effects are occurring (i.e. condition). Replacement or refurbishment of certain components is based on operating experience at specified frequencies.

3. Parameters Monitored/Inspected

The PSPM Program is mainly considered to be a condition monitoring program as described in Appendix A of the SRP, A.1.1, Background. Although some activities within the program may be considered performance monitoring, they will not be relied upon for license renewal in that capacity. The program provides for timely detection of the presence and extent of aging effects.

4. Detection of Aging Effects

The aging effects of concern for LR (e.g. loss of material, cracking, fouling, etc.) will be detected by visual inspection and examination of surfaces of selected equipment, piping and components, and fasteners for evidence of defects and age-related degradation (corrosion, wear, cracking, fouling, etc.). For PM Program aspects such as method or technique (e.g., visual, volumetric, surface inspection); frequency, sample size, data collection and timing of inspections are specifically addressed for each PM/Surveillance activity or task to ensure timely detection and management of aging effects.

The implementing documents contain many aspects concerning the "when," "where," and "how" program data are collected. Procedures include detail necessary to plan, schedule and perform preventive maintenance tasks. Other implementing documents provide the instructions to Initiate, Change, Plan, Schedule, Perform and Delete the Preventive Maintenance Program Asset Repetitive Procedure Tasks contained on the work notification data base.

5. Monitoring and Trending

The PSPM Program is a condition monitoring program, where maintenance activities are performed on a specified frequency (time based, event based, or condition based approach). Results and data are generated from the activity that is documented for review. The Designated Engineer (DE) is responsible for the intent, scope and frequency of the repetitive procedures for assets within their assigned systems or program. Additionally, it states this includes the ongoing responsibility to monitor, identify, evaluate and initiate revisions or deferrals, as needed, due to changing conditions and circumstances. Some of these changing conditions include: design modifications, process changes, changes in equipment performance or operation, industry experience, significant equipment failures, repeat component failures, vendor manual revisions and technical information letters, evaluated changes to PM templates or program recommendations, and others. These specifically identify changes in equipment performance or operation, industry experience, significant equipment failures, repeat component failures, and evaluated changes to PM templates or program recommendations.

The DE determines which equipment will be in the Predictive Monitoring Program and the predictive monitoring technique(s) that will be used to obtain key parameter data. It states that the predictive monitoring technique(s) should consider: activities that acquire

key performance or operating parameter data with the least possible impact on plant operations (e.g., data is obtained in the normal operating configuration), and the monitoring activity should be repeatable to allow for comparison with past data. Additionally, it states that the frequency of the predictive monitoring activity should consider the operating modes, operating conditions, and a best assessment of expected performance or condition degradation rate.

6. Acceptance Criteria

The PSPM Program contains acceptance criteria and guidelines that are unique and specific to each activity and task. Visual inspections and examinations of selected equipment items and components, and leak inspections of piping and components in selected portions of systems, are provided in documents used for the activity.

7. Corrective Actions

Implementing documents establish the requirements for addressing deficient conditions and the confirmation process. It outlines the process for identifying and documenting conditions, including those adverse to quality, their cause(s), and the actions necessary to correct and/or prevent recurrence in a timely manner. The procedure's purpose section states that it satisfies the requirements of 10 CFR 50, Appendix B, Criteria XV (Nonconforming Material, Parts, or Components) and XVI (Corrective Action). It also states that the CR process may also address conditions not subject to the requirements of this regulation.

8. Confirmation Process

Implementing documents establish the requirements for addressing deficient conditions and the confirmation process. It outlines the process for identifying and documenting conditions, including those adverse to quality, their cause(s), and the actions necessary to correct and/or prevent recurrence in a timely manner. The procedure's purpose section states that it satisfies the requirements of 10 CFR 50, Appendix B, Criteria XV (Nonconforming Material, Parts, or Components) and XVI (Corrective Action). It also states that the CR process may also address conditions not subject to the requirements of this regulation.

9. Administrative Controls

The PSPM Program is an existing program that is credited for LR under 10 CFR 54. The program will be administratively controlled through an approved, governing program document and site approved procedures that support the program activities.

10. Operating Experience

The PSPM Program has been effective in maintaining the intended functions of long-lived passive SSCs. Many Condition Reports and Work Orders/Notifications have been generated and resolved through the implementation of this program, which demonstrates the effectiveness of this program to identify and correct age-related degradation prior to a loss of intended function. The effectiveness of this program is also demonstrated by the level of system/equipment availability (per Maintenance Rule Periodic Assessments).

**Enhancements to meet Appendix A, Position A.1.2.3**

**Enhancement 1:** Expand the inspection scope for several credited program activities

The scope of several program inspection activities will be expanded to include commodities and components within the scope of license renewal. Specific aging effects identified during the aging management review process will also be included in the inspection activities.

Program Elements Affected

- **Scope of Program**

  The NUREG-1800 element states that the scope of the program should include the specific structures and components of which the program manages the aging. Credited program activities will be enhanced to include those commodities and components that are not currently included in the inspection activities.

- **Detection of Aging Effects**

  The NUREG-1800 element states that the detection of aging effects should occur before there is a loss of the structure and component intended function(s). Several credited program activities will be enhanced to include those aging mechanisms identified during the aging management review process as requiring management.

**Conclusion**

The continuation of the existing Periodic Surveillance and Preventive Maintenance Program ensures that the effects of aging associated with the in-scope structures and components will be adequately managed. The program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.25 PWR Vessel Internals

### Program Description

The PWR Vessel Internals (RVI) Program supplements the inspection requirements of ASME Section XI, IWB Category B-N-3. The program manages the evaluation and inspection of wrought and cast austenitic stainless steel reactor vessel internals components that are subject to cracking due to stress corrosion cracking (SCC), irradiation assisted stress corrosion cracking (IASCC), loss of fracture toughness due to neutron embrittlement and void swelling, loss of preload due to stress relaxation, and change in dimensions due to void swelling. Additionally, for cast austenitic stainless steel (CASS) components only, the program manages evaluations and inspections for loss of fracture toughness due to thermal aging and neutron embrittlement. The program will include susceptibility evaluations to identify bounding locations for each degradation mechanism based on neutron fluence and stress. The susceptibility evaluations will aid in determining the population of locations or components of the RVI that require enhanced inspections. The program will also determine inspection techniques and inspection schedules for the enhanced inspections. Enhanced inspections will use visual or volumetric techniques based on the flaw size that must be detected and component accessibility. Acceptance criteria for enhanced inspections will be based on flaw tolerance evaluations consistent with ASME Section XI. Program procedures, administrative controls, and corrective actions ensure that intended functions are maintained during the period of extended operation.

FENOC supports development of improved industry data, models, and inspection methodologies through active participation in the EPRI Materials Reliability Program Reactor Vessel Internals Issue Task Group and the Westinghouse Owners Group.

### Program Consistency

The PWR Vessel Internals Program is a new program that will be consistent with the analogous AMP's described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M16, "PWR Vessel Internals," and Section XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)."

### Operating Experience

The PWR Vessel Internals Program will contain a review and summary of BVPS-specific and industry RVI experience. The program will also require periodic review and monitoring of industry experience.

There is no operating experience with regard to degradation of CASS reactor vessel internals. The generation and implementation of a site Reactor Vessel Internals Inspection Program will provide aging management for the CASS RVI components and aging effects credited to this NUREG-1801 defined program. Currently, there are no CAP reports that identify degradation of the CASS RVI components.

## Conclusion

The implementation of the new PWR Vessel Internals Program ensures that the effects of aging associated with the in-scope structures and components will be adequately managed. The program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.26 Reactor Head Closure Studs

### Program Description

The Reactor Head Closure Studs Program is credited with managing stress corrosion cracking of the reactor head closure studs. The program addresses inservice inspection requirements for reactor vessel closure bolting, including inservice inspections to detect aging effects and Regulatory Guide (RG) 1.65 preventive measures to mitigate cracking. The program also details approved lubricants that minimize the potential for cracking. Program procedures, administrative controls, and corrective actions ensure that intended functions of the closure studs are maintained during the period of extended operation.

### Program Consistency

The Reactor Head Closure Studs Program is an existing program that is consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M3, "Reactor Head Closure Studs."

### Operating Experience

A review of plant operating experience shows no occurrences where adverse material conditions were identified with the rector head closure bolting. This operating experience demonstrates that the program is effective in managing stress corrosion cracking of the studs, thus ensuring their intended functions.

### Conclusion

The continuation of the existing Reactor Head Closure Studs Program ensures that the effects of aging associated with the in-scope structures and components will be adequately managed. The program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.27 Reactor Vessel Surveillance

### Program Description

The Reactor Vessel Surveillance Program (RVSP) is credited with managing the aging of the Unit 1 and Unit 2 reactor vessels. The program predicts changes in reactor vessel beltline material fracture toughness by evaluating neutron embrittlement through surveillance capsule testing and evaluation, fluence calculations and benchmarking, and monitoring of effective full power years (EFPYs). The reactor vessel fluence at both BVPS Unit 1 and 2 will continue to be monitored to ensure the projected fluence remains below that assumed for the relevant neutron embrittlement TLAAs. A more detailed fluence management description will be provided to the NRC in the 2007 time frame. The program includes the information provided in the Westinghouse Unit 1 Pressurized Thermal Shock sensitivity study. The RVSP is in accordance with ASTM E185-82, "Recommended Practices for Surveillance Tests for Nuclear Power Reactors," and the Code of Federal Regulations 10 CFR 50, Appendices G and H. The program is defined in WCAP 8457 (Unit 1) and WCAP 9615 (Unit 2). Program procedures, administrative controls, and corrective actions ensure that intended functions are maintained during the period of extended operation.

### Program Consistency

The Reactor Vessel Surveillance Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M31, “Reactor Vessel Surveillance.”

### Enhancements to Meet XI.M31

RVSPs are plant specific, depending on matters such as the composition of limiting materials, availability of surveillance capsules, and projected fluence levels. In accordance with 10 CFR Part 50, Appendix H, an applicant submits its proposed withdrawal schedule for approval prior to implementation.

The following general enhancements will be incorporated to ensure that the requirements of 10 CFR Part 50, Appendix H will continue to be satisfied during the period of extended operation (this listing is consistent with the information presented in the RVSP description in NUREG-1801):

- Include WCAP 8457 and WCAP 9615 as references to the program.
- Create a new RVSP document that describes the purpose, the capsule contents, the withdrawal schedule, test methods, and analysis methods for the supplemental surveillance capsule.
- Include in the new RVSP document a description of the purpose, analysis methods, and justification of using data from sister plants.
- Include in the new RVSP document guidance to integrate the data of the original surveillance program, the data from sister plants, and the data from the supplemental surveillance capsule.

- Include in the new RVSP reference to the Westinghouse sensitivity study and the results/limits.
- Include guidance in the new RVSP program to require a fluence update and evaluation against the Westinghouse sensitivity study following each fuel cycle and the issuance of a fluence update evaluation report.
- Include in the new RVSP document guidance for projecting the extent of irradiation embrittlement for upper shelf energy and pressure-temperature limits for 60 years that includes methods in accordance with Regulatory Guide 1.99.
- An element of the new RVSP document must include how sister plant data are to be used to address licensing issues. This program shall also ensure that no beltline material will exceed the 10 CFR 50.61 screening limit without regulatory approval.
- Include in the new program a commitment to review and incorporate new industry operating experience, developments and guidance, and research.
- Include in the new RVSP document details on materials properties, material chemical composition, irradiation temperature, and neutron fluence.
- Include in the new RVSP document the applicability limitations for surveillance data.
- Include in the new RVSP document provisions to store the contents of tested capsules and all pulled capsules that have not been tested.
- Include in the new RVSP document capsule withdrawal schedules during the period of extended operation.
- Include in the new RVSP document the revised capsule withdrawal schedule, which shall provide withdrawal of standby capsule, so that capsules do not receive excessive neutron fluence.
- Include in the new RVSP document guidance an analysis that demonstrates nozzle materials are not limiting, and therefore need not be included in the surveillance program.
- Include in the new RVSP document guidance an analysis that evaluates the effect of plant operating parameter changes on irradiation embrittlement projection in the event that the operating environment is changed.
- Include in the new RVSP reference to flux reduction to the extent practical, if determined necessary.
- Include a program commitment to submit an updated fluence management strategy to the NRC during the 2007 timeframe when pending site and industry guidance can be reviewed and factored into the new BVPS program.
- Include in the new RVSP document provisions to submit changes in capsule withdrawal schedule to the NRC.

## Operating Experience

A review of site OE indicated that the corrective action process is effective at identifying program deficiencies and initiating corrective actions. No cases of material deficiencies associated with this program were identified during review of OE.

## Conclusion

The continuation of the existing Reactor Vessel Surveillance Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.28 Settlement Monitoring Program (Unit 2 Only)

### Program Description

The Settlement Monitoring Program (Unit 2 Only) is credited with managing adverse piping stresses and deflections by monitoring the settlement of safety-related (Category 1) structures. The program monitors structure settling through field surveys of benchmarks and settlement markers located on structures within the program. Resulting data is evaluated and compared to original design assumptions, which are based on 40-year settlement values. This settlement, and associated piping deflections and imposed stresses, constitutes a time-limited aging analysis (TLAA) for license renewal (LR) at Unit 2. The program maintains settlement data and plots for selected plant structures throughout their design lifetime and will continue to verify that settlement, and the resulting pipe stress calculations, remain valid and within the projected design values. Corrective actions include reanalyzing pipe stresses and/or physical piping or structure modifications to arrest the settlement. Program procedures, administrative controls, and corrective actions ensure that loss of material is effectively managed and intended functions(s) are effectively maintained during the period of extended operation.

### Program Consistency

The Settlement Monitoring Program (Unit 2 Only) is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1800, Appendix A, Position A.1.2.3, "Aging Management Program Elements."

### Enhancements to Meet NUREG-1800

**Enhancement 1:** Include an Addition of Applicable Program Related Documents and other Site References.

The program will be enhanced to include applicable data and reference to engineering evaluations and calculations for in-scope structures, historical Settlement Monitoring Surveys, and related site corrective action program (CAP) reports.

<u>Program Elements Affected</u>

- **Scope of Program**

  NUREG-1800 states that the scope of the program should include the specific structures and components of which the program manages the aging. The program does not include a reference for in-scope structures. Therefore, the program will be enhanced to include data and reference to engineering evaluations and calculations that define the structures within the program scope.

- **Detection of Aging Effects**

  NUREG-1800 states that detection of aging effects should occur before there is a loss of the structure and component intended function. The program does not include the data and surveys that show trending of settling. Therefore, the program will be enhanced to include data and surveys that show the trending of structure data.

- **Acceptance Criteria**

  NUREG-1800 states that program acceptance criteria and its basis should be described. The program does not detail allowable and predicted displacement values. Therefore, reference to applicable engineering evaluations and calculations showing predicted and allowable displacement values, structural limitations, and design bases will be included in the governing program document.

- **Operating Experience**

  NUREG-1800 states that operating experience with existing programs should be discussed. The program document does not include operating experience. Therefore, Condition Reports 02-08731 and 03-08277 will be included as references/commitments to the program.

**Enhancement 2:** Include guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) for unsatisfactory survey results or conditions adverse to quality.

<u>Program Elements Affected</u>

- **Corrective Actions**

  NUREG-1800 states that program actions to be taken when acceptance criteria are not met should be described. Program Administrative Procedures do not address the use of the CR process. Therefore, the program will be enhanced to provide guidance to utilize the condition report (CR) process when unsatisfactory settlement results are identified.

**Aging Management Program Elements**

1. Scope of Program

   The Unit 2 UFSAR states that in 1977 a comprehensive Settlement Monitoring Program (SMP) was established for Unit 2. The settlements of all Unit 2 Category I structures were monitored during construction and will be monitored throughout the life of the plant or until sufficient data is obtained to justify discontinuing monitoring. The program

provides data for engineering evaluation of the settlement effect as it relates to the integrity of the structures and piping systems.

The Unit 2 SMP monitors settlement of structures that are within the scope of LR. This settlement is currently tracked and projected out for the 40 year CLB. Thus, the Unit 2 settlement is addressed in this application as a Time-Limited Aging Analysis (TLAA), as defined in 10 CFR 54.3 and outlined in 10 CFR 54.21(c).

2. Preventive Actions

This program is a condition-monitoring program as described in Appendix A of NUREG-1800, A.1.1, Background. The program provides for timely detection of aging effects and does not support preventive or mitigating actions. Also, the program does not rely on performance monitoring.

3. Parameters Monitored/Inspected

The program measures the settlement of Unit 2 structures at selected locations throughout their operating life, and provides sufficient data for an engineering evaluation of the effect of settlement as it relates to the integrity of the structures. The activity defines the 'Settlement Evaluation' to be a comparison of the existing degree of structure settlement to that anticipated by the original plant designer or that degree of settlement considered to be acceptable by current analysis for each safety related structure included within the SMP. The 'Settlement Markers' are defined as specific points identified for the purpose of monitoring vertical movement of the associated structure relative to established site benchmarks. Settlement markers are installed on safety related and other selected non-safety related structures. The activity identifies the monitored parameters and their link to structure settlement.

It is noted that the structure settlement is not itself a type of aging that is managed for LR; however, the measurement of settlement is a precursor to the other aging effects that require managing in accordance with the TLAA.

4. Detection of Aging Effects

Overall, the program reports, evaluations, and reviews are focused on preserving intended functions by monitoring the settlement rates of susceptible plant structures. The program must address the potential for reaching the settlement limitations where corrective measures will need to be taken to ensure all intended functions are preserved.

The program defines the Settlement Markers as specific points identified for the purpose of monitoring vertical movement of the associated structure relative to established site benchmarks. The Settlement Evaluation ('how') is to be a comparison of the actual total settlement to that anticipated within the “Report On Settlement Monitoring Program.” If the current settlement exceeds that anticipated within the report, a review of current

analysis should be done to determine if such analysis has revised the amount of settlement that is considered acceptable. For Safety Related Structures, significant discrepancies with the actual vs. acceptable degree of settlement as determined by current analysis or the settlement report shall be brought to the attention of the cognizant supervisor for resolution and appropriate action to be taken. An engineering evaluation of the Settlement Monitoring Surveys and the acquired data shall be documented.

The program activity details the survey frequency ('when') and specifies that the settlement markers for Unit 2 shall be surveyed at least annually. The settlement markers ('where') are defined by identifying the current revision of the record drawing. The method and frequency have been shown effective in monitoring and assessing the settlement of BVPS structures. Additionally, it is standard industry practice at other nuclear facilities.

The retained professional surveying organization shall be capable of performing a first order level survey identified here as the Settlement Monitoring Survey. The settlement monitoring coordinator (SMC) is responsible for assuring that the survey organization contracted to perform settlement monitoring surveys is qualified to perform the services.

5. Monitoring and Trending

The structure's settlement has been projected and bounded by a maximum allowed for the CLB. This settlement is trended incrementally to measure, trend, and predict the extent of settlement.

6. Acceptance Criteria

The Settlement Evaluation is a comparison of the existing degree of structure settlement to that anticipated by the original plant designer or that degree of settlement considered to be acceptable by current analysis for each Safety Related Structure included within the SMP.

7. Corrective Actions

See Section B.1.3 for a discussion of this element.

8. Confirmation Process

See Section B.1.3 for a discussion of this element.

9. Administrative Controls

See Section B.1.3 for a discussion of this element.

10. Operating Experience

Currently, settlement of the Unit 2 Valve Pit area is projected to reach a maximum currently allowed by 2027. Should the settlement continue, corrective actions will be required to address the settlement, or to address those SSCs affected by settlement, that will exceed the design limitations. Currently, all other Unit 2 structure settlement trends are tracking as designed and projected. The projected settlement shows the program is sensitive and aware of current adverse trends. It also shows the program is effective in monitoring and managing the settlement (thus managing the aging effects resulting from the settlement).

**Conclusion**

The continuation of the existing Settlement Monitoring Program (Unit 2 Only), together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.29 Steam Generator Tube Integrity

### Program Description

The Steam Generator Tube Integrity Program is credited with managing loss of material, cracking, and other degradation mechanisms associated with steam generator tubes and other primary and secondary steam generator components. The program includes preventive measures, degradation assessments, inspections with established acceptance criteria, foreign material exclusion practices, plugging and repair activities, and leakage monitoring of pressure boundaries. Degradation assessments are performed prior to each outage to identify all inspections needed, including augmented ISI inspections or examinations needed to address industry operating experience, concerns and regulatory communications. Monitoring and control of primary and secondary water chemistry is relied upon to mitigate material degradation. The program is based on the industry guidance in NEI 97-06, "Steam Generator Guidelines." Program procedures, administrative controls, and corrective actions ensure that intended functions are effectively maintained during the period of extended operation.

### Program Consistency

The Steam Generator Tube Integrity Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M19, "Steam Generator Tube Integrity."

### Enhancements to Meet XI.M19

**Enhancement 1:** Detail the program approach to primary and secondary side component inspections.

The program does not clearly identify the approach to primary side (primary manway inserts) and secondary side steam generator component inspections (top head, shell, transition cone, anti-vibration bar, manway covers, tube bundle wrappers, etc.).

<u>Program Elements Affected</u>

- **Scope of Program**

  The NUREG-1801 program is credited with managing steam generator components determined to be within the scope of License Renewal. Therefore, the program will be enhanced to detail the program's approach to primary side (primary manway inserts) and secondary side steam generator component inspections (top head, shell, transition cone, anti-vibration bar, manway covers, tube bundle wrappers, etc.).

### Operating Experience

Although scheduled, the Unit 1 and Unit 2 steam generators at BVPS have not been replaced. Several degradation mechanisms have been identified, including PWSCC and ODSCC. A review of the condition reports revealed several occurrences of minor tube leakage. Extensive tube examinations and repairs have been made, which has prevented significant tube ruptures. Self-assessments made in the year 2000 had resulted in enhancements to the Steam Generator Tube Integrity Program. Additionally, BVPS has evaluated applicable information notices (IN 2003-13) and incorporated applicable guidelines and requirements into the Steam Generator Tube Integrity procedures.

**Conclusion**

The continuation of the existing Steam Generator Tube Integrity Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.30 Structures Monitoring Program

### Program Description

The Structures Monitoring Program is credited with managing age-related degradation of in-scope structures and structural components. The program assesses the condition of structures and structural components through detailed visual inspections that use established acceptance criteria. Groundwater chemistry is also monitored to ensure aggressive environments are not present for below ground structures. The program is based on the requirements and guidance set forth in 10 CFR 50.65 and includes structures and structural components that are within the scope of the Maintenance Rule and those additional structures that are identified within the scope of license renewal. The program follows the guidance of Regulatory Guide (RG) 1.160 and NUMARC 93-01.

The program also manages the degradation of masonry block walls through detailed visual inspections using established acceptance criteria. The scope includes those walls credited for the evaluation basis developed in response to NRC IEB 80-11 and those walls identified to be within the scope of license renewal. The program is aligned with the guidance in NRC Information Notice (IN) 87-67.

Program procedures, administrative controls, and corrective actions ensure that intended functions are effectively maintained during the period of extended operation.

### Program Consistency

The Structures Monitoring Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.S6, "Structures Monitoring Program."

The Structures Monitoring Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.S5, "Masonry Wall Program."

### Enhancements to Meet XI.S6

**Enhancement 1:** Include program guidance for sampling and evaluation of groundwater.

The current program does not routinely sample and analyze the groundwater for aggressive environments.

Program Elements Affected

- **Parameters Monitored or Inspected**

  The NUREG-1801 program attribute states that the structural/aging effect combinations that are managed by the program shall be specified. The groundwater is not currently sampled during the 5-year structural inspections to assess the below ground environment for aggressive conditions. Therefore, the program will be enhanced to direct 5-year sampling and evaluation of the groundwater chemistry to ensure aggressive environments do not exist for below ground structures. The guidance from the GALL on chlorides, sulfates, and pH shall be used for the evaluation. Additionally, the enhancement will detail retention of sampling results.

**Enhancement 2:** Detail inspections of accessible structural bolting in the program. The industry guidance from EPRI TR-104213, "Bolted Joint Maintenance & Applications Guide" on structural bolting shall also be referenced in the program.

The program does not identify structural bolting as part of the 5-year maintenance rule structural inspections. Additionally, the program does not detail industry guidance for structural bolting inspections.

Program Elements Affected

- **Parameters Monitored or Inspected**

  The NUREG-1801 program attribute states that for each structural/aging combination, the specific parameters monitored or inspected are selected to ensure detection of degradation that will lead to a loss of intended function. Structural bolting and associated aging effects and inspection criteria is not detailed in the program (e.g. signs of corrosion, loss of coating, cracking, missing/looseness, evidence of boric acid crystals, physical damage or deformation, full thread engagement of nuts, proper bolt pattern, elongated or oversized bolt holes, proper washers, and proper stud alignment into the building structure). Additionally, no industry guidance for such inspections is referenced in the program. Therefore, the program will be enhanced to detail structural bolting inspections along with typical aging effects and inspection guidance. Also, reference to structural bolting portions of EPRI TR-104213, "Bolted Joint Maintenance & Applications Guide" will be included in the program.

**Enhancement 3:** Align the program with Revision 2 of both Regulatory Guide (RG) 1.160 and NUMARC 93-01 and declare the revision in the program.

The program does not identify the referenced revisions of both industry documents. The GALL identifies Revision 2 of both documents as the recommended implementing versions.

Program Elements Affected

- **Parameters Monitored or Inspected**

  The NUREG-1801 program attribute states that implementation of structures monitoring under 10 CFR 50.65 is addressed in NRC RG 1.160, Rev. 2 and NUMARC 93-01, Rev. 2. The program includes reference to these industry documents but does not identify the applicable revisions. Therefore, the program will be aligned to Revision 2 of both documents and reference to these versions detailed in the program.

**Enhancement 4:** Identify the material used for equipment supports and foundations and applicable aging effects.

The program does not clearly identify material used for equipment supports and foundations and applicable aging effects.

Program Elements Affected

- **Parameters Monitored or Inspected**

  The NUREG-1801 program attribute states that the structural/aging effect combinations that are managed by the program shall be specified. Inspection guidance in the program does not clearly identify the material and applicable aging effects for equipment supports and foundations. Therefore, the program will be enhanced to detail this inspection guidance along with applicable aging effects.

**Enhancement 5:** Include guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) for unsatisfactory inspection results or conditions adverse to quality.

Program Elements Affected

- **Corrective Actions**

  The NUREG-1801 program attribute states that the requirements of 10 CFR 50, Appendix B, are acceptable in addressing corrective actions. Program administrative procedures do not address the use of the CR process. Therefore, the program will be enhanced to explicitly direct generation of a Condition Report (CR) for unsatisfactory inspection results or conditions adverse to quality.

**Enhancement 6:** Include guidance to review structures monitoring related industry documents received by FENOC for applicability to BVPS. Those affecting, or thought to affect BVPS, shall be entered into the CAP for resolution.

The program does not detail the review of industry correspondence (bulletins, letters, notices, OE reports, advisories) related to the structures monitoring program.

Program Elements Affected

- **Operating Experience**

  The NUREG-1801 program attribute details industry correspondence and operating experience related to the program. The program does not detail this review of industry correspondence and operating experience. Therefore, the program will be enhanced to direct a review of all industry correspondence (bulletins, letters, notices, OE reports, advisories) related to the structures monitoring program. Those documents that affect, or are thought to affect BVPS, shall be entered into the site CAP for resolution

**Enhancement 7:** Expand the program scope.

The scope of the Structures Monitoring Program does not currently include components that have been determined to be within the scope of License Renewal and credited to the program for aging management.

Program Elements Affected

- **Scope of Program**

  The NUREG-1801 program is credited with managing structural components that are not currently within the program scope. Therefore, the program will be enhanced to include those components within the scope of License Renewal and credited to the program for aging management.

**Enhancements to Meet XI.S5**

**Enhancement 1:** Include inspection guidance for the Unit 1 masonry block walls, including supporting BVPS and industry documentation and the Unit 1 NRC IE Bulletin (IEB) 80-11 commitment basis.

The program does not include Unit 1 masonry block wall inspection guidance or associated information.

Program Elements Affected

- **Program Description**

  The NUREG-1801 program attribute states that NRC IE Bulletin (IEB) 80-11 and NRC Information Notice (IN) 87-67 constitute an acceptable basis for a program. The Structures Monitoring Program does not currently include guidance or inspection details

for the Unit 1 masonry wall scope. Additionally, the program does not identify supporting BVPS and industry documentation, such as IEB 80-11 structural adequacy assessments and modifications, SERs, TER 5308, EM 30624, 8700-DSS-0083, NRC IEB 80-11, NRC 87-67, and the Unit 1 IEB 80-11 commitment letter containing the NRC acceptance of the Unit 1 SER. Therefore, the program will be enhanced to include guidance and details for the Unit 1 masonry block wall inspection activities and reference to supporting BVPS and industry documentation and Unit 1 commitments to IEB 80-11.

**Enhancement 2:** Include each Unit 1 and Unit 2 masonry block wall that requires inspection and all applicable drawings.

The program does not identify each masonry block wall and its associated drawing that is credited for License Renewal or for the IEB evaluation basis.

Program Elements Affected

- **Scope of Program**

  The NUREG-1801 program attribute states that the scope includes all masonry walls identified as performing intended functions in accordance with 10 CFR 54.4. The Structure Monitoring Program does not identify each masonry block wall that is credited for License Renewal (Unit 1 and Unit 2) or for IEB 80-11 evaluation basis (as identified in TER 5308 for Unit 1 only). Therefore, the program will be enhanced to detail each masonry block wall credited to the program for aging management.

**Enhancement 3:** Include reference to the 8700-DSS-0083 inspection guidance for concrete block walls inspections.

The program does not reference the information or inspection guidance in 8700-DSS-0083.

Program Elements Affected

- **Parameters Monitored or Inspected**

  The NUREG-1801 program attribute states that the primary parameter monitored is wall cracking that could potentially invalidate the evaluation basis. The Structure Monitoring Program does not reference the inspection guidance for masonry block walls that is contained in specification 8700-DSS-0083, Revision 1, such as cracking in joints and missing/broken blocks. Therefore, the program will be enhanced to provide reference to the inspection guidance in 8700-DSS-0083.

**Enhancement 4:** Identify the qualification requirements for block wall inspection personnel.

The program does not define the qualification requirements for personnel performing masonry block wall inspections.

Program Elements Affected

- **Detection of Aging Effects**

  The NUREG-1801 program attribute states that visual examination of the masonry walls by qualified inspection personnel is sufficient. The Structures Monitoring Program does not detail qualification requirements for inspection personnel. Therefore, the program will be enhanced to define these requirements for both active and non-active masonry block walls.

**Enhancement 5:** Identify the inspection frequency for masonry block walls.

The program does not detail the inspection frequency for both active and non-active block walls.

Program Elements Affected

- **Detection of Aging Effects**

  The NUREG-1801 program attribute states that the frequency of inspection is selected to ensure there is no loss of intended function between inspections. The Structures Monitoring Program does not define an inspection frequency; however, current practice is every ten years for non-active and every three years for active block walls. Therefore, the program will be enhanced to declare the inspection frequency for both active and non-active block walls.

**Enhancement 6:** Detail increased inspection frequencies for unreinforced walls identified with new or recent cracking.

The program does not detail more frequent inspection for block walls.

Program Elements Affected

- **Detection of Aging Effects**

  The NUREG-1801 program attribute states that unreinforced masonry walls that have not been contained by bracing warrant the most frequent inspection so that cracking does not invalidate the existing evaluation basis. The Structures Monitoring Program does not detail increased inspection frequencies. Therefore, the program will be enhanced to detail more frequent inspection for block walls (unreinforced) that have been identified with new or recent cracking.

**Operating Experience**

A review of the plant condition reports revealed no serious degradation or condition that would adversely affect the ability of structures, structural components, or masonry block walls to

perform their intended functions. Reports that required additional investigation, repair, or other corrective actions included conditions such as degraded coatings on steel, corrosion, and minor cracking and spalling of concrete.

## Conclusion

The continuation of the existing Structures Monitoring Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope structures and components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.31 System Monitoring

### Program Description

The System Monitoring Program is credited with managing age related degradation of normally accessible, external surfaces of piping, tanks, and other components and equipment. Walkdown visual inspections are the primary detection method and are performed by both System Engineering and Operations personnel. The program also provides for timely detection of adverse conditions, or conditions that can lead to an aggressive environments, for components and equipment within the scope of license renewal. Inspection results are documented, evaluated, trended, and corrective actions implemented. Program procedures, administrative controls, and corrective actions ensure that degradation is effectively managed and intended function(s) maintained during the period of extended operation.

### Program Consistency

The System Monitoring Program is a new program that will be consistent with the analogous AMP described in NUREG-1800, Appendix A, Position A.1.2.3, "Aging Management Program Elements."

### Aging Management Program Elements

1. Scope of Program

   The System Monitoring Program provides for timely detection and recognition of age-related degradation of normally accessible, external surfaces of piping, tanks, and other components and equipment. The inspections also observe for adverse conditions, or conditions that can lead to an aggressive environment, which can adversely affect a system or component. The scope of the program shall include those systems and system areas, and components that are credited to the program for aging management.

2. Preventive Actions

   The System Monitoring Program is a condition monitoring program as described in Appendix A of NUREG-1800, A.1.1, Background. The program provides for timely detection of aging effects and does not support preventive or mitigating actions.

3. Parameters Monitored/Inspected

   The System Monitoring Program includes monitoring of system and component external material conditions through comprehensive walkdown visual inspections. Inspections include applicable aging effects for metallic components, elastomers, and other materials used in system and component construction. The program also provides for timely detection of adverse conditions, or conditions that can lead to aggressive environments, for components and equipment within the scope of license renewal.

4. Detection of Aging Effects

Comprehensive visual inspections performed during System Engineering and Operator walkdowns are the primary detection method. The new program will outline and define inspection frequencies for the System Engineering walkdowns. Operator walkdowns are performed in accordance with administrative guidance, which has been shown to be effective at detecting aging effects.

5. Monitoring and Trending

System Engineering walkdown visual inspection results are documented and retained for a predetermined period of time to permit review of previous problem areas or systems. This site-specific operating experience will be considered in evaluating the inspection frequency and any degrading system or component trends. Also, industry experience and guidance contained in the Westinghouse Owners Group (WOG) Aging Assessment Field Guide will be referenced in the new inspection activity.

Operator walkdown guidance includes equipment and facilities that are diligently inspected to ensure they are operating properly and performing their specified function or, for standby equipment, that it is fully capable of being operated. It includes, but is not limited to, hands-on touch of bearing housings, oil level checks, leakage checks, and other techniques. Additionally, all applicable senses (i.e. touch the pump, listen for changes in pitch, etc.) are utilized while on tour to identify abnormal conditions. These techniques are effective at identifying aging effects and adverse conditions or environments.

6. Acceptance Criteria

Visual inspection is the primary method of discovering material related discrepancies, where acceptance criteria includes the absence of any external surface degradation or unacceptable material condition. Also, the program provides for timely detection of adverse conditions, or conditions that can lead to an aggressive environments, for components and equipment within the scope of license renewal. The inspection acceptance criterion is that no such adverse condition is found or detected. Material condition and degradation deficiencies are documented and are evaluated by the System Engineer and the Supervising Engineer for acceptability.

7. Corrective Actions

See Section B.1.3 for a discussion of this element.

8. Confirmation Process

   See Section B.1.3 for a discussion of this element.

9. Administrative Controls

   See Section B.1.3 for a discussion of this element.

10. Operating Experience

    A review of Condition Reports and other site operating experience yielded several instances of external material degradation and corrosion. Degradation of external surfaces of carbon steel, particularly where paint or coating damage has exposed bare metal, has been widely noted and documented in the CAP. Other component degradation is noted with system components, such as braided hoses and components supports and base plates. Several instances of adverse or aggressive environments are also identified and corrected.

    Several occurrences are noted that show operator rounds to be effective at identifying adverse environments or conditions, as well as unacceptable system or component material conditions.

**Conclusion**

The System Monitoring Program ensures that the effects of aging associated with the in-scope components will be adequately managed so that there is reasonable assurance that their intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation. Additionally, implementation of the program will provide for timely detection of adverse conditions, or conditions that can lead to aggressive environments, for components and equipment within the scope of license renewal.

## B.2.1.32 Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)

### Program Description

The Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is credited with managing thermal aging embrittlement of CASS components. The program will detail a 60-year Leak Before Break (LBB) analysis that evaluates the loss in fracture toughness and increased tensile strength in thermally aged CASS reactor coolant system components. The LBB analysis will determine if sufficient residual fracture toughness is present in the material to resist cracking at the end of the 60 year period of operation. If the LBB analysis results show there is insufficient residual fracture toughness, screening of the CASS components will be performed for susceptibility. Additionally, a management program will be established that outlines continued aging management, which will include flaw tolerance evaluations, augmented inspections, acceptance criteria, and corrective actions. Component screening is conducted according to the guidance in the NUREG-1801 referenced letter from Christopher I. Grimes, U.S. Nuclear Regulatory Commission, to Douglas J. Walters, Nuclear Energy Institute, License Renewal Issue No. 98-0030, Thermal Aging Embrittlement of Cast Stainless Steel Components, dated May 19, 2000.

The program also includes non-RCS CASS components that will be screened for susceptibility. If the material is found to be susceptible, the program will outline corrective actions and management options that include flaw tolerance evaluations, augmented inspections, or component replacement.

Program procedures, administrative controls, and corrective actions ensure that intended functions are maintained during the period of extended operation.

### Program Consistency

The Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is a new program that will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel," with the following additional information:

Revision of the LBB analysis to account for 60 year, thermally aged material properties is not discussed in Section XI.M12 of NUREG-1801 as a method for managing thermal aging embrittlement of CASS piping. NRC Safety Evaluation Report (SER) entitled "Final Safety Evaluation by the Office of Nuclear Reactor Regulation Concerning Westinghouse Owners Group Report, WCAP-14575, Revision 1, License Renewal Evaluation: Aging management for Class 1 Piping and Associated Pressure Boundary Components" declared that confirming the LBB analysis for the 60-year operating period was an acceptable method for managing thermal aging embrittlement of CASS piping components that had previously been approved for LBB. The following two additional requirements were imposed by NRC in the SER: an additional assessment of the margin on the loads is required per NUREG-1061, Volume 3, Section 5.2, item

(i); and, if a CASS component is repaired or replaced, a new LBB analysis based on the material properties of the repaired or replaced component must be performed to reestablish LBB.

**Operating Experience**

The Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program is a new program with no historical operating experience. Industry recognized and approved testing techniques will be utilized for this new program.

**Conclusion**

The new Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS) Program will ensure that thermal aging embrittlement of in-scope, susceptible components will be adequately managed so that there is reasonable assurance their intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

## B.2.1.33 Water Chemistry

### Program Description

The Water Chemistry Program is credited with managing aging effects by monitoring and controlling the internal environment of various primary and secondary and auxiliary systems and components. Chemistry limits are optimized in accordance with the guidelines in EPRI TR-105714 and TR-102134 and maintain detrimental contaminants and impurities, such as chlorides, fluorides, dissolved oxygen and sulfates, at concentrations below those which are known to result in loss of material and crack initiation and growth. Program procedures and administrative controls define the specifications for chemical species, sampling and analysis frequencies, and corrective actions, which ensure that aging is managed and intended functions are maintained during the period of extended operation.

### Program Consistency

The Water Chemistry Program is an existing program that, with the following enhancements, will be consistent with the analogous AMP described in NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Section XI.M2, "Water Chemistry."

### Enhancements to Meet XI.M2

**Enhancement 1:** Include a Technical Basis for Lead Monitoring in the Secondary Chemistry Optimization details.

The BVPS position on lead monitoring is not detailed in the water chemistry optimization performed in accordance with the EPRI guidance.

<u>Program Elements Affected</u>

- Parameters Monitored or Inspected

  The NUREG-1801 program attribute states that the EPRI guidelines for PWR secondary water chemistry recommend monitoring and control of chemistry parameters. The optimization performed in accordance with the EPRI guidance details the BVPS chemistry controls and the comparison with the ERPI recommendations. This optimization does not detail a technical position on lead monitoring. Therefore, the Water Chemistry Program will be enhanced to add details and a technical basis for BVPS' position on lead monitoring to the Secondary Chemistry Optimization, as provided in Section 2.4.7 and Table 6.5 of EPRI TR-102134-R5.

**Enhancement 2:** Include guidance to use the Condition Report (CR) process.

The program does not explicitly direct generation of a Condition Report (CR) for unsatisfactory sample results or conditions adverse to quality.

Program Elements Affected

- **Corrective Actions**

  The NUREG-1801 program attribute states that the requirements of 10 CFR 50, Appendix B, are acceptable in addressing corrective actions. Program administrative procedures do not address the use of the CR process. Therefore, the program will be enhanced to explicitly direct generation of a Condition Report (CR) for unsatisfactory sample results or conditions adverse to quality.
  .

**Enhancement 3:** Include guidance to review water chemistry related industry documents received by FENOC for applicability to BVPS. Those affecting, or thought to affect BVPS, shall be entered into the CAP for resolution.

The program does not detail the review of industry correspondence (bulletins, letters, notices, OE reports, advisories) related to water chemistry.

Program Elements Affected

- Operating Experience

  The NUREG-1801 program attribute details industry correspondence and operating experience related to the program. The program does not detail this review of industry correspondence and operating experience. Therefore, the program will be enhanced to direct a review of all industry correspondence (bulletins, letters, notices, OE reports, and advisories) related to water chemistry. Those documents that affect, or are thought to affect BVPS, shall be entered into the site CAP for resolution

## Operating Experience

The operating experience review for the Water Chemistry Program did not indicate a loss of the component intended function of components exposed to borated and treated water that could be attributed to the inadequacy of the Water Chemistry Program. This operating experience confirms the effectiveness of the Water Chemistry Program for borated and treated water to manage the aging effects of components.

BVPS will review the Water Chemistry Program after the issuance of revised EPRI Primary or Secondary Water Chemistry Guidelines, NEI, or other related industry guidance. Applicable guidelines and requirements have been incorporated into the Water Chemistry Program and implementing procedures.

## Conclusion

The continuation of the existing Water Chemistry Program, together with the enhancement of the program prior to the period of extended operation, ensure that the effects of aging associated with the in-scope components will be adequately managed. The enhanced program provides reasonable assurance that the component intended functions will be maintained consistent with the current licensing basis throughout the period of extended operation.

REFERENCES

1. NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, July 2001.

2. 10 CFR 50 Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."

3. NUREG-1801, "Generic Aging Lessons Learned (GALL) Report", U.S. Nuclear Regulatory Commission, July 2001.

# Appendix C – not used

## Appendix D – Technical Specification Changes

10 CFR 54.22 requires that an application for license renewal include any technical specification changes or additions necessary to manage the effects of aging during the period of extended operation. No changes to the BVPS Unit 1 or Unit 2 Technical Specifications are necessary in that regard.