APPLICATION FOR RENEWED OPERATING LICENSES

NORTH ANNA POWER STATION UNITS 1 AND 2

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1.0 ADMINISTRATIVE INFORMATION

Virginia Electric and Power Company (Dominion) is filing separate License Renewal Applications (LRA) for Surry and North Anna Nuclear Power Stations under the same cover letter to optimize the NRC's review of the administrative and technical information common to both stations.

This application has been prepared to provide the administrative, technical and environmental information required by 10 CFR Part 54 (Reference 1) and 10 CFR Part 51 (Reference 2) to support the renewal of the Operating Licenses for:

North Anna Unit 1- License No. NPF-4
North Anna Unit 2 - License No. NPF-7

Consistent with the exception (Reference 3) requested by Dominion and approved by the U.S. Nuclear Regulatory Commission (Reference 4), one hardcopy of this application is being provided with remaining copies on CD-ROM. For the reviewer's convenience, the CD-ROMs also contain copies of the Updated Final Safety Analysis (UFSAR) and the license renewal (LR) drawings prepared in support of the license renewal effort. Hyperlinks to those documents are provided in the application where appropriate. Six (6) sets of hardcopy drawings are also being provided to the NRC under a separate cover letter.

The UFSAR, LR drawings, and other references cited within the application are for information only, and are not incorporated by reference into the LRA.

This section of the application provides the following information:

1. Information on the organization of the application (Section 1.1).
2. A general plant description (Section 1.2).
3. The administrative information required by 10 CFR 54.17 and 54.19 (Section 1.3).
4. Summary of abbreviations and passive function code definitions (Section 1.4).
5. A distribution list for written communications related to the application (Section 1.5).

Text enclosed in thick border indicates information specific to **NORTH ANNA.**

1.1 Application Format and Content

The application format and content are based on the guidance provided in NEI 95-10 (Reference 5) with the following clarifications:

1. Administrative Information - Section 1.0 has been expanded to provide (1) information on the format and content of the application, (2) a general plant description, (3) a summary of abbreviations and passive function code definitions used in the application, and (4) a distribution list for written communications related to the application.
2. Aging Management Review Methodology - Appendix C documents the methodology used by Dominion to perform aging management reviews (AMRs).
3. Standard Review Plans - The major subsections match those in the NRC's Standard Review Plans (Reference 6) with the following exceptions:
   - Containment isolation systems are not presented under Engineered Safety Features Systems. Containment isolation valves and the associated piping are evaluated as components within their respective process systems. Mechanical containment penetrations and the penetration sleeve portion of electrical containment penetrations have been evaluated as structural components in Section 2.4.1, Containment. The electrical penetration assemblies are within the scope of the Environmental Qualification (EQ) Program and are the subject of a time-limited aging analysis as described in Section 4.4, Environmental Qualification (EQ) of Electric Equipment.
   - New and spent fuel storage are not presented under Auxiliary Systems. New and spent fuel storage have been evaluated as structural components in the Fuel Building. See Section 2.4.4, Fuel Building.
   - Overhead load handling systems are not presented under Auxiliary Systems. Load handling systems have been evaluated as structural components. See Section 2.4.12, Load-handling Cranes and Devices.

Most of the technical and administrative information in the Surry and North Anna applications is common to both stations. To facilitate an efficient simultaneous review of both LRAs, plant-specific information has been identified using the conventions explained in Table 1.1-1.

Table 1.1-1 Conventions for Identifying Plant-Specific Information

Plant-specific information (i.e., information that is not common to both stations) has been enclosed in thick borders so the reviewer can quickly identify station differences. These borders show up red in the electronic version of the Surry LRA and blue in the North Anna LRA. If an entire table contains plant-specific information, then the entire table has been enclosed in thick borders. The application of the conventions for identification of station differences within each section of the LRA is explained below.	
Section 1.0	Plant-specific information has been identified by thick borders.
Section 2.0	Plant-specific information has been identified by thick borders with the following clarifications: • Sections and tables for systems and structures that are common to both stations but only in scope for one station, have been treated as plant-specific and identified accordingly. • Systems or structures for which the in-scope portions at both stations are functionally equivalent, but that are identified by different names, have not been treated as plant-specific. The first time the system or structure name is used in the screening results section, an explanation of the functional equivalency is provided within brackets. Example: Quench Spray (QS) [North Anna-specific name - functionally equivalent to the Surry Containment Spray (CS) system] In the plant-level scoping results tables, the corresponding system or structure functional equivalency is explained in a footnote.

Text enclosed in thick border indicates information specific to **NORTH ANNA.**

Table 1.1-1 Conventions for Identifying Plant-Specific Information

Section 3.0	The only plant-specific information identified by thick borders in the AMR results sections (including the tables) are the differences in materials, environments, aging effects requiring management, and aging management activities.[1] Plant-specific scoping and screening differences (such as name differences, additional systems or structures, and additional in-scope long-lived passive component groups) have already been identified in the scoping and screening results sections of the application, and have not been identified again in Section 3.
Section 4.0	Plant-specific information has been identified by thick borders.
Appendix A	Plant-specific information has been identified by thick borders.
Appendix B	Plant-specific information has been identified by thick borders with the following exception. No attempt has been made to identify the plant-specific cross references to the AMR results sections.
Appendix C	Plant-specific information has been identified by thick borders.
Appendix D	The entire appendix is common to both stations. Therefore, there is no plant-specific information to be identified.
Appendix E	The entire appendix is plant-specific. Therefore, plant-specific information has not been identified.

1. Copper and copper alloys (brass, bronze, aluminum-bronze, etc.) are treated as the same material for the purpose of identifying plant-specific information.

Text enclosed in thick border indicates information specific to **NORTH ANNA.**

1.2 Plant Description

North Anna Units 1 and 2 are located on a site on the southern shore of Lake Anna in Louisa County, Virginia approximately 40 miles north of Richmond, Virginia. Lake Anna has been created by impounding excess waters of the North Anna River. Each unit includes a three-coolant-loop, pressurized light water reactor nuclear steam supply system, and a turbine generator furnished by Westinghouse Electric Corporation. The balance of the plant has been designed and constructed by Dominion with the assistance of its agent, Stone & Webster Engineering Corporation. Each reactor unit was initially operated at a licensed power output of 2775 MWt, with a gross electrical output of approximately 947 MWe.

In 1986, both units were uprated to a core power output of 2893 MWt with an expected gross electrical output of 982 MWe.

Dominion also operates an independent spent fuel storage installation (ISFSI) at the site. The ISFSI is operated under a separate license issued pursuant to the provisions of 10 CFR Part 72 (Reference 7). Therefore, the ISFSI is not addressed in this application.

1.3 Information Required by 10 CFR 54.17 and 10 CFR 54.19

1.3.1 Name of Applicant

Virginia Electric and Power Company (Dominion)

Dominion is the applicant and is authorized to act as an agent for Old Dominion Electric Cooperative, which is a partial financial owner of North Anna Power Station. Dominion is responsible for operating the station.

1.3.2 Address of Applicant

Virginia Electric and Power Company
701 East Cary Street
Richmond, Virginia 23219-3932

Old Dominion Electric Cooperative
4201 Dominion Boulevard
Glen Allen, Virginia 23060

1.3.3 Description of Business or Occupation of Applicant

Virginia Electric and Power Company (Dominion) was incorporated in 1909 as a Virginia public service corporation. Dominion is a regulated public utility engaged in the power generation and electric service delivery business within a 30,000 square-mile service area

in Virginia and northeastern North Carolina. Dominion supplies energy at retail to approximately two million customers. In addition, Dominion sells electricity at wholesale to rural electric cooperatives, power marketers, municipalities, and other utilities. Dominion also engages in off-system wholesale purchases and sales of electricity, and purchases and sales of natural gas, and is developing trading relationships beyond the geographic limits of its retail service territory.

Old Dominion Electric Cooperative (Old Dominion), which was incorporated under the laws of the Commonwealth of Virginia in 1948, is a not-for-profit wholesale power supply cooperative engaged in the business of providing wholesale electric service to twelve member distribution cooperatives, which in turn are engaged in the retail sale of power to member consumers located in 70 counties throughout Virginia, Delaware, Maryland, and West Virginia. Old Dominion's board of directors is made up of two directors from each of its twelve member distribution cooperatives. The Federal Energy Regulatory Commission regulates a number of Old Dominion activities, including the rates and charges made, demanded, or received by Old Dominion for the transmission and wholesale sale of power in interstate commerce. Old Dominion is also subject to regulation by the Virginia State Corporation Commission on the siting of Old Dominion's utility facilities and its acquisition and disposition of its utility assets located in Virginia.

1.3.4 Organization and Management of Applicant

Dominion is not owned, controlled or dominated by an alien, a foreign corporation, or a foreign government. All officers and directors are citizens of the United States of America. The names and addresses of the directors and principal officers are provided below:

Directors

Name	Address
Thomas E. Capps Chairman	P. O. Box 26532 Richmond, VA 23261
Thomas F. Farrell, II	P. O. Box 26532 Richmond, VA 23261
Edgar M. Roach, Jr.	Dominion Tower, 22nd Floor 625 Liberty Avenue Pittsburgh, PA 15222-3199

Principal Officers

Name	Address
Thomas F. Farrell, II Chief Executive Officer	P. O. Box 26532 Richmond, VA 23261
Edgar M. Roach, Jr. Chief Executive Officer	Dominion Tower, 22nd Floor 625 Liberty Avenue Pittsburgh, PA 15222-3199
James P. O'Hanlon President and Chief Operating Officer	P. O. Box 26532 Richmond, VA 23261
Robert E. Rigsby President and Chief Operating Officer	P. O. Box 26666 One James River Plaza, 21st Floor Richmond, VA 23261
James L. Trueheart Group Vice President	P. O. Box 26666 One James River Plaza, 21st Floor Richmond, VA 23261
David A. Christian Senior Vice President - Nuclear Operations and Chief Nuclear Officer	Innsbrook Technical Center, 2SW 5000 Dominion Boulevard Glen Allen, VA 23060-6711

Text enclosed in thick border indicates information specific to **NORTH ANNA.**

M. Stuart Bolton, Jr. Senior Vice President - Financial Management	P. O. Box 26666 One James River Plaza, 17th Floor Richmond, VA 23261
James T. Earwood, Jr. Senior Vice President - Bulk Power Delivery	2400 Grayland Avenue Richmond, VA 23220
G. Scott Hetzer Senior Vice President and Treasurer	P. O. Box 26532 Richmond, VA 23261
E. Paul Hilton Senior Vice President - Bulk Sales	P. O. Box 26532 Richmond, VA 23261
Paul D. Koonce Senior Vice President - Portfolio Management	120 Tredegar Street, 3rd Floor Richmond, VA 23219
Margaret E. McDermid Senior Vice President - Information Technology & Chief Information Officer	P. O. Box 26532 Richmond, VA 23261
Mark F. McGettrick Senior Vice President - Customer Service and Metering	P. O. Box 26666 One James River Plaza, 21st Floor Richmond, VA 23261
Edward J. Rivas Senior Vice President - Fossil & Hydro	Innsbrook Technical Center, 1NE 5000 Dominion Boulevard Glen Allen, VA 23060
John A. Shaw Senior Vice President - Financial Management	P. O. Box 26532 Richmond, VA 23261
Jimmy D. Staton Senior Vice President - Electrical Distribution	P. O. Box 26666 Richmond, VA 23261

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Old Dominion Electric Cooperative (Old Dominion) is not owned, controlled or dominated by an alien, a foreign corporation or foreign government. All officers and directors are citizens of the United States of America. The names and addresses of the directors and principal officers are provided below:

Directors

Name	Address
Mr. Cecil E. Viverette Chairman	Rappahannock Electric Cooperative P.O. Box 7388 Fredericksburg, VA 22404-7388
Vernon N. Brinkley Vice Chairman	A&N Electric Cooperative P.O. Box 1128 Parksley, VA 23421-1128
M. Dale Bradshaw Secretary	Prince George Electric Cooperative P.O. Box 168 Waverly, VA 23890-0168
Frank W. Blake	Old Dominion Electric Cooperative 18507 Matompkin Road Parksley, VA 23421
William M. Leech, Jr.	Old Dominion Electric Cooperative 518 Bluegrass Trail Lexington, VA 24450
Richard L. Weaver	BARC Electric Cooperative P.O. Box 264 Millboro, VA 24460-0264
Fred L. Hubbard	Choptank Electric Cooperative P.O. Box 430 Denton, MD 21629-0430
Carl R. Widdowson	Old Dominion Electric Cooperative 29754 Widdowson Lane Princess Anne, MD 21853

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James M. Reynolds	Community Electric Cooperative P.O. Box 267 Windsor, VA 23487-0267
Carl R. Eason	Community Electric Cooperative 3449 Pittmantown Road Suffolk, VA 23438
E. Paul Bienvenue	Delaware Electric Cooperative P.O. Box 600 Greenwood, DE 19950-0600
Bruce A. Henry	Old Dominion Electric Cooperative RD1, Box 96A Greenwood, DE 19950
M. John Bowman	Mecklenburg Electric Cooperative P.O. Box 2451 Chase City, VA 23924-2451
David J. Jones	Old Dominion Electric Cooperative 6874 Highway One Bracey, VA 23919
Charles R. Rice, Jr.	Northern Neck Electric Cooperative P.O. Box 288 Warsaw, VA 22572-0288
Hunter R. Greenlaw, Jr.	Old Dominion Electric Cooperative P.O. Box 588 Fredericksburg, VA 22404
Stan C. Feuerberg	Northern Virginia Electric Cooperative P.O. Box 2710 Manassas, VA 20108-0875
John E. Bonfadini	Old Dominion Electric Cooperative 7500 Forrester Lane Manassas, VA 20109
Glenn F. Chappell	Old Dominion Electric Cooperative 17420 Old Stage Road Carson, VA 23830

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C. Douglas Wine	Shenandoah Valley Electric Cooperative P.O. Box 236 Mt. Crawford, VA 22841-0236
William M. Alphin	Old Dominion Electric Cooperative 8196 Charlie's Lane Boston, VA 22713
Dick D. Bowman	Old Dominion Electric Cooperative Bowman Brothers, Inc. P.O. Box 405 Mt. Jackson, VA 22842
M. Larry Longshore	Southside Electric Cooperative P.O. Box 7 Crewe, VA 23930-0007
Calvin P. Carter	Old Dominion Electric Cooperative 6262 Bedford Highway Lynch Station, VA 24571

Principal Officers

Name	Address
Jackson E. Reasor President and CEO	Old Dominion Electric Cooperative 4201 Dominion Boulevard Glen Allen, VA 23060
Gus Kappatos Senior VP, Engineering and Operations	Old Dominion Electric Cooperative 4201 Dominion Boulevard Glen Allen, VA 23060

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Dan Walker Senior VP, Accounting and Finance	Old Dominion Electric Cooperative 4201 Dominion Boulevard Glen Allen, VA 23060
Greg White Senior VP, Retail and Alliance Management	Old Dominion Electric Cooperative 4201 Dominion Boulevard Glen Allen, VA 23060
Ken Alexander VP, Asset Development and Production	Old Dominion Electric Cooperative 4201 Dominion Boulevard Glen Allen, VA 23060

1.3.5 Class of License, Use of Facility, and Period of Time for which the License is Sought

Dominion requests renewal of the operating license for a period of 20 years beyond the expiration date of the current licenses as shown below:

Unit	License No.	License Class	Expiration Date
1	NPF-4	103	April 1, 2018
2	NPF-7	103	August 21, 2020

Dominion also requests renewal of the source, special nuclear material, and by-product licenses that are included within the operating licenses and that were issued pursuant to 10 CFR Parts 30, 40, and 70.

1.3.6 Earliest and Latest Dates for Alterations, if Proposed

Dominion does not propose to alter the station in connection with this application. However, the current licensing basis (CLB) will be continued and maintained throughout the period of extended operation.

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1.3.7 Listing of Regulatory Agencies Having Jurisdiction and News Publications

The Federal Energy Regulatory Commission, the State Corporation Commission of Virginia and the North Carolina Utilities Commission are the principal regulators of the company's electric operations in Virginia and North Carolina.

The Honorable David P. Boergers
Secretary
Federal Energy Regulatory Commission
888 First Street, NE, Room 1A
Washington, DC 20426

Mr. Joel H. Peck, Clerk
c/o Document Control Center
Virginia State Corporation Commission
1300 East Main Street
Tyler Building - First Floor
Richmond, Virginia 23218

Ms. Geneva S. Thigpen, Chief Clerk
North Carolina Utilities Commission
4325 Mail Service Center
Raleigh, North Carolina 27699-4325

The area news publications and their associated addresses are provided below

Richmond Times-Dispatch
P.O. Box 85333
Richmond, VA 23293

Central Virginian
P.O. Box 464
Louisa, VA 23093

Daily Progress
P.O. Box 9030
Charlottesville, VA 22906

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Orange County Review
P.O. Box 589
Orange, VA 22960

Free Lance-Star
616 Amelia Street
Fredericksburg, VA 22401

1.3.8 Conforming Changes to Standard Indemnity Agreement

10 CFR 54.19(b) requires that license renewal applications include, "…conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." The current indemnity agreement for the two units does not contain a specific expiration term for the operating licenses. Therefore, conforming changes to account for the expiration term of the proposed renewed licenses are not necessary, unless the license numbers are changed upon issuance of the renewed licenses.

1.3.9 Restricted Data Agreement

This application does not contain restricted data or other national defense information, nor is it expected that subsequent amendments to the license application will contain such information. However, pursuant to 10 CFR 54.17(g) and 10 CFR 50.37, Dominion, as a part of the application for renewed operating licenses, hereby agrees that it 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.

1.4 Abbreviations and Passive Function Code Definitions

1.4.1 Abbreviations

This section contains the abbreviations that pertain to the administrative and technical information within the license renewal application. The abbreviations that pertain to the environmental information are included in the front of Appendix E (Environmental Report).

Abbreviation	Definition
AC	Alternating Current
AAC	Alternate Alternating Current
ACI	American Concrete Institute
AEC	Atomic Energy Commission
AMA	Aging Management Activity
AMP	Aging Management Program
AMR	Aging Management Review
AMSAC	ATWS Mitigation System Actuation Circuit
ANSI	American National Standards Institute
API	American Petroleum Institute
AS	Auxiliary Steam
ASCO	Automatic Switch Company
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	Anticipated Transient Without SCRAM
ASWPH	Auxiliary Service Water Pump House
BC	Bearing Cooling
BD	Blowdown
BIW	Boston Insulated Wire
BR	Boron Recovery
BTP	Branch Technical Position
CA	Compressed Air
CASS	Cast Austenitic Stainless Steel

Text enclosed in thick border indicates information specific to **NORTH ANNA.**

Abbreviation	Definition
CC	Component Cooling
CD	Chilled Water
CD-ROM	Compact Disk-Read only Memory
CFR	Code of Federal Regulations
CH	Chemical Volume and Control
CLB	Current Licensing Basis
CN	Condensate
CRDM	Control Rod Drive Mechanism
CS	Containment Spray
CSA	Conductor Seal Assembly
CSPE	Chlorosulfonated Polyethylene
CUF	Cumulative Usage Factor
CV	Containment Vacuum
CvUSE	Charpy Upper Shelf Energy
CW	Circulating Water
DA	Drains-Aerated
DB	Drains-Building Services
DBE	Design Basis Event
DC	Direct Current
DG	Drains-Gaseous
DGSS	Diesel Generator Support Systems
DLPS	Drains and Liquid Processing Systems
DR	Deviation Report
ECSA	Electrical Conductor Seal Assembly
EDG	Emergency Diesel Generator
EDS	Equipment Data System
EPDM	Ethylene Propylene Diene Monomer

Abbreviation	Definition
EPR	Ethylene Propylene Rubber
EPRI	Electric Power Research Institute
EQ	Environmental Qualification
EQML	Equipment Qualification Master List
ESF	Engineered Safety Features
ESGR	Emergency Switchgear Room
ET	Eddy Current Test
FAC	Flow-Accelerated Corrosion
FC	Fuel Pit Cooling
FMR	Flame and Moisture Resistant
FP	Fire Protection
FPH	Fire Pump House
FPSS	Fire Protection and Supporting Systems
FSAR	Final Safety Analysis Report
FSER	Final Safety Evaluation Report
FW	Feedwater
GDC	General Design Criterion
GE	General Electric
GL	Generic Letter
GN	Primary and Secondary Plant Gas Supply
GSI	Generic Safety Issue
GTR	Generic Technical Report
GW	Gaseous Waste
HC	Post-Accident Hydrogen Control
HELB	High-Energy Line Break
HHSI	High-Head Safety Injection
HMWPE	High Molecular Weight Polyethylene

Text enclosed in thick border indicates information specific to **NORTH ANNA.**

Abbreviation	Definition
HRSS	High Radiation Sampling System
HV	Heating and Ventilation
HVT	High-Voltage Termination
HVAC	Heating, Ventilation, and Air Conditioning
I&C	Instrumentation and Controls
IA	Instrument Air
IASCC	Irradiation-Assisted Stress Corrosion Cracking
IC	Incore Instrumentation
ICCS	Inadequate Core Cooling System
ID	Inner Diameter
IE	Inspection and Enforcement
IGSCC	Intergranular Stress Corrosion Cracking
IN	Information Notice
INEL	Idaho National Engineering Laboratories
INPO	Institute of Nuclear Power Operations
IPA	Integrated Plant Assessment
ISCH	Intake Structure Control House
ISFSI	Independent Spent Fuel Storage Installation‘
ISI	Inservice Inspection
ISRS	Inside Recirculation Spray
ITG	Issues Task Group
LBB	Leak-Before-Break
LHSI	Low-Head Safety Injection
LM	Leakage Monitoring
LOCA	Loss-of-Coolant Accident
LR	License Renewal
LRA	License Renewal Application

Text enclosed in thick border indicates information specific to **NORTH ANNA.**

Abbreviation	Definition
LTOPS	Low Temperature Overpressure Protection System
LW	Liquid and Solid Waste
MCR	Main Control Room
MIC	Microbiologically Induced Corrosion
MOV	Motor Operated Valve
MS	Main Steam
MT	Magnetic Particle Test
MWe	Megawatt-electric
MWt	Megawatt-thermal
NAPS	North Anna Power Station
NDE	Non-destructive Examination
NEI	Nuclear Energy Institute
NFPA	National Fire Protection Association
NI	Nuclear Instrumentation
NPS	Nominal Pipe Size
NRC	Nuclear Regulatory Commission
NS	Non-Safety-Related or Neutron Shield Tank Cooling
NSQ	Non-Safety-Related with Special Quality/Regulatory Requirements
NS>SR	Non-Safety-Related Affecting Safety-Related
NSSS	Nuclear Steam Supply System
NST	Neutron Shield Tank
OSRS	Outside Recirculation Spray
PG	Primary Grade
PL	Plumbing or Power Lead

Text enclosed in thick border indicates information specific to **NORTH ANNA.**

Abbreviation	Definition
PM	Preventative Maintenance
PORV	Power Operated Relief Valve
PT	Liquid Penetrant Test
PTS	Pressurized Thermal Shock
P-T	Pressure-Temperature
PWR	Pressurized Water Reactor
PWSCC	Primary Water Stress Corrosion Cracking
QDR	Qualification Document Review
QS	Quench Spray
RAI	Request for Additional Information
RC	Reactor Coolant
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RG	Regulatory Guide
RH	Residual Heat Removal
RI-ISI	Risk Informed Inservice Inspection
RL	Reactor Cavity Purification
RM	Radiation Monitoring
RP	Refueling Purification
RS	Recirculation Spray
RT	Steam Generator Recirculation and Transfer or Radiographic Test
RTD	Resistance Temperature Detector
RT_{PTS}	Reference temperature for pressurized thermal shock
RT_{NDT}	Reference nil ductility transition temperature
ΔRT_{NDT}	Irradiation-induced shift in the reference nil ductility transition temperature

Text enclosed in thick border indicates information specific to **NORTH ANNA.**

Abbreviation	Definition
RV	Reactor Vessel
RVLIS	Reactor Vessel Level Instrumentation System
RW	Radwaste
RWST	Refueling Water Storage Tank
SA	Service Air
SBO	Station Blackout
SCBA	Self-Contained Breathing Apparatus
SCC	Stress Corrosion Cracking
SD	Steam Drains
SDBD	System Design Basis Document
SEC	Security
SER	Safety Evaluation Report
SG	Steam Generator
SI	Safety Injection
SIS	Single Insulated Strand
SPCS	Steam and Power Conversion Systems
SPS	Surry Power Station
SR	Safety-Related or Silicon Rubber
SRP	Standard Review Plan
SS	Sampling System
SSC	Systems, Structures, and Components
SV	Secondary Vents
SW	Service Water
SWR	Service Water Reservoir
TID	Total Integrated Dose
TGSCC	Transgranular Stress Corrosion Cracking

Text enclosed in thick border indicates information specific to **NORTH ANNA.**

Abbreviation	Definition
TLAA	Time-Limited Aging Analyses
T.S.	Technical Specification
UFSAR	Updated Final Safety Analysis Report
USE	Upper Shelf Energy
UT	Ultrasonic Testing
VA	Vents-Aerated
Vepco	Virginia Electric and Power Company
VG	Vents-Gaseous
VGPS	Vents and Gaseous Processing Systems
VHP	Vessel Head Penetration
VP	Vacuum Priming
VS	Ventilation
VT	Visual Test
WOG	Westinghouse Owner's Group
WT	Steam Generator Water Treatment
XLPE	Cross-linked Polyethylene

1.4.2 Passive Function Code Definitions

This section contains the meanings for the abbreviations used in the Screening and AMR results tables to represent the passive functions for components, subcomponents, and structural members. Passive functions are the specific intended functions performed by in-scope passive components in support of system or structure intended functions. Passive components are components that perform an intended function without moving parts or without a change in configuration or properties.

Code	Definition
CE	Conducts electricity.
EN	Provides enclosure, shelter, or protection for in-scope equipment (including radiation shielding and pipe whip restraint).
EQB	Provides an environmental qualification (EQ) barrier.

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Code	Definition
FB	Provides a rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant.
FD	Provides for flow distribution.
FLB	Provides a protective barrier for internal/external flood events.
FLT	Provides filtration.
HS	Provides a heat sink during SBO or design basis accidents.
HT	Provides for heat transfer.
JIS	Provides jet impingement shielding for high energy line breaks.
MB	Provides a missile (internal or external) barrier.
PB	Provides a pressure boundary.
RF	Restricts flow.
SCW	Provides a source of cooling water for plant shutdown.
SNS	Provides structural and/or functional support to equipment meeting license renewal Criterion 2 (non-safety affecting safety-related) and/or Criterion 3 (the five regulated events).
SP	Provides a spray pattern.
SS	Provides structural and/or functional support for in-scope equipment.
SSR	Provides structural and/or functional support for safety-related equipment.

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Section 1.0 References

1. 10 CFR 54, *Requirements for Renewal of Operating Licenses for Nuclear Power Plants*, U.S. Nuclear Regulatory Commission.

2. 10 CFR 51, *Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions*, U.S. Nuclear Regulatory Commission.

3. Letter from W. R. Matthews, Vepco, to Brenda J. Shelton, U.S Nuclear Regulatory Commission, *Surry Power Station Units 1 and 2, North Anna Power Station Units 1 and 2, Request for Exception to 10 CFR 50.4, Written Communications* (Serial No. 00-377), August 4, 2000.

4. Letter from Brenda J. Shelton, U.S. Nuclear Regulatory Commission, to W. R. Matthews, Vepco, *Virginia Electric and Power Company, Surry Power Station Units 1 and 2, North Anna Power Station Units 1 and 2, Request for Exception to 10 CFR 50.4, Written Communications*, September 21, 2000.

5. NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 -The License Renewal Rule*, Rev. 2, Nuclear Energy Institute, August 2000.

6. *Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants* (Draft for Public Comment), U.S. Nuclear Regulatory Commission, August 2000.

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

2.1 Scoping and Screening Methodology

Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences.

A listing of the abbreviations used in this section is provided in Section 1.4.1.

2.1.1 Introduction

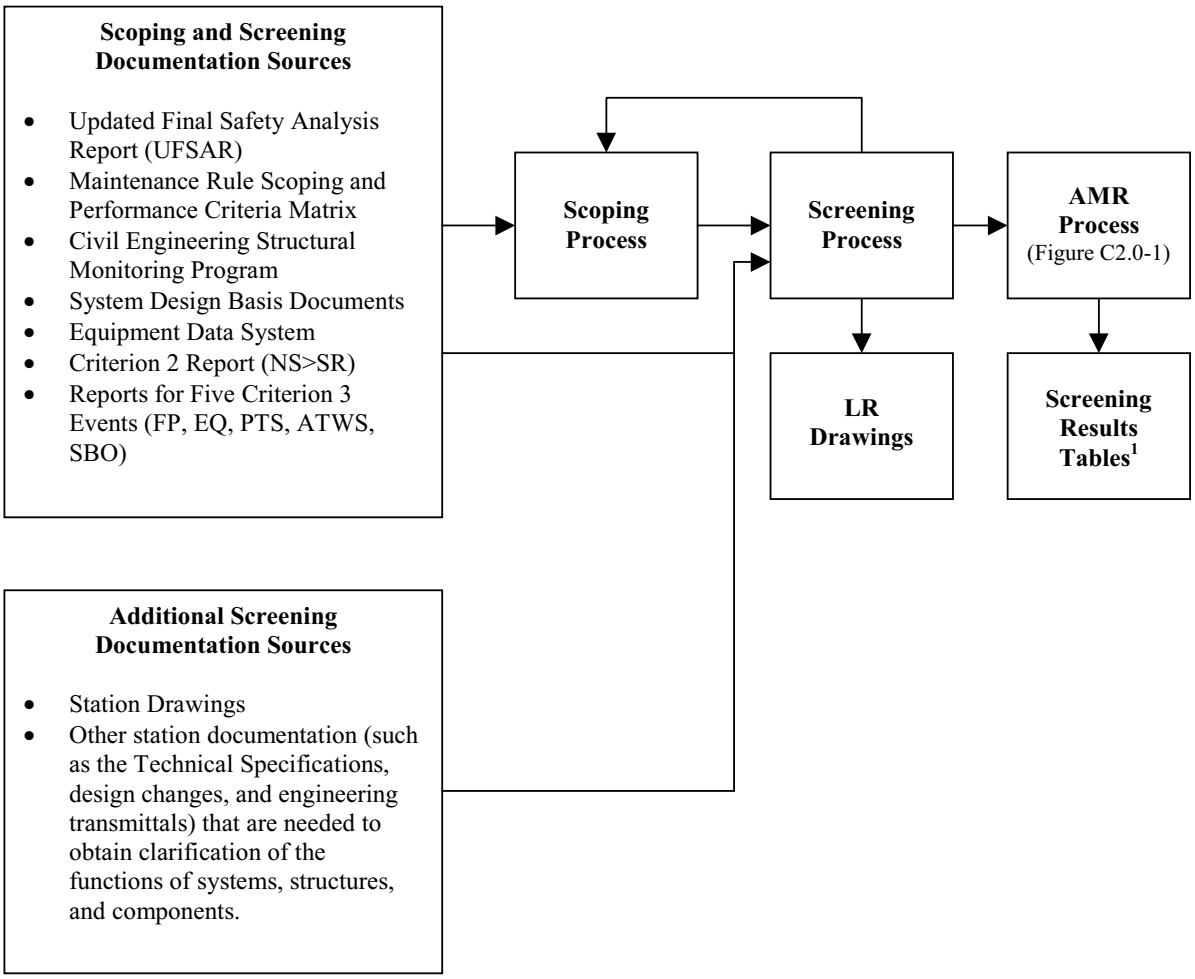
The first step in the Integrated Plant Assessment has involved the identification of the plant systems, structures, and components (SSCs) that are within the scope of license renewal and that require an aging management review (AMR). Section 2.1 provides the information that is required in order to meet the requirements of 10 CFR 54.21(a)(1) and (a)(2).

Scoping and screening have been performed consistent with the guidelines presented in NEI-95-10 (Reference 1) with the following clarifications:

- Reports have been prepared for Criterion 2 (Section 2.1.3.6, Criterion 2 Report) and for each of the five regulated events for Criterion 3 (Section 2.1.3.7, Regulated Event Reports) to provide additional input to the scoping and screening processes.
- Scoping and screening have not been treated as independent activities. Scoping has been performed at the system/structure level. However, after completing screening on a component level basis, the scoping results have been reviewed and revised as required.
- The screening process identified in-scope passive components. The short-lived passive components, that could be excluded from an AMR on the basis of a qualified life or a specified replacement time period, have been identified as part of the AMR process (Appendix C, Aging Management Review Methodology). It was during the AMR process that the procedures used for maintaining and replacing plant equipment were reviewed.

A simplified flow chart, showing the relationship between the scoping and screening processes, is provided in Figure 2.1-1. Section 2.1.2 discusses the application of the 10 CFR 54.4(a) scoping criteria in to the station. Section 2.1.3 provides a discussion of the documentation that has been used to perform scoping and/or screening. Section 2.1.4 describes the scoping methodology, and Section 2.1.5 describes the screening methodology.

Figure 2.1-1 Simplified Scoping and Screening Process Flow Chart



1. Short-lived passive components identified during the AMR process have been excluded from the screening results tables.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

2.1.2 Application of the Scoping Criteria in 10 CFR 54.4(a)

10 CFR 54.4(a)(1), (a)(2) and (a)(3) contain criteria for including systems, structures, and components (SSCs) within the scope of license renewal. Throughout the application these are referred to as Criteria 1, 2 and 3. They have been abbreviated as follows:

Criterion 1 - Safety-related (SR)

Criterion 2 - Non-safety-related affecting safety-related (NS>SR)

Criterion 3 - The five regulated events

- Fire Protection (FP)
- Environmental Qualification (EQ)
- Pressurized Thermal Shock (PTS)
- Anticipated Transients Without Scram (ATWS)
- Station Blackout (SBO)

The application of each of these criteria to plant SSCs is discussed in Section 2.1.2.1, Section 2.1.2.2, and Section 2.1.2.3 which follow:

2.1.2.1 Criterion 1 - Safety-Related

10 CFR 54.4(a)(1) requires that plant SSCs within the scope of license renewal include -

> Safety-related SSCs 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 off-site exposures comparable to those referred to in 10 CFR 50.34(a)(1), 10 CFR 50.67(b)(2), or 10 CFR 100.11, as applicable.

The quality classifications established for mark-numbered plant components and structures are based on reviews of plant accident analyses and evaluations, and safety-related classifications that match the safety-related definitions presented in 10 CFR 50.49(b)(1). Therefore, Dominion has relied on these classifications for the identification of safety-related components and structures. It has not been necessary to reverify those classifications for license renewal.

The Equipment Data System (EDS) and the Q-List (the listing of SR and NSQ plant equipment within EDS) are discussed in Section 2.1.3.5. The use of the EDS during scoping and screening is discussed in Section 2.1.4 and Section 2.1.5, respectively.

2.1.2.2 Criterion 2 - Non-Safety-Related Affecting Safety-Related

10 CFR 54.4(a)(2) requires that plant SSCs within the scope of license renewal include -

> All non-safety-related SSCs whose failure could prevent satisfactory accomplishment of any of the functions identified for Criterion 1 (paragraphs (i), (ii), and (iii)).

A review of the UFSAR and other CLB documents has been performed to provide the guidelines and the sources of information to be used as input to scoping and screening. The results of that review are discussed in Section 2.1.3.6, Criterion 2 Report.

2.1.2.3 Criterion 3 - The Five Regulated Events

10 CFR 54.4(a)(3) requires that plant SSCs within the scope of license renewal include -

> All SSCs 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).

For each of these regulations, a report has been prepared to provide input into the scoping and screening processes. The purpose of those reports has been to (1) identify the systems and structures that are relied on for each of those events, and (2) either identify specific components, or point to the documentation to be used as input for screening. The regulated event reports are discussed in Section 2.1.3.7, Regulated Event Reports.

2.1.3 Documentation Sources Used for Scoping and Screening

2.1.3.1 Updated Final Safety Analysis Report

The Updated Final Safety Analysis Report (UFSAR) has been used as a general source of CLB information for plant SSCs.

2.1.3.2 Maintenance Rule Scoping and Performance Criteria Matrix

The Maintenance Rule Scoping and Performance Criteria Matrix has been used as a source of system functions for both scoping and screening. This matrix includes safety-related (SR) functions and those functions associated with fire protection (FP), equipment qualification (EQ), anticipated transients without scram (ATWS), and station blackout (SBO).

The MR matrix also identifies functions that may fall into the category of non-safety-related affecting safety-related (NS>SR). The NS>SR criterion for license renewal (10 CFR 54.4(a)(2)) and the maintenance rule (10 CFR 50.65(b)(2)(ii)) are similar. However, there have been differences within the industry on how this criterion has been interpreted and applied to the maintenance rule and license renewal scoping efforts. Therefore, a Criterion 2 report has been prepared to provide the guidelines and the sources of information to be used for including SSCs under Criterion 2 (NS>SR). That report is discussed in Section 2.1.3.6, Criterion 2 Report.

2.1.3.3 Civil Engineering Structural Monitoring Program

The Civil Engineering Structural Monitoring Program lists all plant structures and identifies the structures that have been included within the scope of the Maintenance Rule. This program has been used as a starting point for identifying the structures that should be included within the scope of License Renewal under Criterion 1 (SR) and Criterion 2 (NS>SR).

2.1.3.4 System Design Basis Documents

A set of System Design Basis Documents (SDBDs) have been developed to provide a source of design basis information about selected plant systems. The SDBDs include the following information of importance to scoping and screening:

1. System descriptions.
2. References to applicable design basis documents (such as design changes and calculations) associated with the system.

3. A list of SR system functions, functions potentially meeting Criterion 2 (NS>SR), and functions associated with fire protection (FP), equipment qualification (EQ), anticipated transients without scram (ATWS), and station blackout (SBO).

The system functions listed in the SDBDs have been used to supplement the maintenance rule functions for both scoping and screening.

2.1.3.5 Equipment Data System

The Equipment Data System (EDS) is a company database that contains (1) information for each mark-numbered structure and component, (2) the Q-List, and (3) the Environmental Qualification Master List. For each component and structure, EDS includes some or all of the following information of importance to the scoping and screening processes:

1. The mark number (i.e., unique identification number), which includes a system designator.
2. A description of the item.
3. The quality classification (SR - safety-related, NS - non-safety-related, NSQ - non-safety-related with special quality/regulatory requirements).
4. The function(s) of the component (provides system pressure boundary, restricts flow, provides structural integrity, etc.).
5. The applicable classification rules (or basis) for each function. In addition to the SR classification, the classification rules that could apply include those for fire protection (FP), station blackout (SBO), anticipated transients without scram (ATWS), and several NSQ functions with potential applicability to Criterion 2 (NS>SR).
6. Program applicability (“yes/no” field) related to environmental qualification (EQ), EQ related, and Appendix R.

The list of SR/NSQ structures and components within EDS (and their associated functions) is commonly referred to as the Q-List. As stated in Section 2.1.2.1, the Q-List has been used to support the identification of safety-related components within the scope of license renewal for Criterion 1. That list has provided input directly into the scoping and screening processes.

The list of EQ components within EDS and the associated EQ data (such as qualified life and the applicable environmental zone) are commonly referred to as the Equipment Qualification Master List (EQML). That list has been used to identify the EQ Program components (Section 2.1.3.7) within the scope of license renewal. The "EQ related" field in EDS has been used to identify components (such as doors, penetrations, seals, dampers, walls, and floors) that provide a barrier between mild and harsh areas of the plant.

EDS has also been used as a source to identify the NS/NSQ structures and components that support the following:

- Fire protection (FP)
- Station blackout (SBO)
- Anticipated transients without scram (ATWS)
- Mitigation of flooding events (NS>SR)

2.1.3.6 Criterion 2 Report

A review of the UFSAR and other CLB documents has been performed to identify the NS and NSQ SSCs whose failure could prevent satisfactory accomplishment of the SR functions identified in 10 CFR 54.4(a)(1). The review has encompassed the design basis events and hypothetical failures considered within these documents. The NS and NSQ SSCs already included within the scope of license renewal for Criterion 3 have not been identified for inclusion under Criterion 2. The results of the review have been incorporated into a Criterion 2 Report, which has been used as input to scoping and screening. The report has identified the following four categories of NS and NSQ SSCs for inclusion within the scope of Criterion 2:

1. SSCs relied on to mitigate or prevent flooding events.
2. Piping relied on to maintain its integrity in order to prevent a high energy line break outside Containment.
3. Piping that is attached to SR piping and that is seismically designed and supported up to the first equivalent anchor point beyond the SR/NS or SR/NSQ boundary.
4. SSCs that are in close proximity to SR SSCs and whose failure during a seismic event could adversely interact with SR SSCs (Seismic II/I).

These items have been handled during screening as explained below based upon directions provided in the Criterion 2 Report:

a. NS and NSQ SSCs for the first two items have been individually identified during screening using the guidelines and documentation sources referenced within the Criterion 2 Report.

b. The NS and NSQ piping that is attached to SR piping and that is required to be seismically designed and supported up to the first equivalent anchor point beyond the SR/NS or SR/NSQ boundary, has not been identified during screening. The aging effects on the NS and NSQ piping supports will be managed as commodities. In addition, the aging management activities that apply to the SR piping will be extended to include attached NS and NSQ piping up to the first equivalent anchor point.

c. The NS and NSQ SSCs that could potentially have a Seismic II/I interaction have not been uniquely identified during screening. Instead, an areas based approach to screening has been used for Seismic II/I because the potential for seismic interactions is dependent upon the location of NS SSCs relative to SR SSCs. Therefore, the types of NS SSCs that are located in areas containing SR SSCs have been identified for inclusion within the scope of license renewal. Component supports and building subcomponents such as block walls are examples of SSCs that have been included in scope for Seismic II/I. The supports and passive structural members for load handling cranes and devices are also included in this approach for Seismic II/I. In addition, certain load handling cranes and devices of importance to plant operations have been specifically identified for inclusion within the scope of license renewal.

   It should be noted that NS and NSQ mechanical components (e.g., piping, tanks, ducting) have not been included within the scope of license renewal for Seismic II/I because the failure of this equipment during a seismic event has not been postulated in the CLB. The NS and NSQ mechanical components (such as tanks and piping) whose failure could lead to a significant flooding hazard have been reviewed for potential inclusion within the scope of license renewal independent of Seismic II/I considerations.

As discussed above, the Criterion 2 Report has identified four categories of NS and NSQ SSCs for inclusion within the scope of license renewal. However, it is recognized that the UFSAR and other CLB documents do not identify every NS and NSQ SSC that performs a support function (such as supplying instrument air, cooling water, or heating and ventilation) required for SR SSCs to perform their intended functions. Therefore, those SSCs have been identified during the normal screening process. This process has relied on a review of station documents such

as system drawings, the Maintenance Rule (MR) Scoping and Performance Criteria Matrix (Section 2.1.3.2), and the System Design Basis Documents (Section 2.1.3.4). This screening process (Section 2.1.5.1) has addressed the cascading issue (Reference 5) and has demonstrated compliance with 10 CFR 54.4(a)(2) by identifying support systems down to a level necessary to provide satisfactory accomplishment of the SR functions identified in 10 CFR 54.4(a)(1).

2.1.3.7 Regulated Event Reports

A report has been prepared for each of the five regulations covered in 10 CFR 54.4(a)(3) to provide input to the scoping and screening processes. This section provides a discussion of each of those reports:

Fire Protection

The Fire Protection (FP) Program has been developed to maintain compliance with 10 CFR 50.48, Appendix R to 10 CFR 50, and Appendix A of Branch Technical Position APCSB 9.5-1 (Reference 3) by meeting the following objectives in fire areas important to safety:

- Reduce the likelihood of fires.
- Promptly detect and extinguish fires that do occur.
- Maintain safe-shutdown capability if a fire does occur.
- Prevent release of a significant amount of radioactive material if a fire does occur.

In addition to the objectives delineated above, the Fire Protection Program also includes the fire protection equipment required for insurance purposes for facilities such as warehouses, training buildings, records facilities, maintenance shops, and security equipment, none of which have any safety significance. Those SSCs that are not important to safety have been excluded from the scope of license renewal for fire protection.

A review has been performed to identify the specific SSCs that fall within the scope of license renewal for the Fire Protection Program including the SSCs relied upon in the Fire Hazards Analysis. The results of that review have been documented in a regulated event report which has been used as input to the scoping and screening processes. That report either individually lists the SSCs or references the applicable fire protection system drawings. As a result of that review, the following features and equipment have been included within the scope of license renewal for fire protection:

- Fire detection and suppression equipment
- Fire barriers (includes doors, walls, gap covers, penetration seals, etc.)
- Flood barriers (includes curbs, dikes, etc.)
- Safe shutdown equipment (Appendix R)
- Reactor coolant pump oil collection system
- Fire fighting support (communications, lighting, bottled air)
- Panels
- Post-fire repair equipment (required for cold shutdown)
- Radiant energy shields
- Control room envelope pressure boundary (Halon suppression concentration)
- Combustible containment features (includes gravel pits around transformers, berms/dikes around fuel oil tanks, etc.)

The screening methodology applied to the post-fire repair equipment that is maintained in storage is discussed in Section 2.1.5.4, Screening of Stored Equipment.

Environmental Qualification

The Environmental Qualification (EQ) Program has been developed to maintain compliance with 10 CFR 50.49. The program applies to the following electrical equipment that is important to safety and located in a harsh environment:

1. Safety-related electrical equipment that is relied on to remain functional during and following a design basis event.
2. Non-safety-related electrical equipment whose failure, under postulated environmental conditions, could prevent accomplishment of safety functions.
3. Category 1 and 2 post-accident monitoring equipment described in Regulatory Guide 1.97 (Reference 2).

The electrical components that fall within this scope of the EQ program are identified on the Equipment Qualification Master List (EQML) which resides in the Equipment Data System (Section 2.1.3.5). The structural and mechanical components (such as doors, penetrations, seals, dampers, walls, and floors) that provide a barrier between mild and harsh areas of the plant have also been included within the scope of license renewal. These electrical, structural, and mechanical components have been listed in a regulated event report, which has been used as input to the scoping and screening processes.

Pressurized Thermal Shock

10 CFR 50.61 requires that each licensee project a value for the reference temperature for pressurized thermal shock (RT_{PTS}) for the limiting reactor vessel materials for end-of-life neutron fluence. The licensee is also required to implement those flux reduction programs, plant modifications and/or operational changes that are reasonably practicable to avoid exceeding the pressurized thermal shock (PTS) screening criterion set forth in 10 CFR 50.61.

Reactor vessel beltline neutron fluence and RT_{PTS} values have been projected for 60 years of operation. As discussed in Section 4.2, Reactor Vessel Neutron Embrittlement, these values demonstrate that the reactor vessels can be operated safely through the period of extended operation.

The calculated values of RT_{PTS} for North Anna Units 1 and 2 remain compliant with the screening criteria in 10 CFR 50.61 without reliance on any plant modifications or compensatory actions. Therefore, no SSCs have been included in the scope of license renewal for PTS.

Anticipated Transients Without Scram

Plant modifications have been implemented in response to 10 CFR 50.62 to provide equipment, from sensor output to final actuation device, that is diverse from the reactor trip system, to (1) de-energize the power supply to the reactor trip breakers, (2) automatically initiate the auxiliary feedwater system, (3) initiate a turbine trip, and (4) isolate the steam generator blowdown and sampling systems under conditions indicative of an anticipated transient without scram (ATWS). This equipment has been designed to perform its function in a reliable manner and to be independent (from sensor output to the final actuation device) from the existing reactor trip system.

The SSCs required for compliance with 10 CFR 50.62 have been identified in a regulated event report which has been used as input to the scoping and screening processes. The in-scope equipment includes the ATWS Mitigation System Actuation Circuitry (AMSAC) which has been installed in response to the NRC regulation.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Station Blackout

Plant modifications and procedure changes have been implemented in response to 10 CFR 50.63 to enable the station to withstand and recover from a station blackout (SBO) of a specified duration, without sustaining reactor damage. Recovery includes the ability to achieve and maintain hot shutdown.

The SSCs required for compliance with 10 CFR 50.63 have been identified in a regulated event report which has been used as input to the scoping and screening processes. The in-scope SSCs include the (1) AAC diesel, (2) its support systems, (3) the SBO Building, and (4) other equipment relied upon to mitigate an SBO event. These SSCs have been installed in response to the regulation to provide an alternate on-site source of power in the event of a station blackout.

2.1.3.8 Drawings

The screening process for plant systems has involved the review of the controlled drawings which show the system mechanical components. These drawings have been marked up during the screening process to show the passive components that support one or more system intended functions. The marked up drawings have been subsequently used to create a set of license renewal drawings. These drawings provide both system boundaries and system interfaces.

2.1.3.9 Other Documentation

Additional documents such as design change packages, calculations, engineering transmittals, technical reports, and the Technical Specifications have been reviewed during screening if deemed necessary to obtain clarifications of the functions performed by the SSCs.

2.1.4 Scoping Methodology

Scoping has been performed to identify the plant systems and structures within the scope of the license renewal rule. The scoping for systems and structures has been performed as two separate efforts as discussed in the following sections:

2.1.4.1 System Scoping Methodology

Most of the system components at the station are assigned a unique mark number and are entered in the Equipment Data System (EDS) which is discussed in Section 2.1.3.5. The components that are typically mark numbered include equipment such as pumps, valves, tanks, vessels, piping, flow orifices, filters, relays, breakers, switches, and transmitters. Each mark number includes

separate segments of information that identify the component by its station, unit number, system, component type, and a unique identifier. The system code identifies the system to which the component belongs. For example, feedwater system components have an FW system code, and safety injection system components have an SI system code.

The identification of systems for scoping has been based on the system codes in the mark numbers. This approach has also provided a convenient method for grouping mark-numbered components for evaluation during the screening process.

A system was initially identified as being in scope if one or more of the following criteria were met.

1. The system performs an intended function. The system functions considered for this review are those documented in the Maintenance Rule Scoping and Performance Matrix (Section 2.1.3.2) and the applicable System Design Basis Document (Section 2.1.3.4).
2. The component data in EDS (Section 2.1.3.5) indicates that the system has one or more components that perform a SR, EQ, FP, SBO, ATWS or NS>SR function.
3. The system has been identified in the Criterion 2 Report (Section 2.1.3.6) or in one of the five regulated event reports (Section 2.1.3.7) as being within the scope of the rule.

The preliminary scoping results have been used as input to the screening process. However, the system scoping results have been reviewed and updated since system screening was completed. The final system scoping results are presented in Section 2.2.

2.1.4.2 Structure Scoping Methodology

A structure has been initially identified as being within the scope of license renewal if one or more of the following criteria were met:

1. The structure is included in the scope of the Maintenance Rule because it is safety-related (SR) or non-safety-related affecting safety-related (NS>SR), as indicated in the Civil Engineering Structural Monitoring Program (Section 2.1.3.3).

2. The structure is identified in the Criterion 2 Report (Section 2.1.3.6) or in one of the five Criterion 3 regulated event reports (Section 2.1.3.7) as being within the scope of the rule.

The structural scoping results have been used as input to the structural screening process. However, the structural scoping results have been reviewed and updated since structural screening was completed. In addition, following the completion of system screening, the structural scoping results have been updated to reflect any additional structures that were identified as containing or supporting in-scope components. The final structural scoping results are presented in Section 2.2.

2.1.5 Screening Methodology

The initial scoping effort (Section 2.1.4) identified the plant systems and structures that were candidates for inclusion within the scope of the rule. For each of those systems and structures, screening was performed to identify the passive components and structural members that support an intended function for the system or structure. As noted previously, the components that were short-lived (and therefore did not require an AMR) were identified as part of the AMR process as discussed in Appendix C, Aging Management Review Methodology. These determinations have been reflected in the screening results tables.

This section of the application describes the methodology for screening process. Screening has been divided by engineering discipline into three primary areas: (1) mechanical (system), (2) civil/structural, and (3) electrical/instrumentation and controls (I&C). The screening processes for these areas are described in Section 2.1.5.1, Section 2.1.5.2, and Section 2.1.5.3, respectively. Section 2.1.5.4 summarizes the screening review performed for stored equipment. Section 2.1.5.5 summarizes the screening review performed for thermal insulation.

Components have also been screened to identify the passive long-lived subcomponents that require an AMR. That screening has been performed as a part of the AMR process and is discussed in Appendix C, Section C2.2, Identification of In-scope Passive Subcomponents.

2.1.5.1 System (Mechanical) Screening

Each system identified during scoping as being within the scope of license renewal has been screened to identify the passive mechanical components (pump casings, valve bodies, tanks, piping, tubing, etc.) that support one or more of the system's intended functions. The electrical/I&C components (such as heaters) that are in-scope only because they perform a system pressure boundary function, have been treated as mechanical components and have also been identified during system screening.

The intended functions for a system have been used as input to the screening process. Those functions have been developed utilizing the following information:

- The system functions in the Maintenance Rule Scoping and Performance Criteria Matrix (Section 2.1.3.2) and in the System Design Basis Documents (Section 2.1.3.4).
- The system-related information provided in the Criterion 2 Report (Section 2.1.3.6) and the Criterion 3 regulated event reports (Section 2.1.3.7).
- The component data in the Equipment Data System (Section 2.1.3.5).

The system intended functions, in conjunction with component information in Equipment Data System (EDS), the Criterion 2 Report, and the Criterion 3 regulated event reports, and the applicable system drawings have been used to identify the passive components within the scope of license renewal. The following criteria have applied to this effort.

- Passive component determinations have been made in accordance with 10 CFR 54.21(a)(1)(i), the guidance in NEI-95-10 (Reference 1), and other industry guidance as appropriate.
- The cascading issue (Reference 5) has been addressed and compliance with 10 CFR 54.4(a)(2) has been demonstrated by identifying support systems down to a level necessary to provide for the satisfactory accomplishment of the SR functions identified in 10 CFR 54.4(a)(1).
- Attendant passive components (cooling water piping, instrument lines, and valves, etc.) of complex assemblies (such as the emergency diesel generators and air-conditioning units) are shown on the system flow drawings and have been screened separately from the complex assembly. Therefore, the attendant passive components that support a system intended function have been identified for inclusion within the scope of license renewal.

- The LR boundaries for a system have typically been extended to the first normally-closed manual valve, check valve or automatic valve that gets a signal to go closed. A normally-open manual valve has also been used as a boundary in a few instances where a failure down stream of the valve can be quickly detected and the valve can be easily closed by operators to establish the pressure boundary. However, for SBO, Appendix R, high energy line break (HELB), and flooding events, the LR boundaries for a system have been defined consistent with the boundaries established in the CLB evaluations. Those boundaries do not always coincide with an isolation device.

The passive mechanical components initially identified as being within the scope of license renewal have been identified on the applicable system drawings. The annotated drawings provide a visual presentation of the components that support the system intended functions. These drawings have been reviewed to confirm that all passive mechanical components supporting the system intended functions have been identified.

Certain passive structural components such as pipe supports, panels, and cabinets associated with the system are not specifically shown on the system drawings and, therefore, have not been identified for each system. Instead, they have been screened as structural components as explained in Section 2.1.5.2, Civil/Structural Screening.

Following the completion of the screening review for a system the annotated drawings have been used to generate license renewal drawings. The passive mechanical components within the scope of license renewal are identified on those drawings. This includes the passive components determined later during the AMR process to be short-lived, as discussed in Appendix C, Section C2.3, Identification of Short-lived Components and Consumables.

The system screening results are presented in Section 2.3, Scoping and Screening Results: Mechanical Systems. This section addresses each system that has been identified as containing mechanical components that require an aging management review.

The following information is provided in Section 2.3 for each in-scope mechanical system:

System Description - Contains a brief description of the system.

UFSAR Reference - Identifies the UFSAR section(s) that describes the system.

License Renewal Drawings - Lists the license renewal drawings that have been developed for the system. These drawings provide both system boundaries and system interfaces.

Components Subject to AMR - Identifies the screening results table that lists the passive mechanical component groups that require an AMR, along with their associated passive functions. The table also provides a cross reference to the LRA section(s) containing the AMR results for each component group. These tables reflect the deletion of short-lived components identified during the AMR process.

2.1.5.2 Civil/Structural Screening

Screening has been performed for each structure identified during scoping as being within the scope of license renewal. In addition, screening has been performed for the following categories of structural equipment:

- Nuclear steam supply system (NSSS) supports
- Load handling cranes and devices
- Structural plant commodities (general structural supports and other miscellaneous structural commodities)

The purpose of civil/structural screening was to identify the types of passive structural members (walls, beams, floors, grating, block walls, missile shields, pads, liners, etc.) that support the intended function(s) of the structure and, therefore, require an AMR. The types of structural members that require an AMR have been identified based upon a review of the structural detail drawings. For mark-numbered structural members, the data in EDS have also been reviewed.

The screening process for NSSS supports has been similar. The structural members that require an AMR have been identified based upon a review of detailed structural drawings. For mark-numbered structural members, the data in EDS have also been reviewed.

Load handling cranes and devices have been evaluated based upon a review of the UFSAR. For mark-numbered cranes and devices, the data in EDS have also been reviewed. Cranes and devices that are seismically designed have been included within the scope of license renewal for Seismic II/I considerations. However, certain cranes and devices of importance to plant operations have been specifically identified for inclusion within the scope of license renewal.

General structural supports and other miscellaneous structural items such as cable tray covers, fire/EQ barrier doors, fire penetration materials, cabinets, panels, and benchboards have been evaluated as plant commodities.

The screening results are presented in Section 2.4, Scoping and Screening Results: Structures. The following information is provided for each structure and category of structural equipment:

Description - Contains a brief description of the structure, or category of structural equipment.

UFSAR Reference - Identifies (if applicable) the UFSAR section that describes the structure or category of structural equipment.

Components Subject to AMR - Identifies the screening results table that lists the passive structural members (for structures, NSSS supports, and load handling cranes and devices) or commodity groups (for plant commodities) that require an AMR and their associated passive functions. Note that screening results tables for structures do not list the NSSS supports, load handling cranes and devices, and plant commodities that may be contained within those structures. NSSS supports, load handling cranes and devices, and plant commodities are covered in separate screening results tables.

2.1.5.3 Electrical/I&C Screening

Electrical/I&C components have been screened and evaluated on a plant-level basis, rather than on a system-level basis, as explained below.

The majority of electrical/I&C component groups (such as transmitters, switches, breakers, relays, actuators, radiation monitors, recorders, isolators, signal conditioners, meters, batteries, analyzers, chargers, motors, regulators, transformers, and fuses) are considered active, in accordance with 10 CFR 54.21(a)(1)(i) and the supplemental guidelines in NEI 95-10, and therefore do not require an AMR.

The electrical/I&C components (such as immersion heaters) that are in scope only because they perform a passive pressure boundary function, are shown on system drawings. Those components have been treated as mechanical components and identified during the system (mechanical) screening process.

The following electrical/I&C component groups have been identified as performing an electrical passive function in support of system intended functions:

- Cable and connectors

- Electrical penetrations
- Bus duct

The electrical screening results are presented in Section 2.5, Screening Results: Electrical and Instrumentation and Controls Systems. The following information is provided for each of the electrical/I&C component groups identified above.

Description - Contains a brief description of the electrical/I&C component group.

UFSAR Reference - Identifies (if applicable) the UFSAR section that describes the electrical/I&C component group.

Components Subject to AMR - Identifies the parts of the electrical/I&C component group that are subject to an AMR and the passive functions of the component group. This section also provides a cross reference to the LRA section containing the AMR results for the component group.

2.1.5.4 Screening of Stored Equipment

In response to the NRC letter of February 11, 1999 (Reference 6), a review has been performed to identify equipment that (1) is maintained in storage, (2) is reserved for installation in the plant in response to a design basis 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 Appendix R stored equipment is used to restore power to pre-selected plant components and to provide cooling to certain areas after a fire in order to attain cold shutdown. The stored equipment identified as requiring an AMR is listed below, along with a reference to the section of the application that contains the AMR results:

Component Group	LRA Section Containing the AMR Results
Cable and Connectors	Section 3.6.2, Cables and Connectors
Flexible Ductwork	Section 3.3.6, Ventilation and Vacuum Systems
Hoses	Section 3.3.5, Air and Gas Systems
Valve Bodies	Section 3.3.5, Air and Gas Systems

Tools and supplies used to place the reserved equipment in service are not required for the installed equipment to remain operable (once placed in service) and are outside the scope of license renewal.

2.1.5.5 Screening of Thermal Insulation

In response to NRC staff requests for additional information (RAI) on other license renewal applications, a screening review has been performed of thermal insulation. The review has considered the impact of thermal insulation with respect to (1) the effectiveness of heat tracing, (2) room cooling, (3) Seismic II/I, and (4) halogens on pipe. The review has concluded that no thermal insulation needs be included within the scope of license renewal.

Section 2.1 References (Scoping and Screening Methodology)

1. NEI 95-10, Industry Guideline for Implementing the Requirements of 10 CFR Part 54 -The License Renewal Rule, Rev. 2, Nuclear Energy Institute, August 2000.
2. Regulatory Guide 1.97, Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident.
3. Branch Technical Position (BTP) APCSB 9.5-1, Appendix A, Guidelines for Fire Protection for Nuclear Power Plants August 23, 1976.
4. Letter of December 10, 1991, from W. L. Stewart of Vepco to the Nuclear Regulatory Commission, Serial No. 91-328, Subject: "Revision to 10 CFR 50.61 Fracture Toughness for Protection Against Pressurized Thermal Shock Events, Surry Power Station Units 1 and 2, North Anna Power Station Units 1 and 2".
5. Letter of August 5, 1999 from Christopher I. Grimes of the NRC to Douglas J. Walters of NEI, Subject, "License Renewal Issue No. 98-0082, Scoping Guidance".
6. Letter of February 11, 1999 from Christopher I. Grimes of the NRC to Doug Walters of NEI, Subject: Request for Additional Information Regarding Generic License Renewal Issue No. 98-0102, "Screening of Equipment that is Kept in Storage".

2.2 Plant Level Scoping Results

Table 2.2-1 and Table 2.2-3 list the systems and structures that are within the scope of license renewal for the station. A reference to the section of the application that contains the screening results is provided for each item on the list. The referenced screening results provide information regarding the specific portions of the system or structure that require an AMR. The location of in-scope structures is shown on the following license renewal drawings:

11715-LRM-FY-001, Sh. 1
11715-LRM-FY-002, Sh. 1

Table 2.2-2 and Table 2.2-4 list the systems and structures respectively, that did not meet the criteria specified in 10 CFR 54.4(a) and therefore were excluded from the scope of license renewal. For each item on the list, the table also provides a reference (if applicable) to the section of the Updated Final Safety Analysis Report (UFSAR) that describes the system or structure.

Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences. Systems or structures for which the in-scope portions at both stations are functionally equivalent, but that are identified by different names, have not been treated as plant-specific. In this instance, the corresponding system or structure functional equivalency is explained in a footnote.

A listing of the abbreviations used in this section is provided in Section 1.4.1.

Table 2.2-1 Systems Within the Scope of License Renewal

System	Screening Results
AAC Diesel Cooling Water (BCW)	Section 2.3.3.10, Alternate AC (AAC) Diesel Generator Systems
AAC Diesel Fuel Oil (BFO)	Section 2.3.3.10, Alternate AC (AAC) Diesel Generator Systems
AAC Diesel Lube Oil (BLO)	Section 2.3.3.10, Alternate AC (AAC) Diesel Generator Systems
AAC Diesel Starting Air (BSA)	Section 2.3.3.10, Alternate AC (AAC) Diesel Generator Systems
Alternate AC (AAC)	Section 2.3.3.10, Alternate AC (AAC) Diesel Generator Systems
Ambient Temperature Monitoring (AM)[1]	See Footnote No. 1.
Auxiliary Steam (AS)	Section 2.3.4.1, Auxiliary Steam (AS)
Batteries (125V DC system components) (BY)[2]	See Footnote No. 1.
Blowdown (BD)	Section 2.3.4.2, Blowdown (BD)
Boron Recovery (BR)	Section 2.3.3.22, Boron Recovery (BR)
Chemical Volume and Control (CH)	Section 2.3.3.1, Chemical and Volume Control (CH)
Chilled Water (CD)[3]	Section 2.3.3.7, Chilled Water (CD)
Circulating Water (CW)	Section 2.4.6, Intake Structures
Communication (CO)	See Footnote No. 1.
Component Cooling (CC)	Section 2.3.3.8, Component Cooling (CC)
Compressed Air (CA)[3]	Section 2.3.3.13, Compressed Air (CA)
Computer (CM)	See Footnote No. 1.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Table 2.2-1 Systems Within the Scope of License Renewal

System	Screening Results
Condensate (CN)	Section 2.3.4.3, Condensate (CN)
Containment Access (CE)	Section 2.4.1, Containment
Containment Vacuum (CV)	Section 2.3.3.17, Containment Vacuum (CV)
Control Rod Drive Power Supply (ED)	See Footnote No. 1.
Drains - Building Services (DB)[3]	Section 2.3.3.24, Drains - Building Services (DB)
Drains Aerated (DA)	Section 2.3.3.23, Drains - Aerated (DA)
Drains Gaseous (DG)	Section 2.3.3.25, Drains - Gaseous (DG)
Electrical Instrumentation (EI)[4]	See Footnote No. 1.
Electrical Power (EP)	See Footnote No. 1.
Electro-Hydraulic Control (EH)	See Footnote No. 1.
Emergency Diesel Cooling (EC)[3]	Section 2.3.3.11, Emergency Diesel Generator (EDG) Systems
Emergency Diesel Generator (EG)[3]	Section 2.3.3.11, Emergency Diesel Generator (EDG) Systems
Emergency Diesel Lubrication (EL)[3]	Section 2.3.3.11, Emergency Diesel Generator (EDG) Systems
Emergency Diesel Starting Air (EB)[3]	Section 2.3.3.11, Emergency Diesel Generator (EDG) Systems
Emergency Electrical Power (EE)	See Footnote No. 1
Emergency Lighting (ELT)	See Footnote No. 1.
Emergency Response Capability (ERC)	See Footnote No. 1.
Feedwater (FW)	Section 2.3.4.4, Feedwater (FW)

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Table 2.2-1 Systems Within the Scope of License Renewal

System	Screening Results
Fire Protection (FP)	Section 2.3.3.31, Fire Protection (FP)
Fire Protection Monitoring (FPM)[3]	See Footnote No. 1.
Fuel Handling (FH)	Section 2.4.12, Load-handling Cranes and Devices
Fuel Oil (FO)[3]	Section 2.3.3.11, Emergency Diesel Generator (EDG) Systems
Fuel Pit Cooling (FC)	Section 2.3.2.2, Fuel Pit Cooling (FC)
Heat Tracing (HT)	See Footnote No. 1.
Heating and Ventilation (HV)[3]	Section 2.3.3.21, Heating and Ventilation (HV)
High-Radiation Sampling System (HRSS)[3]	Section 2.3.3.2, High-Radiation Sampling System (HRSS)
Incore Instrumentation (IC)	Section 2.3.3.3, Incore Instrumentation (IC)
Instrument Air (IA)	Section 2.3.3.14, Instrument Air (IA)
Leakage Monitoring (LM)	Section 2.3.3.18, Leakage Monitoring (LM)
Liquid and Solid Waste (LW)	Section 2.3.3.26, Liquid and Solid Waste (LW)
Lube Oil (turbines, motors) (LO)	See Footnote No. 1.
Main Steam (MS)	Section 2.3.4.5, Main Steam (MS)
Materials Handling (MH)[5]	Section 2.4.12, Load-handling Cranes and Devices
Neutron Monitoring (NM)[6]	See Footnote No. 1.
Neutron Shield Tank Cooling (NS)	Section 2.3.3.9, Neutron Shield Tank Cooling (NS)
Nuclear Instrumentation (NI)[6]	See Footnote No. 1.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Table 2.2-1 Systems Within the Scope of License Renewal

System	Screening Results
Penetration-Electrical (PE)[7]	Section 2.4.1, Containment
Penetrations (PEN)[7]	Section 2.4.1, Containment
Post-Accident Hydrogen Removal (HC)[3]	Section 2.3.3.28, Post-Accident Hydrogen Removal (HC)
Pressurizer Heaters (HS)[8]	Section 2.3.1.4, Pressurizer
Primary and Secondary Plant Gas Supply (GN)	Section 2.3.3.15, Primary and Secondary Plant Gas Supply (GN)
Primary Grade Water (PG)	See Footnote No. 1.
Quench Spray (QS)[3]	Section 2.3.2.1, Quench Spray (QS)
Radiation Monitoring (RM)	Section 2.3.3.29, Radiation Monitoring (RM)
Radwaste (RW)	Section 2.3.3.27, Radwaste (RW)
Reactor Coolant (RC)	Section 2.3.1, Reactor Coolant System
Reactor Protection (RPS)	See Footnote No. 1.
Recirculation Spray (RS)	Section 2.3.2.3, Recirculation Spray (RS)
Refueling Purification (RP)[3]	Section 2.3.3.4, Refueling Purification (RP)
Residual Heat Removal (RH)	Section 2.3.2.4, Residual Heat Removal (RH)
Rod Control (RCS)	Section 2.3.1.2, Reactor Vessel
Safety Injection (SI)	Section 2.3.2.5, Safety Injection (SI)
Sampling System (SS)	Section 2.3.3.5, Sampling System (SS)
Secondary Vents (SV)	Section 2.3.3.19, Secondary Vents (SV)

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Table 2.2-1 Systems Within the Scope of License Renewal

System	Screening Results
Security (SEC)	Section 2.3.3.12, Security (SEC)
Service Air (SA)	Section 2.3.3.16, Service Air (SA)
Service Water (SW)	Section 2.3.3.6, Service Water (SW)
Solid State Protection (SSP)[4]	See Footnote No. 1.
Steam Drains (SD)[3]	Section 2.3.4.6, Steam Drains (SD)
Steam Generator Water Treatment (WT)[3]	Section 2.3.4.7, Steam Generator Water Treatment (WT)
Turbine (TM)	See Footnote No. 1.
Vacuum Priming (VP)	Section 2.3.3.20, Vacuum Priming (VP)
Valve Monitoring (VMS)	See Footnote No. 1.
Vents-Gaseous (VG)	Section 2.3.3.30, Vents - Gaseous (VG)
Vital Bus (VB)[2]	See Footnote No. 1.

1. This system does not contain any mechanical components that require an AMR. However, this system does contain electrical/I&C and/or structural components, which have been evaluated on a commodity basis.

2. The North Anna batteries (BY) and vital bus (VB) systems are functionally equivalent to the Surry DC Power (EPD) system.

3. North Anna system for which the in-scope portions are functionally equivalent to in-scope portions of a Surry system(s) with a different name as explained in the referenced screening results section.

4. The North Anna electrical instrumentation (EI) and solid state protection (SSP) systems are functionally equivalent to the Surry ATWS mitigation (AMS), consequence limiting safeguards (CLS), process instrumentation (PRO), and recirculation mode transfer (RMT) systems.

5. The North Anna materials handling (MH) system is functionally equivalent to the Surry crane hoists (CR) system.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

6. The North Anna neutron monitoring (NM) and nuclear instrumentation (NI) systems are functionally equivalent to the Surry nuclear instrumentation (NI) system.

7. The North Anna penetration-electrical (PE) and penetrations (PEN) systems are functionally equivalent to the Surry reactor building penetrations (PEN) system.

8. The North Anna pressurizer heaters (HS) system is functionally equivalent to the pressurizer heaters in the Surry pressurizer.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

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

System	UFSAR Reference
AAC Diesel Service Air (BSR)	System not explicitly described in the UFSAR
Auxiliary Boiler (AB)	Section 10.4.1
Bearing Cooling (BC)	Section 10.4.7
Bearing Lube (BL)	System not explicitly described in the UFSAR
Condensate Polishing (CP)	Section 10.4.8
Decontamination (DC)	Section 9.5.9
Domestic Water (DW)[1]	Section 9.2.3.1
Early Warning (EW)	System not explicitly described in the UFSAR
Earthquake Reporting (ER)	System not explicitly described in the UFSAR
Electrical Equipment (4kv & above) (PH)	Section 8.1.2
Extraction Steam (ES)	System not explicitly described in the UFSAR
Gaseous Waste (GW)	Section 11.3
Generator Breaker (GB)	Section 8.1.2
Gland Steam (GS)[1]	Section 10.2
Helium Vacuum Drying (HVD)	System not explicitly described in the UFSAR
Laboratory Vacuum (LV)[1]	System not explicitly described in the UFSAR
Loose Parts Monitoring (LPM)	Section 5.2.5
Main Generator-Gas Supplies (GM)	Section 10.2
Meteorological Metering (MM)	System not explicitly described in the UFSAR
Oil Separation (OS)[1]	System not explicitly described in the UFSAR
Rod Position Indication (RPI)[1]	Section 7.7.1.2
Sanitary Sewage (PB)[1]	System not explicitly described in the UFSAR
Vacuum Priming Seal Water (VSW)[1]	Section 10.4.2.2

1. This North Anna system is functionally equivalent to a Surry system(s) with a different name(s).

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Table 2.2-3 Structures Within the Scope of License Renewal

Structure	Screening Results Section
Auxiliary Building	Section 2.4.2, Auxiliary Building Structure
Auxiliary Feedwater Pump House	Section 2.4.3, Other Class I Structures
Auxiliary Feedwater Tunnel	Section 2.4.3, Other Class I Structures
Auxiliary Service Water Expansion Joint Enclosure	Section 2.4.7, Yard Structures
Buried Fuel Oil Tank Missile Barrier	Section 2.4.7, Yard Structures
Casing Cooling Pump House	Section 2.4.3, Other Class I Structures
Casing Cooling Tank Foundation	Section 2.4.7, Yard Structures
Chemical Addition Tank Foundation	Section 2.4.7, Yard Structures
Circulating Water Intake Tunnel	Section 2.4.6, Intake Structures
Containment	Section 2.4.1, Containment
Discharge Tunnel & Seal Pit	Section 2.4.6, Intake Structures
Domestic Water Treatment Building	Section 2.4.7, Yard Structures
Duct Banks	Section 2.4.7, Yard Structures
Emergency Condensate Storage Tank Foundation and Missile Barrier	Section 2.4.7, Yard Structures
Flood wall west of the Turbine Building	Section 2.4.8, Earthen Structures
Fuel Building	Section 2.4.4, Fuel Building
Fuel Oil Pump House	Section 2.4.3, Other Class I Structures

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Table 2.2-3 Structures Within the Scope of License Renewal

Structure	Screening Results Section
Fuel Oil Storage Tank Dike	Section 2.4.7, Yard Structures
Intake Structure	Section 2.4.6, Intake Structures
Main Steam Valve House	Section 2.4.3, Other Class I Structures
Manholes	Section 2.4.7, Yard Structures
Quench Spray Pump House[1]	Section 2.4.3, Other Class I Structures
Refueling Water Storage Tank Foundation	Section 2.4.7, Yard Structures
Safeguards Building	Section 2.4.3, Other Class I Structures
SBO Building	Section 2.4.5, Miscellaneous Structures
Security Diesel Building	Section 2.4.5, Miscellaneous Structures
Security lighting poles	Section 2.4.7, Yard Structures
Service Building	Section 2.4.5, Miscellaneous Structures
Service Water Pipe Expansion Joint Enclosure	Section 2.4.3, Other Class I Structures
Service Water Pump House	Section 2.4.3, Other Class I Structures
Service Water Reservoir	Section 2.4.8, Earthen Structures
Service Water Tie-in Vault	Section 2.4.3, Other Class I Structures
Service Water Valve House	Section 2.4.3, Other Class I Structures
Transformer Firewalls/Dikes[2]	Section 2.4.7, Yard Structures

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Table 2.2-3 Structures Within the Scope of License Renewal

Structure	Screening Results Section
Turbine Building	Section 2.4.5, Miscellaneous Structures
Yard Valve Pit	Section 2.4.7, Yard Structures

1. The North Anna Quench Spray Pump House is functionally equivalent to the Surry Containment Spray Pump Building.

2. Applies to main and station service transformers.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

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

Structure	UFSAR Reference
Administration Building	Structure is not explicitly described in the UFSAR.
Bearing Cooling Tower	Structure is not explicitly described in the UFSAR.
Boron Recovery Tank Building including the tank dikes	Structures are not explicitly described in the UFSAR.
Compressed gas storage shelter	Structure is not explicitly described in the UFSAR.
Clean Waste Segregation Building	Structure is not explicitly described in the UFSAR.
Concrete firewalls/foundations for the reserve station service transformers	Structures are not explicitly described in the UFSAR.
Concrete foundations for the main transformers and station service transformers	Structures are not explicitly described in the UFSAR.
Condensate Storage Tank Foundation	Structure is not explicitly described in the UFSAR.
Decontamination Building	Section 9.4.3
Emergency Response Vehicle Building	Structure is not explicitly described in the UFSAR.
Fire Pump House Embankment[1]	Structure is not explicitly described in the UFSAR.
Heater Boiler Room	Structure is not explicitly described in the UFSAR.
Independent Spent Fuel Storage Facility (ISFSI)	Structure is not explicitly described in the UFSAR.
Information Center (NANIC)	Structure is not explicitly described in the UFSAR.
Main Dam	Section 3.8.3
Maintenance Building[2]	Structure is not explicitly described in the UFSAR.
Meteorological Tower and Station[2]	Structure is not explicitly described in the UFSAR.
New Fuel Receiving Building	Structure is not explicitly described in the UFSAR.
Old Steam Generator Storage Facility	Structure is not explicitly described in the UFSAR.
Old Visitors Center	Structure is not explicitly described in the UFSAR.
PBX (Communications) Building	Structure is not explicitly described in the UFSAR.
Primary Grade Water Tank Foundation	Structure is not explicitly described in the UFSAR.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

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

Structure	UFSAR Reference
Radio Tower and Building	Structure is not explicitly described in the UFSAR.
Records Storage Building[2]	Structure is not explicitly described in the UFSAR.
RSST exterior bus bar support structure	Structure is not explicitly described in the UFSAR.
Security Buildings	Structures are not explicitly described in the UFSAR.
Service Water Chemical Addition Building	Section 9.2.1.2.1
Service Water Reservoir Horizontal Drains and Piezometers	Section 3.8.4.6 and Appendix 3E.4
Sewage Treatment Facility	Structure is not explicitly described in the UFSAR.
Spent Fuel Cask Handling Structure[2]	Section 15A.2
Switchyard	Structure is not explicitly described in the UFSAR.
Switchyard Control House and Communications Building[2]	Structure is not explicitly described in the UFSAR.
Training Building	Structure is not explicitly described in the UFSAR.
Transmission Line Towers	Structures are not explicitly described in the UFSAR.
Vacuum Priming Pump House[2]	Structure is not explicitly described in the UFSAR.
Warehouse #5 Fire Pump House[3]	Structure is not explicitly described in the UFSAR.
Warehouses, Various Shops and Office Buildings Outside the Protected Area	Structures are not explicitly described in the UFSAR.
Waste Disposal Building	Structure is not explicitly described in the UFSAR.
Waste Heat Treatment Facility	Section 2.4.8
Waste Solids Building	Structure is not explicitly described in the UFSAR.

1. This embankment is associated with the fire protection tanks for the Warehouse #5 Fire Pump House which is not in LR scope.

2. This North Anna structure is functionally equivalent to a Surry structure with a different name.

3. This pump house in not in LR scope since it provides a back-up to the fire protection system for insurance purposes and is not required for safe shutdown.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

2.3 Scoping and Screening Results: Mechanical Systems

Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences. Systems for which the in-scope portions at both stations are functionally equivalent, but that are identified by different names, have not been treated as plant-specific. The first time the system name is used in the screening results section, an explanation of the functional equivalency is provided within brackets.

A listing of the abbreviations used in this section is provided in Section 1.4.1.

2.3.1 Reactor Coolant System

2.3.1.1 Reactor Coolant (RC)

Section 2.3.1.1 provides a description of the reactor coolant (RC) system, excluding the following major RC system components, which are described in the indicated sections:

- Reactor vessel (Section 2.3.1.2)
- Reactor vessel internals (Section 2.3.1.3)
- Pressurizer (Section 2.3.1.4)
- Steam generator (Section 2.3.1.5)

System Description

The RC system transfers heat produced in the reactor core to the steam generators, where steam is generated to drive the turbine generator. Reactor coolant is circulated through the core at a flow rate and temperature consistent with achieving the desired reactor core thermal-hydraulic performance. The reactor coolant also acts as a neutron moderator, a reflector, and a solvent for the neutron absorber.

The RC system provides a pressure boundary for containing the reactor coolant. It also serves to confine radioactive material and limits uncontrolled release to the secondary system and the other parts of the plant.

The RC system consists of three piping loops (A, B, and C) interconnected at the reactor vessel. Each loop consists of one reactor coolant pump, one steam generator, valves, and interconnecting piping. The pressurizer, connected to Loop C hot leg, provides a means for controlling RC system pressure. The RC

system also contains piping and components that allow venting of the reactor vessel and pressurizer.

During operation, the RC system heat capacity attenuates thermal transients. Reactor coolant system piping is used by the safety injection system to deliver cooling water to the core for emergency cooling and shutdown during a loss-of-coolant accident (LOCA).

The RC system also includes the reactor coolant pump (RCP) motor oil collection system components. These components are included in the fire protection (FP) system for Surry.

The RC system includes a neutron shield tank located inside the primary shield wall around the reactor vessel. The tank provides support for the reactor vessel and limits heat transferred to the primary shield wall concrete. The tank is described further in Section 2.4.9, NSSS Equipment Supports. Cooling for the tank is described in Section 2.3.3.9, Neutron Shield Tank Cooling (NS).

UFSAR Reference

Additional RC system details are provided in Chapter 5 of the UFSAR.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

License Renewal Drawings

The license renewal drawings for the reactor coolant system are listed below:

Unit 1	Unit 2
11715-LRM-079B, Sh. 2	12050-LRM-079A, Sh. 2
11715-LRM-079B, Sh. 3	12050-LRM-079A, Sh. 3
11715-LRM-079B, Sh. 4	12050-LRM-079A, Sh. 4
11715-LRM-079B, Sh. 5	12050-LRM-079A, Sh. 5
11715-LRM-090C, Sh. 3	12050-LRM-090A, Sh. 3
11715-LRM-093A, Sh. 1	12050-LRM-093A, Sh. 1
11715-LRM-093A, Sh. 2	12050-LRM-093A, Sh. 2
11715-LRM-093A, Sh. 3	12050-LRM-093A, Sh. 3
11715-LRM-093B, Sh. 1	12050-LRM-093B, Sh. 1
11715-LRM-093B, Sh. 2	12050-LRM-093B, Sh. 2
11715-LRM-093E, Sh. 1	12050-LRM-093E, Sh. 1
11715-LRM-096B, Sh. 1	12050-LRM-096B, Sh. 1
11715-LRM-096B, Sh. 2	12050-LRM-096B, Sh. 2
11715-LRM-096B, Sh. 3	12050-LRM-096B, Sh. 3
11715-LRM-096B, Sh. 4	12050-LRM-096B, Sh. 4
13075-LRM-093C, Sh. 1	13075-LRM-093D, Sh. 1
13075-LRM-093C, Sh. 2	13075-LRM-093D, Sh. 2

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.1-1, Reactor Coolant (RC). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.1.2 Reactor Vessel

Component Description

The Unit 1 and 2 reactor vessels (RV) are categorized as standard Westinghouse 157-inch ID three-loop reactor vessels. Each RV is a cylindrical shell with a welded, hemispherical lower head and a flanged hemispherical upper head. The RV provides structural support for the reactor core and a pressure boundary for the reactor coolant in which the core is submerged.

The reactor vessel shell is constructed of forged rings (upper, intermediate, and lower) welded together circumferentially.

The RV is vertically mounted on welded support pads attached to the bottom of the primary nozzles, which are spaced circumferentially around the vessel just below the vessel flange. The hot-leg and cold-leg reactor coolant loop piping for each of the three loops is welded to the primary nozzles. The internal surfaces of the vessel in contact with borated reactor coolant are clad with a stainless steel overlay, which provides corrosion resistance. The lower head has penetrations (instrumentation tubes), for movable in-core nuclear flux thimble tubes, which extend into the reactor vessel interior and mate with the lower internals assembly. The core support ledge, located inside the vessel just below the vessel flange, supports the weight of the reactor vessel internals and the fuel. The lower internals assembly hangs from the core support ledge and is provided with lateral support by core support lugs.

The vessel flange and the closure head flange are joined by 58 6-inch closure studs, nuts, and spherical washers. Two concentric, hollow, metallic O-rings between the closure head flange and the vessel flange form an inner and outer seal. A dynamic seal is formed when the closure head is bolted in place and by the internal pressure in the reactor vessel.

The reactor vessel closure head dome is penetrated by the CRDM housing tubes and a vent pipe.

Nozzle support pads located below the primary nozzles provide an interface for support of the vessel. The weight of the vessel is transmitted through the nozzle support pads to the neutron shield tank that surrounds the vessel.

UFSAR Reference

Additional RV details are provided in Chapter 5 of the UFSAR.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Subcomponents Subject to Aging Management Review

The subcomponents of the RV that require aging management review are indicated in Table 2.3.1-2, Reactor Vessels, along with each subcomponent's passive function. The aging management review results for these subcomponents are provided in Section 3.1.2, Reactor Vessel.

2.3.1.3 Reactor Vessel Internals

Component Description

The reactor vessel internals are designed to direct coolant flow, support the reactor core, and guide the control rod assemblies when in the withdrawn position.

The reactor internals consist of two basic assemblies: an upper internals assembly that is removed during each refueling operation to obtain access to the reactor core, and a lower internals assembly, which includes the core barrel and baffle/former assembly, that can be removed, if desired, following a complete core unload.

The fact that all of the internals can be removed from the reactor vessel provides the capability to perform periodic inspections to determine the condition of the internals or to effect repairs, if needed. This unique characteristic of all Westinghouse internals provides a means to determine the reactor internals functionality during the extended period of operation.

The lower internals assembly is supported in the vessel by clamping to a ledge below the vessel-head mating surface and closely guided at the bottom by radial support/clevis assemblies. The core support ledge supports the entire weight of the reactor vessel internals and the fuel. The lower internals assembly hangs from the ledge. A circumferential spring rests on top of the lower internal flange, which rests on the ledge.

The upper internals assembly sits on the spring. The spring is compressed when the vessel head is lowered and tightened down, holding the lower internals assembly against the core support ledge and the upper internals assembly against the vessel head. This minimizes flow-induced vibrations and prevents upward motion of the lower internals assembly. The bottom of the upper internals assembly is closely guided by the core plate alignment pins.

UFSAR Reference

Additional details of the reactor vessel internals are provided in Section 4.2.2 of the UFSAR. UFSAR Figure 4.2-13, Figure 4.2-14, and Figure 4.2-15 show the reactor vessel internals.

Subcomponents Subject to Aging Management Review

The subcomponents of the reactor vessel internals that require aging management review are indicated in Table 2.3.1-3, Reactor Vessel Internals, along with each subcomponent's passive function. The aging management review results for these subcomponents are provided in Section 3.1.3, Reactor Vessel Internals.

2.3.1.4 Pressurizer

Component Description

The pressurizer is an ASME Section III Code vessel that is connected to the reactor coolant system hot leg piping via the surge line and the cold leg piping via the spray line. The spray line and surge line nozzles are provided with thermal sleeves which provide thermal shielding. The internal surfaces of the pressurizer in contact with borated reactor coolant are clad with a stainless steel overlay, which provides corrosion resistance. Access is provided by a manway opening near the top of the pressurizer.

During normal operation, the pressurizer contains a combination of borated reactor coolant and steam that is maintained at the desired temperature and pressure by the electric heaters and the pressurizer spray system. The chemical and volume control system maintains the desired water level in the pressurizer during steady-state operation.

The pressurizer is designed to accommodate insurges and outsurges caused by load transients. During an insurge, the spray system condenses steam in the pressurizer to prevent the pressurizer pressure from reaching the operating point of the power-operated relief valve. A continuous spray flow is provided so that the reactor coolant chemistry and boron concentration in the pressurizer and associated piping is consistent with the reactor coolant system. Additionally, the continuous spray flow prevents thermal stratification of the spray and surge line piping. During an outsurge, the flashing of water to steam due to the resulting pressure reduction and the generation of steam by

automatic actuation of the heaters keeps the pressure above the minimum allowable limit.

The license renewal intended function of the pressurizer is to maintain the reactor coolant system pressure boundary. In addition, certain pressurizer subcomponents provide structural support to maintain the integrity of pressure boundary components.

UFSAR Reference

Additional pressurizer details are provided in Section 5.5.5 and Figure 5.5-5 of the UFSAR.

Subcomponents Subject to Aging Management Review

The subcomponents of the pressurizer that require aging management review are indicated in Table 2.3.1-4, Pressurizers, along with each subcomponent's passive function. The aging management review results for these subcomponents are provided in Section 3.1.4, Pressurizer.

2.3.1.5 Steam Generator

Component Description

Three steam generators are installed in each unit with one steam generator installed in each of the three reactor coolant loops. The steam generators are vertical, shell and U-tube heat exchangers with integral moisture-separating equipment. The steam generators function to transfer heat from the single-phase, high-pressure, high-temperature borated reactor coolant on the primary side of the tubes to the two-phase steam-water mixture on the secondary side of the tubes. The internal surfaces of the steam generator in contact with borated reactor coolant are clad with a stainless steel weld overlay, which provides corrosion resistance.

The original recirculating steam generators have experienced significant tube degradation and have undergone an extensive repair program. The steam generator repair program consisted of replacement of the lower assembly (including the channel head, U-tubes, tubesheet, and lower shell section) and refurbishment of the upper assembly.

The steam generator is a recirculating design and consists of a primary (tube) side and a secondary (shell) side. Reactor coolant flows through the primary side through inverted U-tubes, entering and leaving through the primary nozzles located in the hemispherical bottom chamber (channel head). The channel head is welded to a plate (tubesheet) from which the tube bundle extends. The channel head is divided into inlet and outlet chambers by a vertical divider plate extending from the channel head to the tubesheet. Manways are provided for access to both sides of the divided channel head. Pressure boundary integrity is maintained by manway covers that are bolted to the manways.

On the secondary side, tube support plates, stay rods, stay rod spacer pipes, and anti-vibration bars are provided for structural support of the U-tubes. The tube support plate closest to the tubesheet is identified as the flow distribution baffle.

The steam generator tube bundle is contained inside a cylindrical wrapper. The space between the wrapper and the inside of the steam generator shell forms an annular region called the downcomer. Feedwater enters the steam generator through the feedwater inlet nozzle located in the upper shell and is distributed around the periphery of the steam generator by an internal feedwater distribution ring (feedring). The feedwater exits the top of the feedring through J-nozzles, where it mixes with recirculated water from the moisture separators and flows down the downcomer. The mixture of subcooled feedwater and saturated recirculated water exits the downcomer's annular region at the tube sheet, where it flows under the wrapper and is distributed across the tube sheet. The mixture is heated to boiling by reactor coolant heat transferred through the U-tubes. The saturated steam/water mixture enters the moisture separator section, where liquid is removed from the mixture and returned to the evaporator section. Essentially dry steam exiting the moisture separator section is conducted through the steam outlet nozzle that is fitted with a flow-limiting device designed to limit steam flow in the event of a main steam pipe rupture.

Secondary side penetrations (handholes, access ports, blowdown nozzles, instrument taps, and manways) are provided for instrumentation, maintenance, and inspection activities.

A nozzle in the upper shell facilitates the maintenance of wet layup chemistry conditions in the steam generator during shutdown periods via the steam generator recirculation and transfer system.

UFSAR Reference

Additional steam generator details are provided in Section 5.5.2.1 and Section 10.3.2 of the UFSAR.

Subcomponents Subject to Aging Management Review

The subcomponents of the steam generator that require aging management review are indicated in Table 2.3.1-5, Steam Generators, along with each subcomponent's passive function. The aging management review results for these subcomponents are provided in Section 3.1.5.

2.3.2 Engineered Safety Features Systems

The following systems are addressed in this section:

- Quench spray system (Section 2.3.2.1)
- Fuel pit cooling system (Section 2.3.2.2)
- Recirculation spray system (Section 2.3.2.3)
- Residual heat removal system (Section 2.3.2.4)
- Safety injection system (Section 2.3.2.5)

2.3.2.1 Quench Spray (QS)

[North Anna-specific system name - functionally equivalent to the Surry containment spray (CS) system]

System Description

The quench spray (QS) system is designed to pump cool, borated water from the refueling water storage tank (RWST), mixed with a sodium hydroxide solution from the chemical addition tank (CAT), through spray ring headers and nozzles into the Containment. The spray solution absorbs heat from the Containment atmosphere to reduce pressure and prevent challenging the structural integrity of the Containment. In addition, the spray reduces the airborne iodine concentration in the post-LOCA Containment atmosphere to maintain accident dose within limits.

The RWST also provides the source of water to the safety injection (SI) system (Section 2.3.2.5) for the injection phase of design basis accident mitigation.

The major flowpaths of the QS system include components that are subject to aging management review.

UFSAR Reference

Additional QS system details are provided in Section 6.2.2 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the QS system are listed below:

Unit 1	Unit 2
11715-LRM-091A, Sh. 1	12050-LRM-091A, Sh. 1
11715-LRM-091A, Sh. 2	12050-LRM-091A, Sh. 2
11715-LRM-091A, Sh. 3	12050-LRM-091A, Sh. 3

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.2-1, Quench Spray (QS). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.2.2 Fuel Pit Cooling (FC)

System Description

The fuel pit cooling (FC) system transfers heat from the spent fuel pool to the component cooling (CC) system. The system also provides a means for water chemistry control for the spent fuel pool. The FC system recirculates borated water from the spent fuel pool through the FC heat exchangers and back to the pool. The FC pump suction connection to the spent fuel pool is at an elevation that prevents draining the pool below the limiting water level in the event of a leak in the FC system. A bypass purification loop provides the capability to filter and demineralize the spent fuel pool water.

The portion of the FC system that is subject to aging management review consists of the components that support the capability to remove heat from the spent fuel pool.

UFSAR Reference

Additional FC system details are provided in Section 9.1.3 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the FC system are listed below:

Unit 1	Unit 2
11715-LRM-088A, Sh. 4	Common

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.2-2, Fuel Pit Cooling (FC). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.2.3 Recirculation Spray (RS)

System Description

The recirculation spray (RS) system is designed to provide long-term heat removal from the Containment atmosphere and core cooling water following a design basis loss-of-coolant accident (LOCA). The RS system transfers heat from the reactor core, via coolant spilled from the break, and from the Containment atmosphere to the service water (SW) system through the RS heat exchangers. Water collected in the Containment sump is pumped through the heat exchangers, then through spray ring headers and nozzles, into the Containment atmosphere. The RS system is designed to return the post-LOCA Containment to subatmospheric pressure and to maintain subatmospheric conditions for the duration of the accident recovery, thus preventing outleakage of fission products. The cooled water in the Containment sump is pumped back through the reactor core by the safety injection system (Section 2.3.2.5).

Casing cooling components of the RS system provide a source of cool, borated water to the suction of the outside containment RS pumps to provide adequate net positive suction head (NPSH).

The major flowpaths of the RS system include components that are subject to aging management review.

UFSAR Reference

Additional RS System details are provided in Section 6.2.2 of the UFSAR.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

License Renewal Drawings

The license renewal drawings for the RS system are listed below:

Unit 1	Unit 2
11715-LRM-091A, Sh. 3	12050-LRM-091A, Sh. 3
11715-LRM-091A, Sh. 4	12050-LRM-091A, Sh. 4
11715-LRM-091B, Sh. 1	12050-LRM-091B, Sh. 1

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.2-3, Recirculation Spray (RS). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.2.4 Residual Heat Removal (RH)

System Description

The residual heat removal (RH) system transfers heat from the reactor coolant (RC) system to the component cooling (CC) system during reactor shutdown conditions. Water is drawn from the RC system, pumped through the RH heat exchangers, and returned to the RC system to control primary system temperature. The RH system is in service only when RC system temperature and pressure have been reduced to 350°F and 450 psig, respectively.

The RH system also provides the capability to pump the reactor cavity water back to the refueling water storage tank following refueling operations.

The RH system is relied upon in the 10 CFR 50, Appendix R Fire Protection design basis for heat removal to reach cold shutdown conditions.

Portions of RH system piping and certain valves are within the ASME Class 1 reactor coolant system pressure boundary.

The major flowpaths of the RH system include components that are subject to aging management review.

UFSAR Reference

Additional RH system details are provided in Section 5.5.4 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the RH system are listed below:

Unit 1	Unit 2
11715-LRM-091A, Sh. 1	12050-LRM-091A, Sh. 1
11715-LRM-093A, Sh. 1	12050-LRM-093A, Sh. 1
11715-LRM-094A, Sh. 1	12050-LRM-094A, Sh. 1
11715-LRM-094A, Sh. 2	12050-LRM-094A, Sh. 2
11715-LRM-095C, Sh. 1	12050-LRM-095C, Sh. 1
11715-LRM-096B, Sh. 2	12050-LRM-096B, Sh. 2
11715-LRM-096B, Sh. 3	12050-LRM-096B, Sh. 3

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.2-4, Residual Heat Removal (RH). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.2.5 Safety Injection (SI)

System Description

The safety injection (SI) system is designed to provide emergency cooling to the reactor core and to provide adequate shutdown margin in the event of a loss-of-coolant accident (LOCA). The SI system includes high-head injection pumps, low-head injection pumps, and hydro-pneumatic accumulator tanks that provide injection of borated water into the reactor coolant system. The pumps also provide the capability to remove reactor core decay heat for extended periods following an accident. This is accomplished by recirculating coolant, cooled by the recirculation spray system (Section 2.3.2.3), from the Containment sump through the core.

The high-head SI pumps provide a dual function as charging pumps as described in Section 2.3.3.1, Chemical and Volume Control (CH) and are evaluated for the effects of aging with the CH system components (see Section 3.3.1, Primary Process Systems).

Portions of SI system piping and certain valves are within the ASME Class 1 reactor coolant system pressure boundary.

The major flowpaths of the SI system include components that are subject to aging management review.

UFSAR Reference

Additional SI system details are provided in Section 6.3 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the SI system are listed below:

Unit 1	Unit 2
11715-LRM-091A, Sh. 1	12050-LRM-091A, Sh. 1
11715-LRM-095B, Sh. 2	12050-LRM-095B, Sh. 2
11715-LRM-095C, Sh. 1	12050-LRM-095C, Sh. 1
11715-LRM-096A, Sh. 1	12050-LRM-096A, Sh. 1
11715-LRM-096A, Sh. 2	12050-LRM-096A, Sh. 2
11715-LRM-096A, Sh. 3	12050-LRM-096A, Sh. 3
11715-LRM-096B, Sh. 1	12050-LRM-096B, Sh. 1
11715-LRM-096B, Sh. 2	12050-LRM-096B, Sh. 2
11715-LRM-096B, Sh. 3	12050-LRM-096B, Sh. 3
11715-LRM-096B, Sh. 4	12050-LRM-096B, Sh. 4

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.2-5, Safety Injection (SI). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3 Auxiliary Systems

2.3.3.1 Chemical and Volume Control (CH)

System Description

The chemical and volume control (CH) system provides reactor coolant (RC) system letdown and make-up for chemistry control and purification of RC system fluid and control of chemical shim concentration for reactivity control. The CH system also provides RC pump seal injection flow, processing of RC pump seal leak-off flow, and RC system pressurizer level control. The CH system charging pumps provide a dual function as the high-head safety injection pumps during emergency conditions as described in Section 2.3.2.5, Safety Injection (SI). The system also includes chemical addition, boric acid batching, and borated water storage capability.

Portions of CH system are within the ASME Class 1 reactor coolant system pressure boundary.

The major flowpaths of the CH system include components that are subject to aging management review.

UFSAR Reference

Additional CH system details are provided in Section 9.3.4 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the CH system are listed below:

Unit 1	Unit 2
11715-LRM-088A, Sh. 1	12050-LRM-091A, Sh. 1
11715-LRM-091A, Sh. 1	12050-LRM-093A, Sh. 1
11715-LRM-093A, Sh. 1	12050-LRM-093A, Sh. 2
11715-LRM-093A, Sh. 2	12050-LRM-093A, Sh. 3
11715-LRM-093A, Sh. 3	12050-LRM-093B, Sh. 1
11715-LRM-093B, Sh. 1	12050-LRM-095A, Sh. 1
11715-LRM-095A, Sh. 1	12050-LRM-095A, Sh. 2
11715-LRM-095A, Sh. 2	12050-LRM-095B, Sh. 1
11715-LRM-095A, Sh. 3	12050-LRM-095B, Sh. 2
11715-LRM-095A, Sh. 4	12050-LRM-095C, Sh. 1
11715-LRM-095B, Sh. 1	12050-LRM-095C, Sh. 2
11715-LRM-095B, Sh. 2	12050-LRM-95D, Sh. 1
11715-LRM-095C, Sh. 1	12050-LRM-95D, Sh. 2
11715-LRM-095C, Sh. 2	12050-LRM-096A, Sh. 3
11715-LRM-95D, Sh. 1	
11715-LRM-95D, Sh. 2	
11715-LRM-096A, Sh. 2	
11715-LRM-096A, Sh. 3	

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-1, Chemical and Volume Control (CH). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.2 High-Radiation Sampling System (HRSS)

[North Anna-specific system name - functionally equivalent to the high radiation sampling portion of the Surry sampling system (SS)]

System Description

The high-radiation sampling system (HRSS) provides the capability to obtain grab samples from various systems and plant areas that can be used to provide indications of post-accident plant conditions. Sample cooling is provided by the component cooling system (Section 2.3.3.8).

The HRSS is normally isolated from other plant systems and the portion of the system that is subject to aging management review is limited to components that provide a component cooling system pressure boundary at the HRS system sample coolers.

UFSAR Reference

Additional HRSS details are provided in Section 9.3.2 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the HRSS are listed below:

Unit 1	Unit 2
11715-LRM-079C, Sh. 4 11715-LRM-108A, Sh. 1	Common

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-2, High Radiation Sampling System (HRSS). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.3 Incore Instrumentation (IC)

System Description

The incore instrumentation (IC) system provides reactor core performance information in the form of neutron flux distribution data. The IC system consists of moveable incore neutron detectors, bottom mounted instrumentation guide tubes, a seal table with seal assemblies/fittings, and isolation valves. The guide tubes, seal table, and seal table fittings form a pressure boundary for the reactor coolant system. The isolation valves normally do not provide a reactor coolant system pressure boundary, but are designed to be closed in the event of a leak in the IC system pressure boundary components. If closed, the isolation valves form the reactor coolant system pressure boundary.

The portion of the IC system that is subject to aging management review consists of the components that provide, or could be required to provide, a reactor coolant system pressure boundary.

UFSAR Reference

Additional IC system details are provided in Section 7.7.1.9 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the IC system are listed below:

Unit 1	Unit 2
11715-LRM-054F, Sh. 1	12050-LRM-054F, Sh. 1

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-3, Incore Instrumentation (IC). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.4 Refueling Purification (RP)

[North Anna-specific system name - functionally equivalent to the Surry reactor cavity purification (RL) system]

System Description

The refueling purification (RP) system provides a means to maintain the water quality of the filled reactor cavity during refueling operations. The system also includes the capability to pump the reactor cavity water to the refueling water storage tank.

The portion of the RP system that is subject to aging management review consists of the components that perform a pressure boundary function as part of the RP system Containment penetration, the components that provide a pressure boundary for the reactor cavity, and the components that provide a pressure boundary at interfaces with other in-scope systems.

UFSAR Reference

Additional RP system details are provided in Section 9.1.3 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the RP system are listed below:

Unit 1	Unit 2
11715-LRM-088A, Sh. 1	12050-LRM-095B, Sh. 1
11715-LRM-088A, Sh. 2	12050-LRM-096A, Sh. 1
11715-LRM-088A, Sh. 3	
11715-LRM-088A, Sh. 4	
11715-LRM-095B, Sh. 1	
11715-LRM-096A, Sh. 1	

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-4, Refueling Purification (RP). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.5 Sampling System (SS)

System Description

The sampling system (SS) provides a means to monitor fluid quality and other system performance parameters for various plant systems. The sampling system consists of sample tubing and piping, valves, sample coolers, and other components that provide for the control of sample streams. Sample cooling is provided by the component cooling system (Section 2.3.3.8).

Portions of the sampling system are within the ASME Class 1 reactor coolant system pressure boundary.

The portion of the sampling system subject to aging management review consists of the components that form the pressure boundary for other in-scope systems via sample points and sample coolers, and the components that perform a Containment pressure boundary function as part of the sampling system Containment penetration.

UFSAR Reference

Additional sampling system details are provided in Section 9.3.2 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the sampling system are listed below:

Unit 1	Unit 2
11715-LRM-079B, Sh. 1	12050-LRM-079A, Sh. 1
11715-LRM-079C, Sh. 2	12050-LRM-089A, Sh. 3
11715-LRM-079C, Sh. 5	12050-LRM-089B, Sh. 1
11715-LRM-089B, Sh. 3	12050-LRM-093A, Sh. 1
11715-LRM-089D, Sh. 1	12050-LRM-093A, Sh. 2
11715-LRM-093A, Sh. 1	12050-LRM-093A, Sh. 3
11715-LRM-093A, Sh. 2	12050-LRM-093B, Sh. 1
11715-LRM-093A, Sh. 3	12050-LRM-094A, Sh. 1
11715-LRM-093B, Sh. 1	12050-LRM-094A, Sh. 2
11715-LRM-094A, Sh. 1	
11715-LRM-094A, Sh. 2	

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-5, Sampling System (SS). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.6 Service Water (SW)

System Description

The service water (SW) system transfers heat from plant systems and components to the ultimate heat sink provided by the service water reservoir or Lake Anna (North Anna reservoir). The SW system removes heat from the component cooling water system, the recirculation spray system, the charging pump lubricating oil, the instrument air compressors, and the main control room air-conditioning chiller condensers. The normal source of service water is the man-made nine-acre service water reservoir, which is described in Section 2.4.8, Earthen Structures. Service water is pumped from the reservoir, treated with corrosion inhibitors and biocides, circulated through the serviced loads, and then returned to the reservoir through spray nozzles for evaporative cooling. The spray system has a bypass capability for cold weather operation, when evaporative cooling is not required. Water from Lake Anna is an alternate source of service water and is the normal source of make-up supply to the service water reservoir.

The portion of the SW system that is subject to aging management review consists of the service water and auxiliary service water pumps with associated auxiliary equipment, and components that provide cooling water to and from the recirculation spray heat exchangers, the component cooling heat exchangers, the control room chiller condensers, and the charging pump lubricating oil and gearbox coolers.

UFSAR Reference

Additional SW system details are provided in Section 9.2.1 of the UFSAR.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

License Renewal Drawings

The license renewal drawings for the SW system are listed below:

Unit 1	Unit 2
11715-LRM-040D, Sh. 1	12050-LRM-074A, Sh. 3
11715-LRM-040D, Sh. 2	12050-LRM-079B, Sh. 3
11715-LRM-074A, Sh. 3	
11715-LRM-078A, Sh. 1	
11715-LRM-078A, Sh. 2	
11715-LRM-078A, Sh. 3	
11715-LRM-078A, Sh. 4	
11715-LRM-078A, Sh. 5	
11715-LRM-078B, Sh. 1	
11715-LRM-078B, Sh. 3	
11715-LRM-078C, Sh. 1	
11715-LRM-078C, Sh. 2	
11715-LRM-078G, Sh. 1	
11715-LRM-078G, Sh. 2	
11715-LRM-078H, Sh. 1	
11715-LRM-078J, Sh. 1	
11715-LRM-078K, Sh. 1	
11715-LRM-078L, Sh. 1	
11715-LRM-079C, Sh. 3	
11715-LRM-079D, Sh. 4	

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-6, Service Water (SW). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.7 Chilled Water (CD)

[North Anna-specific system name - functionally equivalent to Containment air recirculation cooler flowpath included in the Surry component cooling (CC) system and the main control room and emergency switchgear room (MCR/ESGR) air-conditioning chilled water system included in the Surry ventilation (VS) system and bearing cooling (BC) system]

System Description

The chilled water (CD) system designation is applicable to two separate North Anna systems: the chilled water system and the main control room and emergency switchgear room (MCR/ESGR) air-conditioning chilled water system.

The chilled water system provides chilled water to remove heat from various plant loads including the Containment air recirculation coolers (see Section 2.3.3.21, Heating and Ventilation (HV) for further description). The service water (SW) system can be aligned to supply the chilled water system in the event that the mechanical chillers are unavailable. The portion of the chilled water system that is subject to aging management review consists of the components that perform a Containment pressure boundary function, and the components that provide a SW system pressure boundary when the systems are cross-connected.

The MCR/ESGR air-conditioning chilled water system provides chilled water to remove heat from the control room envelope as described in Section 2.3.3.21, Heating and Ventilation (HV). The portion of the MCR/ESGR air-conditioning chilled water system that is subject to aging management review consists of the passive components required to provide the control room envelope heat removal function.

UFSAR Reference

Additional CD system details are provided in Section 9.2.2 and Section 9.4.1of the UFSAR.

License Renewal Drawings

The license renewal drawings for the CD system are listed below:

Unit 1	Unit 2
11715-LRM-040C, Sh. 1	12050-LRM-079B, Sh. 3
11715-LRM-040C, Sh. 2	
11715-LRM-040E, Sh. 1	
11715-LRM-040E, Sh. 2	
11715-LRM-079D, Sh. 4	

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-7, Chilled Water (CD). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.8 Component Cooling (CC)

System Description

The component cooling (CC) system is an intermediate cooling system that transfers heat from plant systems and components to the service water (SW) system (described in Section 2.3.3.6). The CC system serves safety related and non-safety related systems and components that contain potentially radioactive fluids. The CC system is a closed cooling water system utilizing a corrosion inhibitor.

The portion of the CC system that is subject to aging management review consists of the components that are required to support heat removal functions, and the components that perform a Containment pressure boundary function.

UFSAR Reference

Additional CC system details are provided in Section 9.2.2 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the CC system are listed below:

Unit 1	Unit 2
11715-LRM-079A, Sh. 1	12050-LRM-079A, Sh. 1
11715-LRM-079A, Sh. 2	12050-LRM-079A, Sh. 2
11715-LRM-079A, Sh. 3	12050-LRM-079A, Sh. 3
11715-LRM-079B, Sh. 1	12050-LRM-079A, Sh. 4
11715-LRM-079B, Sh. 2	12050-LRM-079A, Sh. 5
11715-LRM-079B, Sh. 3	12050-LRM-079B, Sh. 3
11715-LRM-079B, Sh. 4	12050-LRM-079C, Sh. 1
11715-LRM-079B, Sh. 5	
11715-LRM-079C, Sh. 1	
11715-LRM-079C, Sh. 2	
11715-LRM-079C, Sh. 3	
11715-LRM-079C, Sh. 4	
11715-LRM-079C, Sh. 5	
11715-LRM-079D, Sh. 4	
11715-LRM-079E, Sh. 1	

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-8, Component Cooling (CC). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.9 Neutron Shield Tank Cooling (NS)

System Description

The neutron shield tank cooling (NS) system provides cooling for the neutron shield tank fluid which is heated by attenuation of neutron and gamma radiation in the vicinity of the reactor vessel. NS system cooling is provided by the component cooling (CC) system.

The NS components that provide a pressure boundary function for the CC system are subject to aging management review.

UFSAR Reference

Additional NS system details are provided in Chapter 9.2.2 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the NS system are listed below:

Unit 1	Unit 2
11715-LRM-079B, Sh. 5	12050-LRM-079A, Sh. 5

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-9, Neutron Shield Tank Cooling (NS). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.10 Alternate AC (AAC) Diesel Generator Systems

This section includes the following plant systems:

- Alternate AC (AAC) system
- AAC diesel cooling water (BCW) system
- AAC diesel fuel oil (BFO) system
- AAC diesel lubricating oil (BLO) system
- AAC diesel starting air (BSA) system

System Description

The alternate AC (AAC) system, installed in response to 10 CFR 50.63, provides ac power to one emergency electrical bus on the selected unit during a Station Blackout (SBO) event. The AAC diesel generator systems consist of the diesel generator and associated support systems.

The portion of the AAC diesel generator systems that is subject to aging management review consists of the components that are required for the operation of the AAC diesel generator to meet SBO requirements. The engine and electrical generator are active components and, therefore, are not subject to aging management review.

UFSAR Reference

Additional AAC diesel generator systems details are provided in Section 9.5.11 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the AAC diesel generator systems are listed below:

Unit 1	Unit 2
11715-LRM-113A, Sh. 1	Common
11715-LRM-113B, Sh. 1	
11715-LRM-113C, Sh. 1	
11715-LRM-113D, Sh. 1	
11715-LRM-113E, Sh. 1	

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Components Subject to AMR

The component groups that require aging management review are indicated in Table 2.3.3-10, Alternate AC (AAC) Diesel Generator Systems. The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.11 Emergency Diesel Generator (EDG) Systems

The emergency diesel generator (EDG) systems includes the following plant systems:

Emergency diesel generator cooling (EC) system

Emergency diesel generator lubrication (EL) system

Emergency diesel generator starting air (EB) system

Emergency generator (EG) system

Fuel oil (FO) system

[The North Anna emergency diesel generator cooling (EC), emergency diesel generator lubrication (EL), emergency diesel generator starting air (EB), emergency generator (EG), and fuel oil (FO) systems are functionally equivalent to the Surry emergency electrical power (EE) and emergency generator (EG) systems.]

System Description

The EDG is a diesel engine-driven electrical generator that provides a back-up source of electrical power to the emergency electrical bus in the event that the normal supply is unavailable. The EDG systems consist of the diesel generator and associated support systems.

The portion of the EDG systems that is subject to aging management review consists of the components that are required for the operation of the EDGs. The engine and electrical generator are active components and, therefore, are not subject to aging management review.

UFSAR Reference

Additional EDG systems details are provided in Section 8.3.1, Section 9.5.4, Section 9.5.5, Section 9.5.6, Section 9.5.7, Section 9.5.8 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the EDG systems are listed below:

Unit 1	Unit 2
11715-LRB-035A, Sh. 1	12050-LRM-107A, Sh. 1
11715-LRB-035A, Sh. 2	12050-LRM-107A, Sh. 2
11715-LRB-035C, Sh. 1	12050-LRM-107A, Sh. 3
11715-LRB-035C, Sh. 2	12050-LRM-107A, Sh. 4
11715-LRB-035C, Sh. 3	12050-LRM-107B, Sh. 1
11715-LRB-035C, Sh. 4	12050-LRM-107B, Sh. 2
11715-LRM-107A, Sh. 1	12050-LRM-107C, Sh. 1
11715-LRM-107A, Sh. 2	12050-LRM-107C, Sh. 2
11715-LRM-107A, Sh. 3	12050-LRM-107D, Sh. 1
11715-LRM-107A, Sh. 4	12050-LRM-107D, Sh. 2
11715-LRM-107B, Sh. 1	
11715-LRM-107B, Sh. 2	
11715-LRM-107C, Sh. 1	
11715-LRM-107C, Sh. 2	
11715-LRM-107D, Sh. 1	
11715-LRM-107D, Sh. 2	

Components Subject to AMR

The component groups that require aging management review are indicated in Table 2.3.3-11, Emergency Diesel Generator (EDG) Systems. The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.12 Security (SEC)

System Description

The security (SEC) system provides the physical security features of the plant. The portion of the system within the scope of license renewal consists of the back-up electrical diesel-generator, cabling, and yard lighting required to meet fire protection requirements. The engine and electrical generator are active components and, therefore, are not subject to aging management review.

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-12, Security (SEC). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.13 Compressed Air (CA)

[North Anna-specific system name - functionally equivalent to the main control room/emergency switchgear room bottled air portion of the Surry ventilation (VS) system]

System Description

The compressed air (CA) system provides compressed dry air of breathing quality to pressurize the main control room (MCR) envelope. The pressurization of the MCR envelope is required for postulated accidents involving radioactive release in order to limit the dose to control room personnel. Pressurization is performed by the CA system initially, and by the MCR/ESGR emergency ventilation system (see Section 2.3.3.21) for the long term. The CA system consists of compressed breathing air bottles, piping and valves.

The portion of the CA system that is subject to aging management review consists of the air bottles, distribution piping, and other passive components that provide pressurization air upon a system actuation.

UFSAR Reference

Additional CA system details are provided in Section 9.4.1 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the CA system are listed below:

Unit 1	Unit 2
11715-LRB-034F, Sh. 1	Common
11715-LRB-034F, Sh. 2	
11715-LRB-034F, Sh. 3	
11715-LRB-034F, Sh. 4	
11715-LRB-034F, Sh. 5	

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-13, Compressed Air (CA). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.14 Instrument Air (IA)

System Description

The instrument air (IA) system provides a reliable source of clean, dry, oil-free compressed air to air-operated valves, instruments, and other miscellaneous components in the plant. Critical components that require compressed air in order to perform intended functions are provided with back-up subsystems and do not rely upon the normal IA system as the sole source of compressed air. The following components are provided with back-up compressed air or gas supplies:

- Pressurizer power-operated relief valves
- Containment hydrogen recombiner trip valves
- Selected feedwater valves
- Selected ventilation system dampers
- Selected component cooling valves
- Selected residual heat removal valves
- Main steam power-operated relief valves
- Main steam supply valves for the auxiliary feedwater turbines

The portion of the IA system that is subject to aging management review consists of the components that perform a Containment pressure boundary function as part of the IA system Containment penetration, and the back-up compressed air subsystem components that provide for operation of critical components.

The IA compressor coolers perform a service water system pressure boundary function and are also subject to aging management review.

UFSAR Reference

Additional IA system details are provided in Section 9.3.1 of the UFSAR.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

License Renewal Drawings

The license renewal drawings for the IA system are listed below:

Unit 1	Unit 2
11715-LRM-082A, Sh. 1	12050-LRM-082A, Sh. 1
11715-LRM-082A, Sh. 2	12050-LRM-082A, Sh. 2
11715-LRM-082C, Sh. 1	12050-LRM-082B, Sh. 1
11715-LRM-082C, Sh. 2	12050-LRM-082B, Sh. 2
11715-LRM-082D, Sh. 2	12050-LRM-082B, Sh. 3
11715-LRM-082M, Sh. 1	12050-LRM-082C, Sh. 1
11715-LRM-082N, Sh. 1	12050-LRM-082C, Sh. 2
11715-LRM-082N, Sh. 2	12050-LRM-093B, Sh. 1
11715-LRM-082N, Sh. 3	
11715-LRM-093B, Sh. 1	

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-14, Instrument Air (IA). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.15 Primary and Secondary Plant Gas Supply (GN)

System Description

The primary and secondary plant gas supply (GN) system provides compressed gas for various plant uses.

The portion of the GN system that is subject to aging management review consists of the system components that provide compressed gas in support of the operation of the hydrogen analyzer system and that provide a backup pneumatic source for the hydrogen analyzer and hydrogen recombiner valves and the pressurizer power-operated relief valves (PORVs) upon a loss of instrument air.

UFSAR Reference

Additional GN system details are provided in Section 5.5.8.2 and Section 9.5.10 of the UFSAR.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

License Renewal Drawings

The license renewal drawings for the GN system are listed below:

Unit 1	Unit 2
11715-LRM-082A, Sh. 2	12050-LRM-082A, Sh. 2
11715-LRM-082C, Sh. 1	12050-LRM-093B, Sh. 1
11715-LRM-093B, Sh. 1	
11715-LRM-105A, Sh. 1	
11715-LRM-105C, Sh. 1	
11715-LRM-106A, Sh. 1	
11715-LRM-106A, Sh. 2	
11715-LRM-106A, Sh. 4	

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-15, Primary and Secondary Plant Gas Supply (GN). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.16 Service Air (SA)

System Description

The service air (SA) system provides a source of compressed air to support plant general service compressed air requirements. The SA system can be used as a source of compressed air to the IA system.

The portion of the SA system that is subject to aging management review is limited to components that perform a Containment pressure boundary function as part of the SA system Containment penetration.

UFSAR Reference

Additional SA system details are provided in Section 9.3.1 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the SA system are listed below:

Unit 1	Unit 2
11715-LRM-082F, Sh. 1	12050-LRM-082F, Sh. 2

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-16, Service Air (SA). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.17 Containment Vacuum (CV)

System Description

The containment vacuum (CV) system establishes and maintains the subatmospheric pressure of the Containment building in support of plant operation. The CV system also provides a flowpath, via the Containment penetration piping, for the Containment post-accident hydrogen analyzer system.

The portion of the CV system that requires aging management review is limited to components that perform a Containment pressure boundary function as part of the CV system Containment penetrations.

The CV pump seal water heat exchangers are cooled by the component cooling (CC) system. These components are subject to aging management review for a CC system pressure boundary function.

UFSAR Reference

Additional CV system details are provided in Section 6.2.6 of the UFSAR.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

License Renewal Drawings

The license renewal drawings for the CV system are listed below:

Unit 1	Unit 2
11715-LRM-079C, Sh. 1 11715-LRM-092A, Sh. 2	12050-LRM-092A, Sh. 2

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-17, Containment Vacuum (CV). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.18 Leakage Monitoring (LM)

System Description

The leakage monitoring (LM) system provides Containment pressure signals to the engineered safety features (ESF) actuation system. The system is also designed to provide pressure sensing during Containment leakrate testing.

The portion of the LM system that is subject to aging management review consists of the components that perform a Containment pressure boundary function as part of the LM system Containment penetrations.

UFSAR Reference

Additional LM system details are provided in Section 6.2.7 and Section 7.3.1.3.2 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the LM system are listed below:

Unit 1	Unit 2
11715-LRM-092A, Sh. 1	12050-LRM-092A, Sh. 1

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-18, Leakage Monitoring (LM). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.19 Secondary Vents (SV)

System Description

The secondary vents (SV) system provides a vent path for non-condensable gases discharged by the main condenser air ejectors. The portion of the SV system that is subject to aging management review is limited to components that perform a Containment pressure boundary function as part of the Containment penetration.

UFSAR Reference

Additional SV system details are provided in Section 10.4.6 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the SV system are listed below:

Unit 1	Unit 2
11715-LRM-072A, Sh. 2	12050-LRM-072A, Sh. 2

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-19, Secondary Vents (SV). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.20 Vacuum Priming (VP)

System Description

The vacuum priming (VP) system removes non-condensable gases from various plant systems.

The portion of the VP system that is subject to aging management review consists of the components that perform a Containment pressure boundary function as part of the VP system Containment penetration.

UFSAR Reference

Additional VP system details are provided in Section 10.4.6 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the VP system are listed below:

Unit 1	Unit 2
11715-LRM-072A, Sh. 2	12050-LRM-072A, Sh. 2

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-20, Vacuum Priming (VP). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.21 Heating and Ventilation (HV)

[North Anna-specific system name - functionally equivalent to the Surry ventilation (VS) system]

System Description

The heating and ventilation (HV) system is comprised of several ventilation subsystems with the general function to provide space and equipment cooling. Certain subsystems also provide radiological controls. The HV subsystems within the scope of license renewal are those that perform essential equipment cooling and those that maintain onsite and offsite radiological doses within limits for postulated accident conditions.

The following HV subsystems are within the scope of license renewal:

Auxiliary Ventilation

The auxiliary ventilation subsystem is comprised of fresh air supply and exhaust ventilation for the Auxiliary Building, Fuel Building, Decontamination

Building and Safeguards Building, and a common filtration unit. The auxiliary ventilation subsystem also includes the exhaust ventilation filters, fans, dampers, and ductwork for the engineered safety features (ESF) equipment areas (emergency system).

The portions of the auxiliary ventilation subsystem that are subject to aging management review are the components that provide required post-accident ESF equipment cooling and control of radiological conditions, including portions of the normal supply and exhaust that provide a pressure boundary for the emergency system.

Containment Ventilation

The containment ventilation subsystem consists of containment air recirculation, control rod drive mechanism (CRDM) ventilation, and containment purge ventilation.

The containment air recirculation ventilation provides Containment heat removal during normal and shutdown operations. The portion that is subject to aging management review is limited to the cooling coils that provide the chilled water (CD) system pressure boundary.

The CRDM ventilation cools the ventilation air drawn from the CRDM area of the reactor vessel head in order to remove heat generated in the head region. The portion that is subject to aging management review is limited to the cooling coils that provide the CD system pressure boundary.

The containment purge provides for Containment atmosphere air changes for radiological control and personnel habitability during plant shutdown conditions. The portion of the containment purge that is subject to aging management review is limited to the ductwork and components that perform a Containment pressure boundary function as part of the HV system Containment penetrations, and the dampers and ductwork that provide a pressure boundary for the ESF areas exhaust ventilation.

Main Control Room and Emergency Switchgear Room Ventilation

The main control room and emergency switchgear room (MCR/ESGR) ventilation subsystem is comprised of air-conditioning ventilation components and MCR envelope pressurization components.

The air-conditioning system consists of supply and exhaust ventilation, and a recirculation system. The supply and exhaust system is secured in an emergency in order to isolate the MCR envelope. The recirculation

air-conditioning system, including water chillers and associated equipment, air handling units, dampers, and ductwork, provides cooling during normal and emergency conditions. The air-conditioning components that are subject to aging management review are the HV components that provide isolation of the MCR envelope and the HV components that provide MCR envelope cooling.

The pressurization of the MCR envelope is required for postulated accidents involving radioactive release in order to limit the dose to control room personnel. Pressurization is performed by the MCR/ESGR bottled air system initially, and by the MCR/ESGR emergency ventilation system for the long term. The bottled air system consists of compressed breathing air bottles, piping, and valves. The MCR/ESGR emergency ventilation system consists of fans, filters, dampers, and ductwork. The components that provide pressurization of the MCR envelope are subject to aging management review.

Additional details of the MCR/ESGR bottled air system are provided in Section 2.3.3.13, Compressed Air (CA).

Other Ventilation Subsystems

There are various other ventilation subsystems installed at the plant. The ventilation subsystems that are within the scope of license renewal and include components that require aging management review are described below:

Ventilation components are installed to provide cooling for critical areas of the Auxiliary Building and the Fuel Building in the event that a severe fire disables the normal ventilation system. The passive components of these subsystems are subject to aging management review.

The rod drive room and cable vault ventilation includes emergency supply ventilation fans and ductwork that provide cooling to safety-related motor control centers if normal ventilation is lost. The passive components of these subsystems are subject to aging management review.

UFSAR Reference

Additional ventilation system details are provided in Section 9.4 of the UFSAR.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

License Renewal Drawings

The license renewal drawings for the HV system are listed below:

Unit 1	Unit 2
11715-LRB-006A, Sh. 1	12050-LRM-079A, Sh. 2
11715-LRB-006A, Sh. 2	12050-LRM-079A, Sh. 3
11715-LRB-006A, Sh. 3	12050-LRM-079A, Sh. 4
11715-LRB-23A, Sh. 1	12050-LRM-079B, Sh. 3
11715-LRB-034F, Sh. 1	
11715-LRB-034F, Sh. 2	
11715-LRB-034F, Sh. 3	
11715-LRB-034F, Sh. 4	
11715-LRB-034F, Sh. 5	
11715-LRB-040C, Sh. 1	
11715-LRB-040C, Sh. 2	
11715-LRB-040D, Sh. 1	
11715-LRB-040D, Sh. 2	
11715-LRB-040E, Sh. 1	
11715-LRB-040E, Sh. 2	
11715-LRM-079B, Sh. 2	
11715-LRM-079B, Sh. 3	
11715-LRM-079B, Sh. 4	
11715-LRM-079D, Sh. 4	
11715-LRM-106A, Sh. 4	

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-21, Heating and Ventilation (HV). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.22 Boron Recovery (BR)

System Description

The boron recovery (BR) system is a common system serving both units. The system degasifies and stores borated radioactive water letdown by the chemical and volume control (CH) system or gaseous drain water transferred by the drains - gaseous (DG) system.

The portion of the BR system that is subject to aging management review is limited to those components that perform a pressure boundary function for the component cooling (CC) and fuel pit cooling (FC) systems.

UFSAR Reference

Additional BR system details are provided in Section 9.3.5 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the BR system are listed below:

Unit 1	Unit 2
11715-LRM-079C, Sh. 1 11715-LRM-079C, Sh. 4 11715-LRM-079C, Sh. 5 11715-LRM-086B, Sh. 3	Common

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-22, Boron Recovery (BR). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.23 Drains - Aerated (DA)

System Description

The drains - aerated (DA) system collects potentially radioactive fluids in building sumps and discharges the sump fluids to the waste disposal system for processing and disposal.

The portion of the DA system that is subject to aging management review consists of the components that perform a Containment pressure boundary function as part of the DA system Containment penetration.

UFSAR Reference

Additional DA system details are provided in Section 9.3.3 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the DA system are listed below:

Unit 1	Unit 2
11715-LRM-090A, Sh. 1	12050-LRM-090A, Sh. 3
11715-LRM-090C, Sh. 3	12050-LRM-090B, Sh. 1

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-23, Drains - Aerated (DA). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.24 Drains - Building Services (DB)

[North Anna-specific system name - functionally equivalent to the Surry plumbing (PL) system]

System Description

The drains - building services (DB) system, in addition to normal services, prevents or mitigates plant flooding. The portion of the DB system that is subject to aging management review consists of the main control room and emergency switchgear room (MCR/ESGR) chiller rooms sump discharge path components that prevent flooding of the chiller rooms.

UFSAR Reference

Additional DB system details are provided in Section 9.3.3 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the DB system are listed below:

Unit 1	Unit 2
11715-LRB-201A, Sh. 1 11715-LRB-201A, Sh. 2	Common

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-24, Drains - Building Services (DB). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.25 Drains - Gaseous (DG)

System Description

The drains - gaseous (DG) system collects potentially radioactive fluids and discharges them to the boron recovery system. Drains collected from the primary systems are processed via the primary drains transfer tank and cooler.

The portion of the DG system that is subject to aging management review consists of the components that perform a Containment pressure boundary function as part of the DG system Containment penetration, and the primary drains transfer tank cooler which provides a pressure boundary for the component cooling system.

UFSAR Reference

Additional DG system details are provided in Section 9.3.3 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the DG system are listed below:

Unit 1	Unit 2
11715-LRM-079B, Sh. 5	12050-LRM-079A, Sh. 5
11715-LRM-090C, Sh. 1	12050-LRM-090A, Sh. 1

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-25, Drains - Gaseous (DG). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.26 Liquid and Solid Waste (LW)

System Description

The liquid and solid waste (LW) system is common to both units and is designed to process potentially radioactive liquid and solid wastes produced by the operation of the plant.

The portion of the LW system that is subject to aging management review consists of the components that provide the pressure boundary for the chemical and volume control (CH) and component cooling (CC) systems.

UFSAR Reference

Additional LW system details are provided in Section 11.2 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the LW system are listed below:

Unit 1	Unit 2
11715-LRM-079C, Sh. 1	Common
11715-LRM-087D, Sh. 1	
11715-LRM-087D, Sh. 2	

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-26, Liquid and Solid Waste (LW). The table provides the passive function and a reference to the aging management review results section for each component group.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

2.3.3.27 Radwaste (RW)

System Description

The radwaste (RW) system is common to both units and is designed to process potentially radioactive liquid and solid wastes produced by the operation of the plant.

The portion of the RW system that is subject to aging management review consists of the components that provide the pressure boundary for the chemical and volume control (CH) system.

UFSAR Reference

Additional RW system details are provided in Section 11.2 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the RW system are listed below:

Unit 1	Unit 2
11715-LRM-087D, Sh. 1	12050-LRM-095A, Sh. 1
11715-LRM-087D, Sh. 2	12050-LRM-095A, Sh. 2
11715-LRM-095A, Sh. 3	
11715-LRM-095A, Sh. 4	

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-27, Radwaste (RW). The table provides the passive function and a reference to the aging management review results section for each component group.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

2.3.3.28 Post-Accident Hydrogen Removal (HC)

[North Anna-specific system name - functionally equivalent to the in-scope portion of the Surry gaseous waste (GW) system]

System Description

The post-accident hydrogen removal (HC) system provides the capability to monitor and control the post-accident Containment atmosphere hydrogen concentration. The HC system is comprised of hydrogen recombiner units, hydrogen analyzers, and associated components.

The portion of the HC system that is subject to aging management review consists of the components that are associated with Containment hydrogen monitoring and control, and that perform a Containment pressure boundary function as part of the HC system Containment penetration.

UFSAR Reference

Additional HC system details are provided in Section 6.2.5 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the HC system are listed below:

Unit 1	Unit 2
11715-LRM-092A, Sh. 2	12050-LRM-092A, Sh. 2
11715-LRM-106A, Sh. 1	
11715-LRM-106A, Sh. 2	
11715-LRM-106A, Sh. 3	
11715-LRM-106A, Sh. 4	

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-28, Post Accident Hydrogen Removal (HC). The table provides the passive function and a reference to the aging management review results section for each component group.

The hydrogen analyzers are within the scope of the Environmental Qualification program and are subject to a time-limited aging analysis as discussed in Section 4.4, Environmental Qualification (EQ) of Electric Equipment.

2.3.3.29 Radiation Monitoring (RM)

System Description

The radiation monitoring (RM) system provides indication of radiation conditions in various plant areas and within potentially radioactive plant systems.

The portion of the RM system that is subject to aging management review consists of the components that perform a Containment pressure boundary function as part of the RM system Containment penetration.

UFSAR Reference

Additional RM system details are provided in Section 11.4 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the RM system are listed below:

Unit 1	Unit 2
11715-LRM-082N, Sh. 3	12050-LRM-082B, Sh. 2

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-29, Radiation Monitoring (RM). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.30 Vents - Gaseous (VG)

System Description

The vents - gaseous (VG) system collects and processes potentially radioactive gases vented from various plant systems.

The portion of the VG system that is subject to aging management review consists of the components that perform a Containment pressure boundary function as part of the VG system Containment penetration.

UFSAR Reference

Additional VG system details are provided in Section 9.3.3 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the VG system are listed below:

Unit 1	Unit 2
11715-LRM-090C, Sh. 1	12050-LRM-090A, Sh. 1

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-30, Vents - Gaseous (VG). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.3.31 Fire Protection (FP)

System Description

The fire protection (FP) system provides for detection and suppression of fires such that plant equipment damage is minimized and safe shutdown of the plant can be achieved. The FP system also provides a back-up source of make-up or cooling water to various plant systems.

The FP system is comprised of fire and smoke detection components, water-based fire suppression components (including water tanks, fire pumps, distribution piping, valves, hose stations, hydrants, and sprinkler systems), and gas-based fire suppression components (including CO_2 and Halon distribution equipment).

The reactor coolant pump (RCP) motor oil collection system components are included in the reactor coolant (RC) system (Section 2.3.1.1).

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

The portion of the FP system that is subject to aging management review consists of the components that are required to provide fire protection for structures and components within the scope of license renewal.

Other fire protection features at the plant that have been determined to be within the scope of license renewal are identified in Section 2.1.3.7, Regulated Event Reports, including:

- Fire barriers (includes doors, walls, gap covers, penetration seals, etc.)
- Flood barriers (includes curbs, dikes, etc.)
- Safe shutdown equipment (Appendix R)
- Fire fighting support (communications, lighting, bottled air)
- Panels
- Post-fire repair equipment (required for cold shutdown)
- Radiant energy shields
- Pressure boundary for the control room envelope (Halon suppression concentration)
- Combustible containment features (includes gravel pits around transformers, berms/dikes around fuel oil tanks, etc.)

A discussion of fire protection system consumable items is provided in Appendix C, Section C2.3, Identification of Short-lived Components and Consumables.

UFSAR Reference

Additional FP system details are provided in Section 9.5.1 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the FP system are listed below:

Unit 1	Unit 2
11715-LRB-035A, Sh. 1	12050-LRB-104A, Sh. 1
11715-LRB-41B, Sh. 1	12050-LRB-105A, Sh. 1
11715-LRB-101A, Sh. 1	12050-LRB-105A, Sh. 2
11715-LRB-101B, Sh. 1	12050-LRB-105A, Sh. 3
11715-LRB-101E, Sh. 1	12050-LRB-105A, Sh. 4
11715-LRB-102A, Sh. 1	12050-LRM-074A, Sh. 3
11715-LRB-102B, Sh. 1	
11715-LRB-103A, Sh. 1	
11715-LRB-103A, Sh. 2	
11715-LRB-103A, Sh. 3	
11715-LRB-103A, Sh. 4	
11715-LRB-103E, Sh. 1	
11715-LRB-104A, Sh. 1	
11715-LRB-104B, Sh. 1	
11715-LRB-104B, Sh. 2	
11715-LRB-104C, Sh. 1	
11715-LRB-104C, Sh. 2	
11715-LRB-104C, Sh. 3	
11715-LRB-104C, Sh. 4	
11715-LRB-104D, Sh. 1	
11715-LRB-104D, Sh. 2	
11715-LRB-104E, Sh. 1	
11715-LRM-074A, Sh. 3	

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.3-31, Fire Protection (FP). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.4 Steam and Power Conversion Systems

The following systems are addressed in this section:

- Auxiliary steam system (Section 2.3.4.1)
- Blowdown system (Section 2.3.4.2)
- Condensate system (Section 2.3.4.3)
- Feedwater systems (Section 2.3.4.4)
- Main steam system (Section 2.3.4.5)
- Steam drains system (Section 2.3.4.6)
- Steam generator water treatment system (Section 2.3.4.7)

2.3.4.1 Auxiliary Steam (AS)

System Description

The auxiliary steam (AS) system supplies low pressure, saturated steam to various plant systems.

The portion of the AS system subject to aging management review includes the steam pressure regulating valve and associated bypass and isolation valves that are credited with providing a main steam system pressure boundary function in the event of a station blackout (SBO) event or severe fire (Appendix R) event.

UFSAR Reference

Additional AS system details are provided in Section 10.4.1 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the AS system are listed below:

Unit 1	Unit 2
11715-LRM-072A, Sh. 1	12050-LRM-072A, Sh. 1

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.4-1, Auxiliary Steam (AS). This table provides the passive function and a reference to the aging management review results section for each component group.

2.3.4.2 Blowdown (BD)

System Description

The blowdown (BD) system provides a flowpath for the continuous blowdown flow from the steam generator secondary-side to maintain acceptable steam generator water chemistry. The BD system isolates flow for containment isolation, to maintain steam generator inventory during transients, and in the event of a high energy line break.

The portion of the BD system subject to aging management review consists of the components from the steam generator to the first manual isolation valves downstream of the outboard containment isolation valves.

The portion of the BD system that provides the CC system pressure boundary at the BD system vent condenser is also subject to aging management review.

UFSAR Reference

Additional BD system details are provided in Section 10.4.6 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the BD system are listed below:

Unit 1	Unit 2
11715-LRM-079A, Sh. 3	12050-LRM-098A, Sh. 2
11715-LRM-098A, Sh. 2	12050-LRM-098A, Sh. 3
11715-LRM-098A, Sh. 3	12050-LRM-098A, Sh. 4
11715-LRM-098A, Sh. 4	12050-LRM-102B, Sh. 1
13075-LRM-102C, Sh. 1	

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.4-2, Blowdown (BD). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.4.3 Condensate (CN)

System Description

The primary purpose of the condensate (CN) system is to provide chemically treated water to the suction of the main feedwater pumps at sufficient pressure to support main feedwater pump operation.

The CN system also provides the piping, valves, water storage, and make-up supply for auxiliary feedwater. An emergency condensate storage tank is provided for each Unit. Each tank supplies water to the three auxiliary feedwater pumps through individual lines. These tanks and the associated components up to the suction of the pumps comprise the portion of the CN system that is subject to aging management review.

UFSAR Reference

Additional CN system details are provided in Section 9.2.4, Section 10.4.3, and Section 10.4.4 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the CN system are listed below:

Unit 1	Unit 2
11715-LRM-074A, Sh. 3	12050-LRM-074A, Sh. 3
11715-LRM-078B, Sh. 1	
11715-LRM-078B, Sh. 3	

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.4-3, Condensate (CN). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.4.4 Feedwater (FW)

System Description

The feedwater (FW) system is comprised of main feedwater and auxiliary feedwater. Main feedwater provides treated water to maintain inventory in the steam generators (SG) for the production of steam and to provide a heat sink for the reactor coolant system. Main feedwater components provide a flowpath for auxiliary feedwater flow to the steam generator and provide isolation of main feedwater flow in response to plant transients. Auxiliary feedwater provides an emergency source of water to the SG for reactor heat removal. Auxiliary feedwater provides a heat sink during design basis accidents including loss of power conditions. The system consists of three auxiliary feedwater pumps and associated components. The source of water is provided from the emergency condensate storage tank in the condensate (CN) system.

The portion of the FW system subject to aging management review includes the components from the high-energy line break (HELB) analysis boundary outside of the Containment downstream to the SG feedwater nozzle, and the auxiliary feedwater pumps and discharge line components up to the feedwater piping connection. The auxiliary feedwater pumps lubricating oil and seal cooling components support the function of the pump and are also subject to aging management review. Additionally, back-up compressed air components required for the function of selected feedwater isolation valves are subject to an aging management review.

UFSAR Reference

Additional FW system details are provided in Section 10.4.3 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the FW system are listed below:

Unit 1	Unit 2
11715-LRM-070A, Sh. 3	12050-LRM-070A, Sh. 3
11715-LRM-074A, Sh. 1	12050-LRM-074A, Sh. 1
11715-LRM-074A, Sh. 3	12050-LRM-074A, Sh. 3
11715-LRM-074A, Sh. 4	12050-LRM-074A, Sh. 4
11715-LRM-074B, Sh. 1	12050-LRM-074B, Sh. 1

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.4-4, Feedwater (FW). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.4.5 Main Steam (MS)

System Description

The main steam (MS) system transports steam produced in the steam generators to the main turbine for the production of electricity. Additionally, the MS system:

- Provides motive steam to the turbine-driven auxiliary feed pump.
- Removes heat from the reactor coolant system via the Code safety valves, SG power-operated relief valves (PORVs), and/or condenser steam dump valves.
- Isolates steam flow to the main turbine following a reactor trip or during accident conditions to prevent an excessive cooldown that could have an adverse effect on the reactor.

The major flowpaths of the MS system from the steam generator outlet nozzle to the turbine stop valves and the condenser steam dump valves is subject to aging management review. The evaluation boundary extends beyond the safety-related boundary of the system based on high-energy line break (HELB) analysis, station blackout (SBO) and Appendix R requirements.

UFSAR Reference

Additional MS system details are provided in Section 10.3 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the MS system are listed below:

Unit 1	Unit 2
11715-LRM-070A, Sh. 1	12050-LRM-070A, Sh. 1
11715-LRM-070A, Sh. 2	12050-LRM-070A, Sh. 2
11715-LRM-070A, Sh. 3	12050-LRM-070A, Sh. 3
11715-LRM-070B, Sh. 1	12050-LRM-070B, Sh. 1
11715-LRM-070B, Sh. 2	12050-LRM-070B, Sh. 2
11715-LRM-070B, Sh. 3	12050-LRM-070B, Sh. 3
11715-LRM-072A, Sh. 1	12050-LRM-072A, Sh. 1

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.4-5, Main Steam (MS). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.4.6 Steam Drains (SD)

[North Anna-specific system name - functionally equivalent to steam trap drain piping included in the Surry main steam (MS) system]

System Description

The steam drains (SD) system provides a flowpath for returning condensate drips from various steam sources to the CN system. The portions of the SD system that are subject to aging management review are steam trap drain line piping sections that form the MS system pressure boundary upstream of the main steam trip valves.

UFSAR Reference

Additional SD system details are provided in Section 10.4.6 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the SD system are listed below:

Unit 1	Unit 2
11715-LRM-070A, Sh. 3	12050-LRM-070A, Sh. 3
11715-LRM-070B, Sh. 1	12050-LRM-070B, Sh. 1
11715-LRM-070B, Sh. 2	12050-LRM-070B, Sh. 2
11715-LRM-070B, Sh. 3	12050-LRM-070B, Sh. 3

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.4-6, Steam Drains (SD). The table provides the passive function and a reference to the aging management review results section for each component group.

2.3.4.7 Steam Generator Water Treatment (WT)

[North Anna-specific system name - functionally equivalent to the Surry steam generator recirculation and transfer (RT) system]

System Description

The purpose of the steam generator water treatment (WT) system is to provide a means of recirculating water in the steam generator during periods of wet layup to help maintain steam generator water chemistry within limits and to provide the capability for water transfer from the steam generator.

The portion of the WT system that is subject to aging management review provides the steam generator pressure boundary and the Containment pressure boundary.

UFSAR Reference

Additional WT system details are provided in Section 10.4.3 of the UFSAR.

License Renewal Drawings

The license renewal drawings for the WT system are listed below:

Unit 1	Unit 2
11715-LRM-074A, Sh. 1	12050-LRM-074A, Sh. 1
11715-LRM-102A, Sh. 2	12050-LRM-102A, Sh. 2
13075-LRM-102C, Sh. 1	12050-LRM-102B, Sh. 1

Components Subject to AMR

The component groups for this system that require aging management review are indicated in Table 2.3.4-7, Steam Generator Water Treatment (WT). The table provides the passive function and a reference to the aging management review results section for each component group.

2.4 Scoping and Screening Results: Structures

Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences. Structures for which the in-scope portions at both stations are functionally equivalent, but that are identified by different names, have not been treated as plant-specific. The first time the structure name is used in the screening results section, an explanation of the functional equivalency is provided within brackets.

A listing of the abbreviations used in this section is provided in Section 1.4.1.

To optimize the aging management review, structures that are attached to or contained within larger structures, have been reviewed with the larger structure. Also, structures that have similar materials and experience similar environments have been grouped and reviewed together. The following list identifies and groups these structures that have been determined to be subject to aging management review, and Sections 2.4.1 through 2.4.8 describe them

- Containment
- Auxiliary Building Structure, which includes the following:
  - Auxiliary Building
  - Cable vault
  - Cable tunnel
  - Pipe tunnel
  - Rod drive room
  - Hydrogen recombiner vault
- Other Class I Structures, which include the following:
  - Safeguards Building
  - Main Steam Valve House
  - Quench Spray Pump House

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- Fuel Oil Pump House
- Auxiliary Feedwater Pump House
- Auxiliary Feedwater Tunnel
- Casing Cooling Pump House
- Service Water Pump House
- Service Water Pipe Expansion Joint Enclosure
- Service Water Valve House
- Service Water Tie-in Vault

- Fuel Building, which includes
  - Fuel Building structure
  - New fuel storage area
  - Fuel pool, including transfer canals
  - Spent fuel storage racks
- Miscellaneous Structures, which include the following:
  - Turbine Building
  - Service Building
  - SBO Building
  - Security Diesel Building
- Intake Structures, which include the following:
  - Intake structure
  - Discharge tunnel and seal pit
- Yard Structures, which include the following:
  - Tank Foundations and Missile Barriers
  - Manholes
  - Fuel Oil Storage Tank Dike
  - Transformer Firewalls/Dikes
  - Duct banks

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- Security lighting poles
- Domestic Water Treatment Building
- Auxiliary service water expansion joint enclosure
- Yard valve pit

- Earthen Structures, which include the following:
  - Service Water Reservoir
  - Floodwall West of the Turbine Building

Additionally, the following structural components are addressed in Sections 2.4.9 through 2.4.12

- NSSS Equipment Supports
- General Structural Supports
- Miscellaneous Structural Commodities
- Load-handling Cranes and Devices

The screening results for each of the structures in Section 2.4.1 through 2.4.8 do not list the NSSS equipment supports, general structural supports, miscellaneous structural commodities, or load handling cranes and devices since these items have their own screening evaluations.

2.4.1 Containment

Description

The Unit 1 and Unit 2 Containments are Seismic Class I structures that house the reactor and other Nuclear Steam Supply System (NSSS) components for the respective unit. Each Containment consists of a reinforced concrete cylinder with a hemispherical dome and a flat, 10-foot-thick reinforced concrete mat foundation.

The mat foundation is supported on fresh, crystalline, metamorphic rock.

A waterproof membrane is located below the Containment's structural mat and extends up the Containment wall to ground level.

Attached to the inside of the cylindrical Containment wall and dome is a liner of varying thickness. The liner attachments to the cylindrical wall and dome are Nelson concrete anchors that were cast in the Containment concrete as the concrete was poured against the liner. Steel insert plates are used in the Containment liner so that the Containment liner is not a load carrying structural member.

The liner at the bottom of the Containment is covered with a thick reinforced concrete slab to protect the Containment liner from potential interior missiles.

The Containment is divided by the crane wall that supports the polar crane into an outer annulus section and a central section. The central section is further subdivided into equipment cubicles that are connected to each other and to the outer annulus by open archways, grating floors, and unsealed penetrations. A Seismic Class I drainage sump with a stainless steel liner is provided in the Containment basement.

The Containment contains personnel and equipment access openings. The personnel access hatch opening has an inner and an outer door that are maintained in the closed position by interlocking tooth closure mechanisms. The equipment access hatch is a large diameter single-door equipment hatch that is bolted in-place to the interior of the exterior Containment wall. A two-door emergency escape air lock is provided through the equipment hatch for emergency access to the Containment. The emergency escape air lock inner door has steel strong backs that secure the door closed. There are no strong backs for the outer door of the emergency escape air lock.

The equipment hatch platform, which is located adjacent to the equipment access hatch of each Containment, supports the missile barrier located in front of the equipment access hatch.

A Seismic Class I reinforced concrete reactor cavity with a butt-welded stainless steel liner is provided in the Containment for refueling. The normally dry reactor cavity forms a pool above the reactor when it is filled with borated water for refueling. The reactor vessel flange is sealed to the bottom of the reactor cavity by the reactor cavity seal ring that prevents leakage of refueling water from the cavity.

The Containment has numerous mechanical and electrical penetrations that form part of the Containment pressure boundary, all of which are within the scope of license renewal. The penetrations are welded to the Containment liner and provide a seal between Containment and the outside atmosphere. High temperature piping penetrations include inner and outer coolers to limit the heat transferred to the Containment concrete wall. The high temperature penetrations are cooled by the component cooling system.

A fuel transfer tube penetration is provided in the Containment to permit fuel movement between the refueling canal in the Containment and the spent fuel pool in the Fuel Building. The fuel transfer tube assembly also forms part of the Containment pressure boundary.

In addition, a dome opening for ventilation during construction is installed at the apex of the Containment structure.

The ventilation dome opening has a hatch cover located on the outside of the Containment, and is filled with concrete.

UFSAR Reference

A list of the major piping penetrations through the Containment penetrations is provided in Table 6.2-37 of the UFSAR.

Components Subject to AMR

The Containment structural members that require aging management review are indicated in Table 2.4.1-1, Containment, along with their passive function(s).

Except as identified below, the aging management review results for these components are provided in Section 3.5.1, Containment.

The exposed portion of the anchor bolts for the Nuclear Steam Supply System (NSSS) equipment supports inside containment are evaluated for aging management with the associated NSSS equipment support and the results are provided in Section 3.5.9, NSSS Equipment Supports.

The internal surfaces of the Containment penetration process piping, the external surfaces of the process piping from the first attachment weld to the piping system both inside and outside of the Containment, and the associated Containment isolation valves are evaluated for aging management with the applicable process system.

The inner and outer coolers attached to the high temperature pipe penetrations are evaluated for aging management with the component cooling system and the aging management review results are provided in Section 3.3.3, Closed Water Systems.

The electrical penetration assemblies, excluding sleeves and o-rings, are within the scope of the Environmental Qualification Program as discussed in Section 2.5, Screening Results: Electrical and Instrumentation and Controls Systems.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

2.4.2 Auxiliary Building Structure

The following structures, which comprise the Auxiliary Building Structure, are addressed in this section:

- Auxiliary Building
- Cable vault
- Cable tunnel
- Pipe tunnel
- Hydrogen recombiner vault
- Rod drive room
  [North Anna specific name - functionally equivalent to Surry motor control center room]

For the remainder of the LRA discussion of the Auxiliary Building Structure, the term Auxiliary Building Structure is understood to include the Auxiliary Building, and the Unit 1 and Unit 2 cable vaults, cable tunnels, pipe tunnels, hydrogen recombiner vault, and rod drive rooms, unless specified otherwise. A brief discussion of these structures follows.

Description

The Auxiliary Building Structure includes the Auxiliary Building that is common to both units, and the structures that comprise the Unit 1 and Unit 2 cable vaults (also called “electrical penetration area”), cable tunnels, pipe tunnels (pipe penetration area), hydrogen recombiner vault, rod drive rooms.

The Auxiliary Building Structure is a safety-related structure that provides support and shelter to safety-related and non-safety-related equipment that is within the scope of license renewal.

The Auxiliary Building is a four-story structure located between the Unit 1 and Unit 2 Containments and contains systems that service both units. The structure is comprised of a reinforced concrete foundation mat with monolithic finish, below grade (substructure) reinforced concrete walls, with intermediate concrete floor slabs (cast on metal deck forms, which remain in place, or cast on removable form work), and metal siding supported by structural steel for the upper two stories. Rolling steel and hollow metal doors are provided for access. The roof is comprised of steel framing and a single-ply, mechanically attached membrane roofing system, and metal roof decking supported by structural steel. Flood protection barriers, fire and EQ doors, fire barrier penetrations, and fire barrier seals are provided to protect safety-related equipment.

Reinforced concrete walls and slabs are provided for biological and missile shielding.

The hydrogen recombiner vault is a single story, reinforced concrete structure that is missile-protected and has missile-protected metal sliding doors. It contains the Unit 1 and Unit 2 hydrogen recombiner units. The hydrogen recombiner vault is attached to the east side of the Unit 2 rod drive room. These structures share the same reinforced concrete foundation as the Auxiliary Building.

The cable vault, cable tunnel, rod drive room and pipe tunnel for each unit are reinforced concrete structures. These structures share the same reinforced concrete foundation as the Auxiliary Building. For each structure, the pipe tunnel is in the lower story, the cable vault and cable tunnel are in the intermediate story, and the rod drive room is in the uppermost story. Each unit's structure has three exterior reinforced concrete walls, two intermediate floor slabs, and a roof. The fourth side of the Unit 1 structure is open to the exterior of the Unit 1 Containment. The fourth side of the Unit 2 structure is open to the exterior of the Unit 2 Containment.

UFSAR Reference

A description of the Auxiliary Building is provided in UFSAR Section 1.2 and Section 3.8.1. A plot plan showing the general layout of the Auxiliary Building, cable vault, tunnel, and hydrogen recombiner vault structure is shown in UFSAR Figure 1.2-2.

Components Subject to AMR

The Auxiliary Building Structure structural members that require aging management review are indicated in Table 2.4.2-1, Auxiliary Building Structure, along with their passive function(s).

The aging management review results for these components are provided in Section 3.5.2, Auxiliary Building Structure.

2.4.3 Other Class I Structures

The following structures are addressed in this section:

- Safeguards Building
- Main Steam Valve House
- Quench Spray Pump House [North Anna-specific name - functionally equivalent to Surry Containment Spray Pump Building]

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- Fuel Oil Pump House
- Auxiliary Feedwater Pump House
- Auxiliary Feedwater Tunnel
- Casing Cooling Pump House
- Service Water Pump House
- Service Water Pipe Expansion Joint Enclosure
- Service Water Valve House
- Service Water Tie-in Vault

For the remainder of the LRA discussion of the Other Class I Structures, the term Other Class I Structures is understood to include the Safeguards Building, Main Steam Valve House, Quench Spray Pump House, the Fuel Oil Pump House, Auxiliary Feedwater Pump House, Auxiliary Feedwater Tunnel, Casing Cooling Pump House, Service Water Pump House, Service Water Pipe Expansion Joint Enclosure, Service Water Valve House, and Service Water Tie-in Vault unless specified otherwise. A brief description of these structures follows.

Description

Safeguards Building

The Safeguards Building is a Seismic Class I structure that contains the outside recirculation spray pumps, the low-head safety injection pumps, and the associated pipe tunnel. The Safeguards Building is a reinforced concrete structure, founded on a reinforced concrete mat, with three exterior walls and a fourth wall that is a common wall with Containment.

The exterior walls and roof are heavy reinforced concrete structures built to resist missiles. Twenty-four-inch service water lines that run in a separate cubicle in Unit 2 are part of the Safeguards Building.

Roof openings with concrete hatches are provided for the removal of equipment.

Main Steam Valve House

The Main Steam Valve House is a Seismic Class I reinforced concrete structure supported by a reinforced concrete mat.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

The structure is adjacent to the Containment and the cable vault. It has a concrete roof slab and an intermediate concrete floor slab. Both the intermediate floor and roof slabs are supported by structural steel framing and are cast against permanent metal deck formwork.

The main steam and feed water systems occupy the volume provided by the extended upper story. Intermediate and light steel framing is provided above for access platforms and walkways around the main steam isolation valves. Roof openings are provided for the removal of equipment from the Main Steam Valve House.

The roof openings have concrete hatches.

Quench Spray Pump House

The Quench Spray Pump House is a Seismic Class I Structure. The Quench Spray Pump House consists of Quench spray and refueling water recirculation pump areas.

The Quench Spray Pump House is a reinforced concrete structure with exterior walls supported by a reinforced concrete mat. The structure is open to the exterior of the Containment and is adjacent to the Main Steam Valve House and Safeguards Building. It has a metal deck roof and an intermediate concrete floor slab. The intermediate floor slab is supported by structural steel framing and is cast against permanent metal deck formwork.

Fuel Oil Pump House

The Fuel Oil Pump House is a Seismic Class I structure that is common to both units. The Fuel Oil Pump House consists of two reinforced concrete cubicles that house the diesel generator fuel oil supply pumps. An interior reinforced concrete wall divides the Fuel Oil Pump House into two cubicles.

A motor control center room is also part of the Fuel Oil Pump House. The Fuel Oil Pump House is constructed at ground grade.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Auxiliary Feedwater Pump House

The Auxiliary Feedwater Pump House is a concrete structure and is divided into two cubicles. One cubicle houses the two motor-driven auxiliary feedwater pumps and the other cubicle contains one turbine-driven auxiliary feedwater pump. The Auxiliary Feedwater Pump House is a single-story building founded at grade. The two cubicles are separated by a concrete wall, which is part of the Auxiliary Feedwater Pump House. The Auxiliary Feedwater Pump House is a tornado-missile protected structure. There are missile protected concrete hatches in the roof openings. An auxiliary feedwater tunnel runs between the Auxiliary Feedwater Pump House and the Quench Spray Pump House.

Auxiliary Feedwater Tunnel

A reinforced concrete tunnel runs between the Quench Spray Pump House and the Auxiliary Feedwater Pump House. The tunnel carries the auxiliary feedwater pump piping and other safeguards piping. The tunnel is located below grade and is seismic and tornado missile protected. Missile-protected manholes are provided at grade elevation.

Casing Cooling Pump House

The Casing Cooling Pump House is a reinforced concrete structure, constructed on a common mat foundation with the casing cooling tank. The mat is founded directly on bedrock. The pump house provides a weather-protected enclosure for the casing cooling systems, motors, and other equipment. The roof consists of a concrete slab on metal decking that is supported by a structural steel frame.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Service Water Pump House

Service Water Pump House is provided to house service water system equipment for both units. The building is built of reinforced concrete walls with a mat foundation, and it is located at the edge of the service water reservoir. Missile barriers are provided between the service water pumps. The structure also has missile-protected concrete roof openings.

Service Water Pipe Expansion Joint Enclosure

The service water expansion joint enclosure is a single-story reinforced concrete structure. The floor slab is concrete on grade, and the reinforced concrete walls are supported on concrete footing. The reinforced concrete roof slab and exterior walls act as missile barriers. The roof has a missile-protected steel manhole cover for access to the building.

Service Water Valve House

The Service Water Valve House is a reinforced concrete structure that provides shelter and protection for both units service water valves and related equipment. It has missile-protected concrete roof openings. A reinforced concrete expansion joint access pit is located along the north side of the Service Water Valve House. This pit serves to enclose, protect, and provide access to the two 36-inch pressure balanced expansion joints in the service water return headers entering the valve house.

Service Water Tie-in Vault

A reinforced concrete vault is provided to tie-in to the original buried service water lines and to protect the four service water headers, four new service water line expansion joints, and two new access ports from adverse effects of tornado generated missiles and effects due to earthquake induced ground motion.

The tie-in vault houses the four pressure-balanced expansion joints and pipe access hatches. Platforms are provided for gaining access to the pipe access hatches. A manhole opening with a steel manhole cover is located in the vault roof for personnel access into the tie-in vault. A removable equipment concrete hatch is provided for construction and permanent access for equipment installation and removal.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

UFSAR Reference

Additional information about the Other Class I Structures is provided in the following UFSAR Sections:

Safeguards Building - Section 3.8.1.1.1

Main Steam Valve House - Section 3.8.1.1.1 and Section 9.5.1.3.1.10

Quench Spray Pump House - Section 3.8.1.1.1 and Section 9.5.1.3.1.11

Fuel Oil Pump House - Section 3.8.1.1.10 and Section 9.5.1.3.1.2

Auxiliary Feedwater Pump House - Section 9.5.1.3.1.3

Auxiliary Feedwater Tunnel - Section 3C.5.4.9

Casing Cooling Pump House - Section 3.8.1.1.12

Service Water Pump House - Section 3.8.1.1.7 and Section 9.2.1.2.4

Service Water Valve House - Section 3.8.1.1.13 and Section 9.2.1.2.4.1

Service Water Tie-in Vault - Section 3.8.1.1.14 and Section 9.2.1.2.4.2

Components Subject to AMR

The Other Class I Structures structural members that require aging management review are indicated in the following Tables along with their passive function(s):

Table 2.4.3-1, Other Class I Structures — Safeguards Building

Table 2.4.3-2, Other Class I Structures — Main Steam Valve House

Table 2.4.3-3, Other Class I Structures — Quench Spray Pump House

Table 2.4.3-4, Other Class I Structures — Fuel Oil Pump House

Table 2.4.3-5, Other Class I Structures — Auxiliary Feedwater Pump House

Table 2.4.3-6, Other Class I Structures — Auxiliary Feedwater Tunnel

Table 2.4.3-7, Other Class I Structures — Casing Cooling Pump House

Table 2.4.3-8, Other Class I Structures — Service Water Pump House

Table 2.4.3-9, Other Class I Structures — Service Water Pipe Expansion Joint Enclosure

Table 2.4.3-10, Other Class I Structures — Service Water Valve House

Table 2.4.3-11, Other Class I Structures — Service Water Tie-in Vault

The aging management review results for these components are provided in Section 3.5.3, Other Class I Structures.

2.4.4 Fuel Building

Description

The Fuel Building contains the following major structures:

- Fuel Building structure
- New fuel storage area
- Spent fuel pool, including transfer canals
- Spent fuel storage racks

For the remainder of the LRA discussion of the Fuel Building, the term Fuel Building is understood to include the Fuel Building structure, the new fuel storage area, the spent fuel pool (including transfer canals), and the spent fuel storage racks, unless specified otherwise. The following paragraphs provide a brief description of these structures.

Fuel Building structure

The Fuel Building is a Seismic Class 1 structure that is common to both units. The license renewal intended function of the Fuel Building is to provide support and shelter to the safety-related and non-safety-related equipment that is within the scope of license renewal.

The Fuel Building structure is supported by a reinforced concrete mat, which is founded on bedrock.

The enclosing exterior walls extend from the top of the mat to the top of the fuel pool. The Fuel Building structure consists of intermediate reinforced concrete floor slabs, beams, interior walls, and masonry walls. The reinforced concrete pipe tunnel is supported on the top of the mat.

The Fuel Building superstructure extends from the top of the concrete walls to the roof and is enclosed with insulated metal siding. Blow-off metal siding is also used. The roof is covered with insulated metal decking and a single-ply, mechanically attached membrane roofing system. The superstructure walls and the roof of the Fuel Building are supported on structural steel framing. The platforms, walkways, and stairs are also supported on structural steel framing.

New Fuel Storage Area

The new fuel storage area is located in the Fuel Building and is designed to support new fuel storage assemblies (guide tubes). The stainless steel guide tubes are attached to structural steel members, which are attached to the concrete floor.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Spent Fuel Pool, including Transfer Canals

The spent fuel pool receives spent fuel from the Containment through the fuel transfer tubes, which enter the transfer canals on the east and west ends of the Fuel Building. The fuel pool and the fuel transfer canals are Seismic Class 1 reinforced concrete structures, lined inside with stainless steel plates, that are butt-welded together to protect against loss of water. The transfer canal can be isolated from the rest of the spent fuel pool via movable stainless steel gates.

The spent-fuel pool contains a stainless steel lined reinforced concrete wall, which separates the spent-fuel cask area from the spent-fuel storage racks.

Spent Fuel Storage Racks

The spent fuel storage racks are high-density racks that are submerged in treated water (borated water) in the spent fuel pool. The racks are free-standing but laterally restrained at the floor and are resting on the floor's support pads, which are integrally connected to the embedded plates. The spent fuel storage racks are designed as Seismic Class 1 structures.

UFSAR Reference

Additional information about the Fuel Building is provided in Section 3.8.1.1.4, Section 3.8.1.4.7, Section 9.1.1, Section 9.1.2, Section 9.1.3, Section 9.1.4.3.2, Section 9.4.5, Table 3.2-1, Appendix 9A, and Appendix 9B of the UFSAR.

Components Subject to AMR

The Fuel Building's structural members that require aging management review are indicated in Table 2.4.4-1, Fuel Building, along with their passive function(s).

The aging management review results for these components are provided in Section 3.5.4, Fuel Building.

The aging management review results for the fuel transfer tube penetration are provided in Section 3.5.1, Containment.

2.4.5 Miscellaneous Structures

The following structures are addressed in this section:

- Turbine Building
- Service Building
- Station Blackout (SBO) Building

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- Security Diesel Building

For the remainder of the LRA discussion of the Miscellaneous Structures, the term miscellaneous structures is understood to include the Turbine Building, the Service Building, the SBO Building, and the Security Diesel Building, unless specified otherwise. A brief description of these structures follows.

Description

Turbine Building

The Turbine Building is a non-safety-related structure; however, the portion of the Turbine Building that is adjacent to the main control room has been designed for tornado wind load to prevent its collapse on the main control room.

One wall of the Turbine Building is shared with a portion of the Service Building, which contains safety-related equipment. The operating floor of the Turbine Building is an open area that serves both Unit 1 and Unit 2. Below the operating floor, a block wall separates Units 1 and 2.

The Turbine Building is a steel-framed structure founded on reinforced concrete footings and grade beams. The below-grade portions of the exterior walls are constructed of concrete, and the above-grade portions are constructed of metal siding. The roof is constructed of metal decking covered with a roof membrane. The operating floor is constructed of reinforced concrete supported on steel framing. The mezzanine level and platforms are steel-framed with floors of concrete or metal grating. Stairways between floors are constructed of metal grating. Flood protection barriers, fire doors, fire barrier penetrations, and fire barrier seals are provided to protect safety-related equipment. The exterior concrete block walls are protected from atmospheric weather.

Service Building

The Service Building is adjacent to the Auxiliary Building, and the Turbine Building and serves both Units 1 and 2. The Service Building is a multi-story structure, which is divided into several rooms and cubicles. The following rooms and cubicles within the Service Building protect safety-related equipment, as well as non-safety-related equipment that can affect safety-related equipment:

- Emergency switchgear and relay rooms
- Control room
- Emergency diesel-generator rooms
- Battery rooms

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- Cable tray rooms
- Cable vault (at column line E)
- Normal switchgear rooms
- Stairwell
- Technical support center
- AC chiller rooms [North Anna-specific name - functionally equivalent to Surry MER-3.]
- Mechanical Equipment Rooms [North Anna-specific name - functionally equivalent to Surry MER-1 and MER-2.]
- Instrument Repair Shop

The emergency switchgear and relay rooms, battery rooms, cable vault, diesel generator rooms, AC chiller rooms, and the control room are Seismic Class 1 structures. The cable tray rooms, normal switchgear rooms, technical support center, mechanical equipment rooms, and stairwell are all non-safety structures. The cable tray rooms and the normal switchgear rooms house the SBO equipment and components. The technical support center protects essential fire-protection-related components, and the stairwell provides access to fire protection equipment.

The Instrument Repair Shop protects essential fire protection components.

The Service Building is founded on reinforced concrete piers, spread footings, and grade beams. The Service Building flooring consist of slabs on grade and intermediate floors, some of which provide radiation shielding. All structural floor slabs are cast on permanent metal deck forms supported by structural steel framing. Thick reinforced concrete walls surround the cubicles providing tornado missile protection. Flood protection barriers, fire and EQ doors, fire barriers, including penetration seals, are provided to protect safety-related equipment. The roof over the mechanical equipment rooms and the normal switchgear room is constructed of metal decking covered with a roof membrane. The exterior concrete block walls are protected from atmospheric weather.

The Control Room has a suspended luminous ceiling of aluminum panels. The panels are supported by aluminum tee-bars, which are hung from the control room ceiling by carbon steel wires. The panels are tied together with stainless steel clips, which provide adequate restraint for the panels in a seismic event.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Station Blackout Building

The Station Blackout (SBO) Building is a one-story non-safety and non-seismic structure. The SBO Building houses the AAC diesel generator and its associated auxiliaries, which are non-safety but provide alternate power to the safe shutdown equipment in Units 1 and 2 in the event of a station blackout.

The SBO Building structure is founded on reinforced concrete piers and spread footings. The SBO Building structure consists of concrete-grade floor slab and steel-framed structures with the lower portions of the exterior walls constructed of concrete and the upper portions of metal siding. The roof is constructed of metal decking covered with a roof membrane.

Security Diesel Building

The Security Diesel Building is a one-story, non-safety and non-seismic structure that houses the security diesel generator.

UFSAR Reference

Additional information about the Miscellaneous Structures is provided in the following UFSAR Sections:

Turbine Building - Section 3.8.1.1.11 and Section 9.4.4

Service Building - Section 3.8.1.1.5 and Section 9.4.7

Control Room and Relay Rooms - Section 3.8.1.1.5 and Section 9.4.1

Diesel-Generator Rooms - Section 3.8.1.1.5

Battery Rooms - Section 3.8.1.1.5

Cable Vault - Section 3.8.1.1.2

Cable Tray Rooms - Section 3.8.1.1.5

Normal Switchgear Rooms - Section 3.8.1.1.5

Technical Support Center - Section 7.8 and Section 13.3

AC Chiller Rooms - Section 9.4.1.2

Components Subject to AMR

The Miscellaneous Structures structural members that require aging management review are indicated in the following Tables along with their passive function(s):

Table 2.4.5-1, Miscellaneous Structures — Turbine Building

Table 2.4.5-2, Miscellaneous Structures — Service Building

Table 2.4.5-3, Miscellaneous Structures — SBO Building

Table 2.4.5-4, Miscellaneous Structures — Security Diesel Building

The aging management review results for these components are provided in Section 3.5.5, Miscellaneous Structures.

2.4.6 Intake Structures

The following structures are addressed in this section:

- Intake structure (including the circulating water intake tunnel header, Auxiliary Service Water Pump House, Fire Pump House, and Intake Structure Control House)
- Discharge Tunnels and Seal Pit

For the remainder of the LRA discussion of the Intake Structures, the term Intake Structures is understood to include the Intake Structure (including the intake tunnel header, Auxiliary Service Water Pump House, Fire Pump House, and Intake Structure Control House), and the discharge tunnels and seal pit, unless specified otherwise. A brief description of these structures follows.

Description

Intake Structure (including the intake tunnel header, Auxiliary Service Water Pump House, Fire Pump House, and Intake Structure Control House)

The Intake Structure is located on the shore of the North Anna reservoir (Lake Anna). Circulating water is withdrawn from the North Anna reservoir into the Intake Structure to provide cooling water for the main condensers for Units 1 and 2. Before entering the Intake Structure, the inlet water passes through a trash rack and traveling screen located at the mouth of each bay, or screenwell, which provides a physical barrier to debris contained in the water. The water is then pumped into the intake tunnel, via the intake tunnel header, to provide cooling water for the main condensers. Backup service water for Units 1 and 2 and make-up water for the service water reservoir is also provided from the Intake Structure, through separate water lines. The primary source of service water is the Service Water reservoir, while the North Anna reservoir is the backup.

An Auxiliary Service Water Pump House and a Fire Pump House are located on the exposed deck of the Intake Structure. Also associated with the Intake Structure is the Intake Structure Control House and the intake tunnel header.

The Intake Structure is an eight-bay (four bays per unit) reinforced concrete structure that serves both units. A reinforced concrete interior wall separates each bay. A 3-foot-thick reinforced concrete mat that is founded on natural soil supports the Intake Structure. Two reinforced concrete wing walls are installed on the waterside corners of the Intake Structure to help direct the water into the bays. The water elevation in the intake bays is dependent upon the water level of the North Anna reservoir, which is normally at Elevation 250 feet. Grade elevation in the area of the Intake Structure varies but is at approximately Elevation 264 ft. Approximately 46 feet of the Intake Structure is below grade.

The exposed deck of the Intake Structure is at Elevation 265 feet. The 2-foot-thick reinforced concrete deck provides missile protection to two service water lines and a makeup water line for the Service Water reservoir that exit the Intake Structure. Two of the access panels to the circulating water pumps, in the area of the service water lines, have three-inch steel plates installed as missile barriers to protect the service water lines.

There are a total of eight trash racks, but only the two trash racks associated with the safety-related auxiliary service water system and one trash rack associated with the auxiliary fire pump are within the scope of license renewal. The steel trash racks extend from the mat foundation up to the top of the intake structure. The trash racks are supported by wide flange steel beams, the mat foundation, and the intake structure's top slab.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

The non-safety-related reinforced concrete intake tunnel header that parallels the Intake Structure provides support for two safety-related 24-inch auxiliary service water lines, an 8-inch makeup line to the service water reservoir, and the electrical duct bank that contains the power feed to the auxiliary fire pump. The header is slightly recessed into the south side of the Intake Structure. Reinforcing bars from the intake tunnel header extend into the Intake Structure and tie the two structures together. The intake tunnel header's foundation is supported on soil and steel H-piles. The intake tunnel headers for both units share a common end wall that is located at about the centerline of the Intake Structure.

An Auxiliary Service Water Pump House (ASWPH) is located on the exposed deck of the Intake Structure. The ASWPH is a two-foot-thick reinforced concrete structure (including the floor and roof) that houses the two safety-related auxiliary service water pumps and two safety-related screen wash pumps. Two steel platforms, which provide access to the auxiliary service water piping, are located in the bay area of the Intake Structure and directly below the ASWPH.

A Fire Pump House (FPH) is located on the exposed deck of the Intake Structure. The FPH is a concrete block structure that provides shelter to the auxiliary motor-driven fire pump. The floor of the structure is the exposed deck of the Intake Structure. The FPH has a reinforced concrete roof slab. A square opening is provided in the roof for the removal of the auxiliary motor-driven fire pump. The opening has a concrete curb and is covered with metal plate, fire resistant insulation, and an aluminum cover. A built-up roof system is applied over the reinforced concrete roof slab, but is not within the scope of license renewal.

The Intake Structure Control House (ISCH) is located adjacent to the west side of the Intake Structure. The ISCH houses the electrical equipment required to operate the auxiliary motor-driven fire pump, which is in the scope of license renewal due to the fire protection regulations.

The east and west exterior walls of the ISCH are constructed of reinforced concrete. The north and south walls utilize a combination of reinforced concrete columns with a concrete block wall between the columns. The below-grade portions of the exterior walls are constructed of reinforced concrete. The structure is supported by reinforced concrete spread footings. The ISCH roof is constructed with reinforced concrete ceiling beams that are integral with a reinforced concrete ceiling slab. A built-up roof system is also installed over the ceiling slab, but is not within the scope of license renewal.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Discharge Tunnel and Seal Pit

Outlet water from the main condensers is directed to a reinforced concrete discharge tunnel. A separate discharge tunnel is provided for each unit.

The Unit 2 discharge tunnel combines with the Unit 1 discharge tunnel opposite the Unit 1 condensers to form a common tunnel. The two tunnels share an inner wall from this point to where they terminate at the seal pit. Each discharge tunnel is a reinforced concrete structure that is soil supported and has inside dimensions of 17 ft. 0 in. x 10 ft. 6 in.

UFSAR Reference

Additional information about the Intake Structures is provided in Section 10.4.2.2 of the UFSAR.

Components Subject to AMR

The Intake Structures structural members that require aging management review are indicated in the following Tables, along with their passive function(s):

Table 2.4.6-1, Intake Structures — Intake Structure

Table 2.4.6-2, Intake Structures — Discharge Tunnels and Seal Pit

The aging management review results for these components is provided in Section 3.5.6, Intake Structures.

The auxiliary service water lines that discharge into the Unit 2 discharge tunnel are evaluated for aging management with the service water system and the results are provided in Section 3.3.2, Open Water Systems.

2.4.7 Yard Structures

The following yard structures are addressed in this section:

- Tank Foundations and Missile Barriers, which include the following:
  - Buried fuel oil tank missile barrier
  - Chemical addition tank foundation
  - Emergency condensate storage tank foundation and missile barrier
  - Refueling water storage tank foundation.
  - Casing Cooling tank foundation
- Manholes

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- Fuel Oil Storage Tank Dike
- Transformer Firewalls/Dikes
- Duct banks
- Security lighting poles
- Domestic Water Treatment Building
- Auxiliary service water expansion joint enclosure
- Yard valve pit

For the remainder of the LRA discussion of the Yard Structures, the term Yard Structures is understood to include the buried fuel oil tank missile barrier, chemical addition tank foundation, emergency condensate storage tank foundation and missile barrier, refueling water storage tank foundation, casing cooling tank foundation, manholes, fuel oil storage tank dike, transformer firewalls/dikes, duct banks, security lighting poles, Domestic Water Treatment Building, auxiliary service water expansion joint enclosure, and the yard valve pit unless specified otherwise.

Description

Buried fuel oil tank missile barrier

Two underground fuel oil tanks supply fuel oil to three emergency diesel generators. A soil-supported 2-foot-thick reinforced concrete slab (missile barrier) protects the two tanks. The top of the reinforced concrete slab is sloped to provide positive drainage.

Chemical addition tank foundation.

The chemical addition tanks (CAT) are rock-supported on reinforced concrete mat foundations. Anchor bolts attach the tank to the foundation.

Emergency condensate storage tank foundation and missile barrier

The emergency condensate storage tanks are soil-supported on 4-foot-thick reinforced concrete mat foundations. A reinforced concrete missile barrier completely encapsulates each tank. The missile barrier has 2-foot-thick reinforced concrete walls, which are integral to the mat foundation, and a sloping, reinforced concrete roof. Anchor bolts attach the tank to the foundation.

A 20-inch opening, which is covered with a 600-lb. blind carbon-steel flange, is installed in the roof to provide access and missile protection to the tank.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Refueling water storage tank foundation

The refueling water storage tanks are supported on a reinforced concrete mat foundation. Anchor bolts attach the tank to the foundation.

The mat foundation consists of backfill concrete that is poured to sound rock.

Casing Cooling tank foundation

A 110,000-gallon casing cooling tank is provided for each unit. Each tank is located adjacent to its corresponding Casing Cooling Pump House. The 26-foot-diameter casing cooling tank is supported on a common concrete mat foundation with its adjacent casing cooling pump house. The foundation mat is rock-supported. Anchor bolts attach the tank to the foundation.

Manholes

The concrete manholes in the scope of license renewal are small reinforced concrete structures that are cast-in place and soil supported. The manhole structure is surrounded by backfill material and located underground. Manhole access openings occur approximately at grade level. Safety related manhole openings are protected with missile-resistant, steel manway covers.

Concrete hatches/missile barriers are installed in the roof of some of the manholes for cable installation and removal.

Fuel Oil Storage Tank Dike

The above-ground fuel oil storage tank dike in the scope of license renewal is a 12-inch thick reinforced concrete wall. The dike is sized to contain the entire capacity of the 210,000-gallon fuel oil tank. The dike is attached below grade to a soil-supported spread footing.

Transformer Firewalls/Dikes

The main and station service transformer dikes, firewalls, and crushed stone pits are in the scope of license renewal. The dike walls and crushed stone pits are sized to contain the full volume of oil from a transformer in order to prevent the oil from spreading. The dike walls are 8-inch thick concrete embedded in soil. The firewalls are 12-inch thick

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concrete walls that separate each transformer to prevent the spread of fire. The firewall is attached below grade to a soil-supported spread footing.

Duct banks

The concrete duct banks in the scope of license renewal contain reinforcing steel, unless otherwise noted, and are soil supported.

Security lighting poles.

Seventeen galvanized steel poles support floodlights that provide security lighting for operator access to various components in other buildings or structures in the yard area, which are required for Appendix R safe shutdown.

A steel base plate that is welded to the base of the pole has openings for four anchor bolts. The anchor bolts attached the pole to a 3-foot-square reinforced concrete lighting pole foundation.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Domestic Water Treatment Building

The Domestic Water Treatment Building is a one-story structure that is supported by a reinforced concrete mat foundation and enclosed with masonry block walls. The roof system consists of metal decking covered with built-up roofing. The Domestic Water Treatment Building houses the 475-gallon hydropneumatic tank associated with the fire protection system. The hydropneumatic tank is supported by the foundation mat slab; therefore, only the foundation mat slab is within the scope of license renewal.

Auxiliary service water expansion joint enclosure

An underground soil-supported reinforced concrete structure is installed adjacent to the intake structure. This structure encloses, protects, and provide access to the expansion joints which accommodate movement in the 24-inch auxiliary service water lines and the 8-inch service water make-up line.

The top of the structure is missile protected with reinforced concrete, and a manhole access opening with a missile-resistant cover is provided. Two reinforced concrete hatches are provided in the top of the structure for equipment installation and removal.

Yard valve pit

An underground soil-supported reinforced concrete valve enclosure structure is installed in line with the expansion joint enclosure structure for the two 24-inch safety-related auxiliary service water lines and the 8-inch service water make-up line. The structure encloses, protects, and provides access to valves and associated equipment connected with the three water lines.

The roof of the structure is missile protected with reinforced concrete. Three reinforced concrete hatches are provide for equipment installation and removal and personnel access to the valves. A steel platform inside the structure provides access to the valves and associated equipment.

UFSAR Reference

Additional information about the structures comprising the Yard Structures is provided in Section 6.2.2.2, Section 9.5.1.3.1.2, Section 9.5.1.4.1.2, Section 9.5.4.3, and Section 10.4.3.3 of the UFSAR.

Components Subject to AMR

The Yard Structures structural members that require aging management review are indicated in the following Tables along with their passive function(s):

Table 2.4.7-1, Yard Structures — Tank Foundations and Missile Barriers

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Table 2.4.7-2, Yard Structures — Manholes

Table 2.4.7-3, Yard Structures — Dikes and Firewalls

Table 2.4.7-4, Yard Structures — Duct Banks

Table 2.4.7-5, Yard Structures — Security Lighting Poles

Table 2.4.7-6, Yard Structures — Domestic Water Treatment Building

Table 2.4.7-7, Yard Structures — Auxiliary Service Water Expansion Joint Enclosure

Table 2.4.7-8, Yard Structures — Yard Valve Pit

The aging management review results for these components are provided in Section 3.5.7, Yard Structures.

2.4.8 Earthen Structures

The following earthen structures are addressed in this section:

- Service water reservoir
- Floodwall west of the Turbine Building

Description

The Service Water Reservoir (SWR) supports normal operation of safety related equipment and provides cooling water for plant shutdown. The SWR is the ultimate heat sink for both units. Enough water is stored in the SWR to guarantee 30 days of operation without makeup water from Lake Anna.

The purpose of the flood wall west of the Turbine Building is to provide protection from the probable maximum flood.

Service water reservoir

The service water reservoir (SWR) is an earthen structure located south of the station and more than 40 feet above plant grade. The SWR is the primary source of cooling water for plant shutdown. Technical Specification requirements ensure that a minimum 30-day supply of service water is available in the SWR for each of the two reactors operating at the site, in the event of the design basis accident.

The SWR has been constructed by diking an area between two adjacent gullies and excavating from the area behind the dikes to provide the required volume of emergency cooling water. The dike embankment has a maximum height of 35 feet with an upstream slope of 3H:1V and a downstream slope of 2H:1V. The crest of the dike is approximately 20 feet wide.

The dike embankment consists of a wide core of compacted random fill, fine and coarse filters, and a wide outside zone of compacted rockfill. On the upstream side, the core is protected by select fill (a 2-foot clay liner) that is subsequently protected against erosion with a layer of dumped rockfill. The entire bottom of the service water reservoir is also covered with a 2-foot clay liner.

On the downstream side of the core is a transition filter zone of a fine and coarse filter, which provides internal drainage and forms a transition zone between the impervious core and the compacted rockfill on the exterior portion of the dike. The rockfill extends across the crest of the dike and completely covers the downstream slope. The rockfill across the crest is covered with a coarse aggregate to form the access road around the perimeter.

A reinforced concrete apron is installed on the bottom clay liner in the Service Water Pump House intake area to prevent erosion of the liner from flowing water.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

A spray piping system is installed in the service water reservoir (SWR) to dissipate heat from the service water. An underwater bypass system is installed for winter operation. The SWR spray piping system, consisting of a braced frame superstructure, is supported by reinforced concrete foundations that are installed on the SWR clay liner. A portion of the clay liner in the vicinity of the Service Water Valve House is covered with a layer of coarse aggregate for liner erosion protection during winter bypass operation of the service water spray piping system.

Floodwall west of the Turbine Building

An earthen floodwall dike is located just west of the Unit 2 end of the Turbine Building and the Heating Boiler Room Service Building in the Unit 3 and 4 restoration area. The dike provides protection from the probable maximum flood; it will protect the station from floodwaters entering the restoration area from Lake Anna through the abandoned Unit 3 and 4 intake tunnel.

The floodwall is a homogenous dike constructed with random earthfill. The floodwall dike is approximately 20 feet high with side slopes of 2.5H:1V. A small portion of the dike is constructed (due to space restrictions) with side slopes of 2H:1V. The dike crest is approximately 30 feet wide. The dike slopes are protected from erosion with vegetation, and rip-rap is placed at the junctions of the dike fill, at the existing railroad dike, and at the existing bank near the Heating Boiler Room Service Building.

A steel culvert is installed through the dike to drain the area between the dike and the Turbine Building. The steel culvert's exterior is tape wrapped and provided with cathodic protection, and the culvert's interior has a cement-mortar liner.

UFSAR Reference

Additional information about the service water reservoir and the floodwall west of the Turbine Building is provided in Section 3.8.4 and Section 9.2.1 of the UFSAR.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Components Subject to AMR

The Earthen Structures structural members that require aging management review are indicated in the following tables, along with their passive function(s):

Table 2.4.8-1, Earthen Structures — Service Water Reservoir

Table 2.4.8-2, Earthen Structures — Floodwall West of the Turbine Building

The results of the aging management review of the earthen structures are provided in Section 3.5.8, Earthen Structures.

The safety-related SWR spray piping system is in the scope of license renewal. The concrete spread footings and the embedded portion of the anchor bolts that support the spray piping system are evaluated for aging management with the earthen structures, and the results are provided in Section 3.5.8, Earthen Structures. The aging management review results for the safety-related SWR spray piping are provided in Section 3.3.2, Open Water Systems. The SWR spray piping braced frame superstructure aging management review results are provided in Section 3.5.10, General Structural Supports.

The Service Water Pump House and Service Water Valve House, which are integral to the SWR dike embankment, are evaluated for aging management with the Other Class I Structures, and the results are provided in Section 3.5.3, Other Class I Structures.

2.4.9 NSSS Equipment Supports

Description

The Nuclear Steam Supply System (NSSS) equipment supports are the plant structures and components that support the following reactor coolant system equipment and restrain it to the surrounding reactor Containment structure:

- Reactor pressure vessel (neutron shield tank assembly)
- Reactor coolant pumps
- Steam generators
- Pressurizer

The evaluation boundary for each NSSS equipment support lies between the integral attachment on equipment being supported and its Containment concrete supporting structure.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Specifically,

- Pins, bolting, and other removable hardware that are part of the connection to the NSSS equipment integral attachment have been evaluated with the NSSS equipment supports (Section 3.5.9, NSSS Equipment Supports).
- Exposed portions of the embedded components (i.e. end portion of threaded anchor and nut) are evaluated with the NSSS equipment supports (Section 3.5.9, NSSS Equipment Supports).
- Concrete supporting structures (including the embedded portion of threaded anchor) are evaluated with the Containment structure (Section 2.4.1, Containment).
- Integral attachments for the NSSS equipment are evaluated for aging management with the specific NSSS equipment (Section 3.1.2, Reactor Vessel; Section 2.3.1.1, Reactor Coolant (RC); Section 2.3.1.5, Steam Generator; and Section 2.3.1.4, Pressurizer).

A description of the NSSS supports for the RCS components indicated above follows.

Reactor Vessel Support

Support for the reactor vessel (RV) is provided by six sliding foot assemblies that are mounted to the neutron shield tank (NST) assembly. The NST is a skirt-mounted steel tank that transfers the loading from the tank support ring to the concrete mat of the Containment structure. The tank is filled with corrosion inhibited water, which circulates through an external heat exchanger, limiting heat transfer to the concrete primary shield wall and cooling the sliding feet assemblies. The water also serves to minimize gamma and neutron heating of the concrete primary shield wall and to attenuate neutron radiation through the primary shield wall. The outer periphery of the NST contacts the primary shield wall under normal operating conditions.

The sliding foot assemblies support the RV from pads that are integral to and located beneath each of the six RV primary loop nozzles. Each pad is bolted to a sliding foot assembly that is mounted on the NST. A sliding foot assembly consists of a ball-and-socket joint mounted on a foot, which is permitted to slide only radially along the RV centerline. The sliding surface for the foot is lubricated with a low-friction lubricant (Lubrite).

A stainless steel dust cover is installed over each sliding foot assembly to prevent dust and dirt from entering onto lubricated parts.

Bolting and connection hardware for the RV support structure includes threaded bolting components, nuts, washers, and anchorage components.

Reactor Coolant Pump Support

Each reactor coolant pump (RCP) is mounted to a structural support assembly. The support assembly consists of a lower support frame that is supported from the cubicle floor by three pin-ended support columns. Lateral seismic restraint for the pump is provided by hydraulic snubbers between the pump support frame and the steam generator's lower support frame.

The design of the support frame permits low friction radial thermal expansion between the RCP feet and the lower support frame. The low friction is provided by a bronze alloy plate, impregnated with Lubrite lubricant.

Spherical bearing assemblies have been provided at the connections to allow for unrestrained rotational movement. Each bearing assembly consists of a high-grade steel ball (hard chrome plated) encased within a high-grade stainless steel socket.

Bolting and pin-connection hardware utilized in the RCP support structures include threaded bolting components, pins, nuts, washers, and anchorage components.

Steam Generator Support

Each steam generator (SG) is mounted on a structural support assembly. The support assembly consists of a lower support frame and an upper support ring. The lower support frame is a rigid structure that carries the weight of the SG and is anchored to the concrete support structure. The steam generator's upper support consists of a pair of snubbers and a pair of rigid restraints attached to the upper support ring. One end of the snubbers and rigid struts are attached to embedded plates on the SG cubicle through the clevis and pin arrangements. Bronze alloy plate, impregnated with Lubrite lubricant, provides low-friction thermal expansion between the SG and its lower support frame.

Spherical bearing assemblies have been provided at the connections to allow for unrestrained rotational movement. Each assembly consists of a high-grade steel ball (hard chrome plated) encased within a high-grade stainless steel socket.

The bolting and pin-connection hardware used for the SG support structures include threaded bolting components, pins, nuts, washers, and anchorage components.

Pressurizer Support

The pressurizer (PZR) structural support assembly consists of a rigid support ring girder supported by rods. Lateral restraint is provided by a plate assembly and gapped rigid restraints.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

The lower PZR support arrangement includes a rigid support ring girder bolted to the PZR skirt. The support ring girder is suspended from the building structure. At the upper PZR casing lugs, lateral restraint against dynamic loads is provided by gapped rigid restraints.

Bolting and pin-connection hardware used in the PZR support structures include threaded bolting components, pins, nuts, washers, and visible anchorage components.

UFSAR Reference

Additional information about the reactor coolant system equipment supports is provided in Section 5.5.9 of the UFSAR. UFSAR Figure 5.5-7 depicts the reactor vessel support. UFSAR Figure 5.5-8 and Figure 5.5-9 depicts the steam generator and reactor coolant support assembly. UFSAR Figure 5.5-11 depicts the support assembly for the pressurizer.

Components Subject to AMR

The components of the NSSS equipment supports that require aging management review are indicated in Table 2.4.9-1, NSSS Equipment Supports along with their passive function(s).

The aging management review results for these components are provided in Section 3.5.9, NSSS Equipment Supports.

2.4.10 General Structural Supports

Description

Structural supports for mechanical and electrical components are an integral part of all plant systems. The majority of these supports are not uniquely identified, however, all structural supports exhibit similar characteristics such as design, materials of construction, environments, and anticipated stressors. Therefore, structural supports for mechanical and electrical components are evaluated as plant structural commodities across system boundaries.

The commodity evaluation applies to structural supports within the structures identified in Table 2.2-3, Structures Within the Scope of License Renewal. Major primary system component supports are addressed in Section 2.4.9, NSSS Equipment Supports. The remaining structural supports are addressed in this section, including supports for the following equipment:

- Mechanical components (pumps, tanks, fans, heat exchangers, gas bottles, etc.)
- Electrical and I&C components (cabinets, panels, junction boxes, battery racks, etc.)

- Piping (including whip restraints), tubing, and ductwork
- Cable trays and electrical conduit
- Miscellaneous equipment (fire hose racks, restraints for stored equipment, etc.)

In addition, cable trays, conduits, instrument racks, and structural frames are addressed in this section.

Some equipment is restrained or supported to prevent interaction with safety-related equipment. This equipment may not be included within the scope of license renewal, but the structural supports for the equipment are included in-scope and are subject to aging management review. Additionally, as a commodity evaluation, there are structural supports included within the evaluation boundary that, upon detailed review, would not be within the scope of license renewal.

The evaluation boundary for structural supports lies between the equipment or component being supported and the building supporting structure (concrete or structural steel). Integral attachments and welds to pressure retaining components are addressed with the specific component in other sections. In addition, embedded steel support attachments are addressed with the associated building structure.

Commodity Subcomponents Subject to an AMR

The structural support subcomponents that are subject to aging management review are the long-lived, passive structural elements of the support assembly. The results of the aging management review for the major primary system component supports are presented in Section 3.5.9, NSSS Equipment Supports. The results of the aging management review for the remaining structural supports are addressed in Section 3.5.10, General Structural Supports. The commodity groups for the general structural supports that are within the scope of license renewal and require aging management review are identified in Table 2.4.10-1, General Structural Supports, along with their intended functions.

2.4.11 Miscellaneous Structural Commodities

Description

Table 2.2-3, Structures Within the Scope of License Renewal, defines those buildings and structures (areas) containing components that perform 10 CFR 54.4(a) intended functions. These buildings and structures contain miscellaneous structural commodities, which protect safety-related equipment and equipment meeting license renewal Criterion 2 and 3. These miscellaneous structural commodities are within the scope of license renewal and are subject to aging management review.

Identified below are the miscellaneous structural commodities that have been identified as being within the scope of license renewal and subject to aging management review:

- Fire barriers
- Electrical Enclosure Commodities
- Seismic Gap Materials

Fire barriers are located in safety and non-safety buildings to protect equipment within the scope of license renewal from fire and harsh environments. Some of the fire barriers also serve as EQ zone boundaries.

Fire barriers consist of walls, floors, ceilings, doors, penetration seals, fire stops, cable tray covers, seismic-gap covers, radiant energy shields, fire wraps (including fire wrap bands), fire-dampers, and gypsum boards.

Electrical enclosure commodities include bus duct and switchgear enclosures, electrical panels and cabinets, junction, terminal, and pull boxes. The electrical panels and cabinets contain supports for electrical components located inside the enclosure. Gaskets provide a leaktight condition from weather for the junction, terminal, and pull boxes.

Seismic gaps are provided between adjacent building structures to allow for relative motion between the structures. Intrusion of foreign material into these seismic gaps is prevented by compressible filler material.

UFSAR Reference

Additional information about fire barriers is provided in UFSAR Section 9.5.1.2.4.2 and Section 9.5.1.3.1.1. Additional details about electrical enclosure commodities are provided in UFSAR Section 7.1.2.

Commodity Subcomponents Subject to an AMR

The commodity groups included in the miscellaneous structural commodities that are within the scope of license renewal and require aging management review are indicated in Table 2.4.11-1, Miscellaneous Structural Commodities along with their intended function(s). The aging management review results for these commodity groups are provided in Section 3.5.11, Miscellaneous Structural Commodities.

Fire dampers are evaluated for aging management with the ventilation systems and the results are provided in Section 3.3.6, Ventilation and Vacuum Systems.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Fire barrier walls, floors, and ceilings have been evaluated for the effects of aging with the individual structures in which they are installed and the results are provided in Section 3.5, Aging Management of Structures and Component Supports.

2.4.12 Load-handling Cranes and Devices

Description

The load-handling cranes and devices within the scope of license renewal are listed below:

- Containment polar cranes (supported by the Containment crane wall)
- Containment annulus monorails
- Containment jib cranes
- Refueling manipulator cranes
- Fuel handling bridge crane
- Spent fuel crane
- New fuel transfer elevator
- Auxiliary Building monorails

The elements of load-handling cranes and devices that are subject to aging management review are limited to those load-bearing elements that support the lift in a passive manner. This includes the structural beams, girders, columns, trolley rails, baseplates and anchors for attachment to structures, and retaining clips.

UFSAR Reference

Additional load-handling cranes and devices details are provided in Section 9.1 and Section 9.6 of the UFSAR.

Components Subject to AMR

The load-handling cranes and devices elements that are subject to aging management review are long-lived, passive structural elements that support load handling. The results of the aging management review for the load-handling cranes and devices are provided in Section 3.5.12, Load-handling Cranes and Devices. The results of the aging management review for embedded steel anchorages associated with the load-handling cranes and devices are included with the applicable structure evaluation results in Section

3.5, Aging Management of Structures and Component Supports. The elements of the load-handling cranes and devices that are within the scope of license renewal and require aging management review are identified in Table 2.4.12-1, Load Handling Cranes and Devices along with their intended functions.

2.5 Screening Results: Electrical and Instrumentation and Controls Systems

Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences.

A listing of the abbreviations used in this section is provided in Section 1.4.1.

As stated in Section 2.1.5.3, Electrical/I&C Screening, the electrical and I&C components have been screened and evaluated on a plant-wide basis rather than on a system basis. Section 2.1.5.3 identifies the following electrical/I&C component groups as performing an electrical passive function in support of system intended functions:

- Bus duct
- Cables and connectors
- Electrical penetrations

The screening results for bus duct are presented in Section 2.5.1, Bus Duct.

Cables and connectors within the scope of the Environmental Qualification (EQ) Program are the subject of time-limited aging analyses (TLAA) as described in Section 4.4, Environmental Qualification (EQ) of Electric Equipment. The screening results for non-EQ cables and connectors are provided in Section 2.5.2, Cables and Connectors.

All electrical penetration assemblies are within the scope of the EQ Program and are also the subject of a TLAA as described in Section 4.4, Environmental Qualification (EQ) of Electric Equipment.

2.5.1 Bus Duct

Description

A bus duct is a component assembly conducting electrical power between equipment using a pre-assembled raceway (enclosure) design, with conductors installed on insulated supports.

The following non-segregated bus ducts are within the scope of license renewal, with the reason indicated in parenthesis:

- The three 3000-ampacity bus ducts of Transfer Buses D, E, and F. (SBO)
- The four 1200-ampacity bus ducts of the H and J buses for each of the two units. (SR)

The non-segregated bus ducts in the scope of license renewal used at the site are the totally enclosed non-ventilated type. These bus ducts are located above the switchgear, and are connected to the top of the entry cubicles.

UFSAR Reference

Additional information about station power distribution is provided in Chapter 8 of the UFSAR.

Components Subject to AMR

The boundary of a non-segregated bus duct which is evaluated for aging management is the point at which the non-segregated passive bus duct connects with active switchgear (i.e., the bolted connections of the bus assembly to the active switchgear bus and the bolted connection of the enclosure assembly to the switchgear housing).

Table 2.5.1-1 indicates the components of a non-segregated bus duct that are in the scope of license renewal and require an aging managing review and provides a reference to the aging management review results section.

The results of the aging management review of the bus assembly and bus support assembly are provided in Section 3.6.1, Bus Duct.

The results of the aging management review of the switchgear and bus duct enclosures are provided in 3.5.11, Miscellaneous Structural Commodities.

The results of the aging management review of the external bus duct supports along the length of the enclosure are provided in Section 3.5.10, General Structural Supports.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

2.5.2 Cables and Connectors

Description

Cables, and associated connectors, provide electrical connections to specified sections of an electrical circuit to deliver system voltage and current. The insulation resistance, which precludes shorts, grounds, and unacceptable leakage currents, maintains circuit integrity.

Cables and connectors are an integral part of all plant systems. Many of these cables are not uniquely identified for each system, but all cables exhibit similar characteristics such as design, materials of construction, environments, and anticipated stressors. Therefore, cables and connectors are evaluated as commodities across system boundaries.

A cable consists of single or multiple insulated metallic conductors. The cable may also include a metallic shield that provides electromagnetic isolation of the cable from its surroundings.

UFSAR Reference

One-line diagrams depicting the electric distribution system from the switchyard to the onsite system are provided in UFSAR Figure 8.2-1.

Components Subject to AMR

Table 2.2-3, Structures Within the Scope of License Renewal, defines those buildings and structures (areas) containing components that perform 10 CFR 54.4(a) intended functions. These same areas contain the cables and connectors needed to support component intended functions. These cables and connectors are within the scope of license renewal and are subject to aging management review.

The evaluation boundary generally includes all cables and connectors in these areas to provide the complete coverage of cables and connectors in the scope of license renewal.

The following cable types require evaluation for aging management:

- Power Cables
  - Medium-voltage power (2.0 kV to 15 kV)
  - Low-voltage power (below 2.0 kV)
- Instrumentation and Control
  - Control
  - Instrumentation
  - Thermocouple

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- Communication

Table 2.5.2-1 indicates the passive function for the cables and connectors commodity group and provides a reference to the aging management review results section.

The aging management review results for the raceway and raceway supports are provided in Section 3.5.10, General Structural Supports.

The aging management review results for the electrical panels and enclosures containing cable terminations are provided in Section 3.5.11, Miscellaneous Structural Commodities.

Section 2.0 Screening Results Tables

Reactor Coolant System Screening Results Tables

Table 2.3.1-1 Reactor Coolant (RC)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bellows (RVLIS)	Provides pressure boundary	Section 3.1.1, Reactor Coolant System
Bolting	Provides pressure boundary	Section 3.1.1, Reactor Coolant System
Drip pan enclosures[1]	Provides enclosure/shelter/protection for in-scope equipment (including radiation shielding and pipe whip restraint)	Section 3.3.9, Fire Protection and Supporting Systems
Drip pans[1]	Provides enclosure/shelter/protection for in-scope equipment (including radiation shielding and pipe whip restraint)	Section 3.3.9, Fire Protection and Supporting Systems
Flame Arrestors[1]	Provides rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant	Section 3.3.9, Fire Protection and Supporting Systems
Flexible connections / hoses	Provides pressure boundary	Section 3.1.1, Reactor Coolant System
Flexible connections / hoses[1]	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Flow Elements	Provides pressure boundary, Restricts flow	Section 3.1.1, Reactor Coolant System

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

Table 2.3.1-1 Reactor Coolant (RC)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bottom Mounted Instrumentation Flux Thimble Tubes	Provides pressure boundary	Section 3.1.2, Reactor Vessel
Instrument Valve Assemblies	Provides pressure boundary	Section 3.1.1, Reactor Coolant System
Neutron Shield Tanks	Provides pressure boundary; Provides structural and/or functional support for in-scope equipment	Section 3.3.3, Closed Water Systems Section 3.5.9, NSSS Equipment Supports
Pipe[1]	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Pipe	Provides pressure boundary	Section 3.1.1, Reactor Coolant System
Pump Casings	Provides pressure boundary	Section 3.1.1, Reactor Coolant System
RCP Motor Lower Bearing Oil Coolers	Provides pressure boundary	Section 3.1.1, Reactor Coolant System
RCP Motor Stator Coolers	Provides pressure boundary	Section 3.1.1, Reactor Coolant System
RCP Motor Upper Bearing Oil Coolers	Provides pressure boundary	Section 3.1.1, Reactor Coolant System

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

Table 2.3.1-1 Reactor Coolant (RC)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Reactor Cavity Seals	Provides pressure boundary	Section 3.5.1, Containment
Restricting Orifices	Provides pressure boundary, Restricts flow	Section 3.1.1, Reactor Coolant System
Tanks[1]	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Thermowells	Provides pressure boundary	Section 3.1.1, Reactor Coolant System
Tubing	Provides pressure boundary	Section 3.1.1, Reactor Coolant System
Valve Bodies[1]	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Valve Bodies	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
		Section 3.1.1, Reactor Coolant System

1. Reactor coolant pump motor oil collection system component.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

Table 2.3.1-2 Reactor Vessels

Subcomponent	Passive Function(s)
Bottom Mounted Instrumentation Flux Thimble Tubes	Provides pressure boundary
Bottom Mounted Instrumentation Guide Tubes	Provides pressure boundary
Bottom Head Dome and Torus (and cladding)	Provides pressure boundary
Closure Head Dome and Flange (and cladding)	Provides pressure boundary
Closure Studs, Nuts, and Washers	Provides pressure boundary
Core Support Lugs	Provides structural and/or functional support for in-scope equipment
CRDM Housing Flanges	Provides pressure boundary
CRDM Housing Tubes	Provides pressure boundary
CRDM Latch Housings	Provides pressure boundary
CRDM Rod Travel Housings	Provides pressure boundary
Seal Table Fittings	Provides pressure boundary

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

Table 2.3.1-2 Reactor Vessels

Subcomponent	Passive Function(s)
Instrumentation Port Assemblies	Provides pressure boundary
Instrumentation Tubes	Provides pressure boundary
Instrumentation Tubes' Safe End	Provides pressure boundary
Lifting Lugs	Provides structural and/or functional support for in-scope equipment
Primary Nozzles and Support Pads (and cladding)	Provides pressure boundary
Primary Nozzles' Safe End	Provides pressure boundary
Refueling Seal Ledge	Provides structural and/or functional support for in-scope equipment
Seal Table	Provides pressure boundary
Vent Pipe	Provides pressure boundary

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Table 2.3.1-2 Reactor Vessels

Subcomponent	Passive Function(s)
Ventilation Shroud Support Ring	Provides structural and/or functional support for in-scope equipment
Vessel Flange and Core Support Ledge (and cladding)	Provides pressure boundary
Vessel Shell (Upper, Intermediate and Lower - and cladding)	Provides pressure boundary

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Table 2.3.1-3 Reactor Vessel Internals

Subcomponent	Passive Function(s)
Baffle and Former Assembly	Provides flow distribution, Provides structural and/or functional support for in-scope equipment
Bolting (Baffle/Former and Barrel/Former)	Provides structural and/or functional support for in-scope equipment
Control Rod Guide Tube Split Pins	Provides structural and/or functional support for in-scope equipment
Control Rod Guide Tubes	Provides structural and/or functional support for in-scope equipment
Core Barrel	Provides flow distribution, Provides structural and/or functional support for in-scope equipment
Core Barrel Holddown Spring	Provides structural and/or functional support for in-scope equipment
Head and Vessel Alignment Pins	Provides structural and/or functional support for in-scope equipment
Head Cooling Spray Nozzles	Provides flow distribution
Instrument Guide Tubes	Provides structural and/or functional support for in-scope equipment
Lower Core Plate	Provides structural and/or functional support for in-scope equipment
Lower Support Plate and Columns	Provides structural and/or functional support for in-scope equipment

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Table 2.3.1-3 Reactor Vessel Internals

Subcomponent	Passive Function(s)
Radial Support Clevis Inserts	Provides structural and/or functional support for in-scope equipment
Radial Support Keys	Provides structural and/or functional support for in-scope equipment
Secondary Support Assembly	Provides structural and/or functional support for in-scope equipment
Thermal Shield	Provides structural and/or functional support for in-scope equipment
Upper Core Plate	Provides structural and/or functional support for in-scope equipment
Upper Core Plate Alignment Pins	Provides structural and/or functional support for in-scope equipment
Upper Instrument Columns	Provides structural and/or functional support for in-scope equipment
Upper Support Column	Provides structural and/or functional support for in-scope equipment
Upper Support Plate	Provides structural and/or functional support for in-scope equipment

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Table 2.3.1-4 Pressurizers

Subcomponent	Passive Function(s)
Heater Well and Heater Sheath	Provides pressure boundary
Instrument Nozzles	Provides pressure boundary
Lower Head (and cladding)	Provides pressure boundary
Manway (includes Pad and cladding)	Provides pressure boundary
Manway Cover Bolts	Provides pressure boundary
Manway Cover w/Insert	Provides pressure boundary
Relief Nozzle (and cladding)	Provides pressure boundary
Relief Nozzle Safe End	Provides pressure boundary
Safety Nozzle (and cladding)	Provides pressure boundary
Safety Nozzle Safe End	Provides pressure boundary
Sample Line Nozzle	Provides pressure boundary

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Table 2.3.1-4 Pressurizers

Subcomponent	Passive Function(s)
Seismic Support Lugs	Provides structural and/or functional support for in-scope equipment
Shell (and cladding)	Provides pressure boundary
Spray Nozzle (and cladding)	Provides pressure boundary
Spray Nozzle Safe End	Provides pressure boundary
Spray Nozzle Thermal Sleeve[1]	Provides pressure boundary
Support Skirt and Flange	Provides structural and/or functional support for in-scope equipment
Surge Nozzle (and cladding)	Provides pressure boundary
Surge Nozzle Safe End	Provides pressure boundary
Surge Nozzle Thermal Sleeve[1]	Provides pressure boundary[1]
Upper Head (and cladding)	Provides pressure boundary

1. The thermal sleeves are a design feature which provide thermal shielding to minimize nozzle low-cycle thermal fatigue.

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Table 2.3.1-5 Steam Generators

Subcomponent	Passive Function(s)
Anti-vibration Bars	Provides structural and/or functional support for in-scope equipment
Channel Head (and cladding)	Provides pressure boundary
Channel Head Divider Plate	Provides flow distribution
Feedwater Inlet Nozzle	Provides pressure boundary
Primary Inlet and Outlet Nozzles (and cladding)	Provides pressure boundary
Primary Inlet and Outlet Nozzle Safe Ends	Provides pressure boundary
Primary Manway (includes Pad and cladding)	Provides pressure boundary
Primary Manway Cover Bolting	Provides pressure boundary
Primary Manway Cover and Insert	Provides pressure boundary
Secondary Manway (includes Pad)	Provides pressure boundary

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Table 2.3.1-5 Steam Generators

Subcomponent	Passive Function(s)
Secondary Closure Cover Bolting	Provides pressure boundary
Secondary Closure Covers	Provides pressure boundary
Secondary Side Shell Penetrations	Provides pressure boundary
Secondary Side Shell (Head, Upper Shell, Lower Shell, Transition Cone, and Girth Weld)	Provides pressure boundary
Stay Rod	Provides structural and/or functional support for in-scope equipment
Steam Flow Limiter	Restricts flow
Steam Outlet Nozzle	Provides pressure boundary
Support Pads	Provides structural and/or functional support for in-scope equipment
Tube Bundle Wrapper	Provides structural and/or functional support for in-scope equipment
Tube Plugs	Provides pressure boundary

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Table 2.3.1-5 Steam Generators

Subcomponent	Passive Function(s)
Tube Support Plates	Provides structural and/or functional support for in-scope equipment
Tubesheet (and cladding)	Provides pressure boundary
U-Tubes	Provides pressure boundary

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Engineered Safety Features Systems Screening Results Tables

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Table 2.3.2-1 Quench Spray (QS)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Filters/Strainers	Provides pressure boundary, Provides filtration	Section 3.2, Aging Management of Engineered Safety Features Systems
Flow Element	Provides pressure boundary, Restricts flow	Section 3.2, Aging Management of Engineered Safety Features Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Nozzles	Provides spray pattern	Section 3.2, Aging Management of Engineered Safety Features Systems
Pipe	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Pump Casings	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Restricting Orifices	Provides pressure boundary, Restricts flow	Section 3.2, Aging Management of Engineered Safety Features Systems
Tanks	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems

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Table 2.3.2-1 Quench Spray (QS)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Thermowells	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Tubing	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Valve Bodies	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems

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Table 2.3.2-2 Fuel Pit Cooling (FC)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Expansion Joints	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Pipe	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Pump Casings	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Spent Fuel Pit Coolers	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Thermowells	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Tubing	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Valve Bodies	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems

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Table 2.3.2-3 Recirculation Spray (RS)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Expansion Joints	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Filters/Strainers	Provides filtration, Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Flow Element	Provides pressure boundary, Restricts flow	Section 3.2, Aging Management of Engineered Safety Features Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Nozzles	Provides spray pattern	Section 3.2, Aging Management of Engineered Safety Features Systems
Pipe	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Pump Casings	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Pump Seal Coolers	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems

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Table 2.3.2-3 Recirculation Spray (RS)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Recirculation Spray Coolers	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Restricting Orifices	Provides pressure boundary, Restricts flow	Section 3.2, Aging Management of Engineered Safety Features Systems
Sump Screens	Provides filtration	Section 3.2, Aging Management of Engineered Safety Features Systems
Tanks	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Thermowells	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Tubing	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Valve Bodies	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems

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Table 2.3.2-4 Residual Heat Removal (RH)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Flow Element	Provides pressure boundary, Restricts flow	Section 3.2, Aging Management of Engineered Safety Features Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Pipe	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Pump Casings	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Pump Seal Coolers	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Residual Heat Removal Heat Exchangers	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems

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Table 2.3.2-4 Residual Heat Removal (RH)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Thermowells	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Tubing	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Valve Bodies	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems

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Table 2.3.2-5 Safety Injection (SI)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Accumulators (and cladding)	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Bolting	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Flow Element	Provides pressure boundary, Restricts flow	Section 3.2, Aging Management of Engineered Safety Features Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Pipe	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Pump Casings	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Restricting Orifices	Provides pressure boundary, Restricts flow	Section 3.2, Aging Management of Engineered Safety Features Systems
Sump Screens	Provides filtration	Section 3.2, Aging Management of Engineered Safety Features Systems

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Table 2.3.2-5 Safety Injection (SI)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Tanks	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Tubing	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems
Valve Bodies	Provides pressure boundary	Section 3.2, Aging Management of Engineered Safety Features Systems

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Auxiliary Systems Screening Results Tables

Table 2.3.3-1 Chemical and Volume Control (CH)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bellows	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Bolting	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Filters/Strainers	Provides pressure boundary, Provides filtration	Section 3.3.1, Primary Process Systems
Flexible connections	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Flow Elements	Provides pressure boundary, Restricts flow	Section 3.3.1, Primary Process Systems
Flow Orifices	Provides pressure boundary, Restricts flow	Section 3.3.1, Primary Process Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Level Indicators	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Non-Regenerative and Excess Letdown Heat Exchangers	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Pipe	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Pump Casings	Provides pressure boundary	Section 3.3.1, Primary Process Systems

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Table 2.3.3-1 Chemical and Volume Control (CH)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Pump Lube Oil Coolers	Provides for heat transfer, Provides pressure boundary	Section 3.3.1, Primary Process Systems
RCP Seal Water Heat Exchangers	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Regenerative Heat Exchangers	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Restricting Orifices	Provides pressure boundary, Restricts flow	Section 3.3.1, Primary Process Systems
Tanks	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Thermowells	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Tubing	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Valve Bodies	Provides pressure boundary	Section 3.3.1, Primary Process Systems

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Table 2.3.3-2 High Radiation Sampling System (HRSS)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Pipe	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Valve Bodies	Provides pressure boundary	Section 3.3.1, Primary Process Systems

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Table 2.3.3-3 Incore Instrumentation (IC)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Seal Table	Provides pressure boundary	Section 3.1.2, Reactor Vessel
Seal Table Fittings	Provides pressure boundary	Section 3.1.2, Reactor Vessel
Bottom Mounted Instrumentation Guide Tubes	Provides pressure boundary	Section 3.1.2, Reactor Vessel
Valve Bodies	Provides pressure boundary	Section 3.3.1, Primary Process Systems

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Table 2.3.3-4 Refueling Purification (RP)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Pipe	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Valve Bodies	Provides pressure boundary	Section 3.3.1, Primary Process Systems

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Table 2.3.3-5 Sampling System (SS)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Pipe	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Sample Coolers	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Tubing	Provides pressure boundary	Section 3.3.1, Primary Process Systems
Valve Bodies	Provides pressure boundary	Section 3.3.1, Primary Process Systems

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Table 2.3.3-6 Service Water (SW)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Service Water Instrument Air Receivers	Provides pressure boundary	Section 3.3.2, Open Water Systems
Corrosion Rate Monitor	Provides pressure boundary	Section 3.3.2, Open Water Systems
Expansion Joints	Provides pressure boundary	Section 3.3.2, Open Water Systems
Filters/Strainers	Provides filtration, Provides pressure boundary	Section 3.3.2, Open Water Systems
Flexible Connections	Provides pressure boundary	Section 3.3.2, Open Water Systems
Flow Element	Provides pressure boundary, Restricts flow	Section 3.3.2, Open Water Systems
Flow Orifices	Provides pressure boundary, Restricts flow	Section 3.3.2, Open Water Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.3.2, Open Water Systems
Instrumentation	Provides pressure boundary	Section 3.3.2, Open Water Systems
Spray Nozzles	Spray pattern	Section 3.3.2, Open Water Systems

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Table 2.3.3-6 Service Water (SW)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Pipe	Provides pressure boundary	Section 3.3.2, Open Water Systems
Pump Casings	Provides pressure boundary	Section 3.3.2, Open Water Systems
Radiation Sensors	Provides pressure boundary	Section 3.3.2, Open Water Systems
Restricting Orifices	Provides pressure boundary, Restricts flow	Section 3.3.2, Open Water Systems
Temperature Sensors	Provides pressure boundary	Section 3.3.2, Open Water Systems
Thermowells	Provides pressure boundary	Section 3.3.2, Open Water Systems
Tubing	Provides pressure boundary	Section 3.3.2, Open Water Systems
Valve Bodies	Provides pressure boundary	Section 3.3.2, Open Water Systems

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Table 2.3.3-7 Chilled Water (CD)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Filters/Strainers	Provides filtration, Provides pressure boundary	Section 3.3.3, Closed Water Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Pipe	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Valve Bodies	Provides pressure boundary	Section 3.3.3, Closed Water Systems

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Table 2.3.3-8 Component Cooling (CC)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Component Cooling Heat Exchangers	Provides for heat transfer, Provides pressure boundary	Section 3.3.3, Closed Water Systems
Expansion Joints	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Filters/Strainers	Provides filtration, Provides pressure boundary	Section 3.3.3, Closed Water Systems
Flexible Connections	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Flow Elements	Provides pressure boundary, Restricts flow	Section 3.3.3, Closed Water Systems
Flow Indicators	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Level Indicators	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Pipe	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Pipe Penetration Cooling Coils	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Pump casings	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Radiation Sensors	Provides pressure boundary	Section 3.3.3, Closed Water Systems

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Table 2.3.3-8 Component Cooling (CC)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Tanks	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Thermowells	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Tubing	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Valve Bodies	Provides pressure boundary	Section 3.3.3, Closed Water Systems

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Table 2.3.3-9 Neutron Shield Tank Cooling (NS)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Neutron Shield Tank Coolers	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Pipe	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Pump Casings	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Tanks	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Valve Bodies	Provides pressure boundary	Section 3.3.3, Closed Water Systems

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Table 2.3.3-10 Alternate AC (AAC) Diesel Generator Systems

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Accumulators	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Air Receivers	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Diesel Aftercoolers	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Diesel Fuel Oil Coolers	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Diesel Jacket Water Radiators	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Diesel Lube Oil Coolers	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Fan/Blower Housing	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Filters/Strainers	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Heaters	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Level Indicators	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Oil Pans	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Pipe	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems

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Table 2.3.3-10 Alternate AC (AAC) Diesel Generator Systems

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Pump casings	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Restricting Orifices	Provides pressure boundary, Restricts flow	Section 3.3.4, Diesel Generator Support Systems
Tanks	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Thermowells	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Tubing	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Valve Bodies	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems

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Table 2.3.3-11 Emergency Diesel Generator (EDG) Systems

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Air Receivers	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Diesel Aftercoolers	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Diesel Jacket Water Radiators	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Diesel Lube Oil Coolers	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Fan/Blower Housings	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Filters/Strainers	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Flow Orifices	Provides pressure boundary, Restricts flow	Section 3.3.4, Diesel Generator Support Systems
Heaters	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Level Indicators	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Oil Pans	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Pipe	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Pump casings	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems

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Table 2.3.3-11 Emergency Diesel Generator (EDG) Systems

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Tanks	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Thermowells	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Tubing	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Valve Bodies	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems

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Table 2.3.3-12 Security (SEC)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Diesel Jacket Water Radiators	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Diesel Lube Oil Coolers	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Fan/Blower Housing	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Heaters	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Lighting Poles	Provides structural support	Section 3.5.7, Yard Structures
Oil Pans	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Pipe	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Pump casings	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Tanks	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Tubing	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems
Valve Bodies	Provides pressure boundary	Section 3.3.4, Diesel Generator Support Systems

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Table 2.3.3-13 Compressed Air (CA)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Instrument Valve Assemblies	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Tubing	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Valve Bodies	Provides pressure boundary	Section 3.3.5, Air and Gas Systems

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Table 2.3.3-14 Instrument Air (IA)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Gas Bottles	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Hoses	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Instrument Air Compressor Coolers	Provides pressure boundary	Section 3.3.2, Open Water Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Pipe	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Tubing	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Valve Bodies	Provides pressure boundary	Section 3.3.5, Air and Gas Systems

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Table 2.3.3-15 Primary and Secondary Plant Gas Supply (GN)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Gas Bottles	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Hoses	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Pipe	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Tubing	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Valve Bodies	Provides pressure boundary	Section 3.3.5, Air and Gas Systems

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Table 2.3.3-16 Service Air (SA)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Pipe	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Valve Bodies	Provides pressure boundary	Section 3.3.5, Air and Gas Systems

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Table 2.3.3-17 Containment Vacuum (CV)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Containment Vacuum Heat Exchangers	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Pipe	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems
Valve Bodies	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems

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Table 2.3.3-18 Leakage Monitoring (LM)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems
Pipe	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems
Tubing	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems
Valve Bodies	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems

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Table 2.3.3-19 Secondary Vents (SV)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Valve Bodies[1]	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems

1. The piping associated with these components is included in the vacuum priming (VP) system.

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Table 2.3.3-20 Vacuum Priming (VP)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Pipe	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems
Valve Bodies	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems

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Table 2.3.3-21 Heating and Ventilation (HV)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
CARF HVAC Cooling Coils	Provides pressure boundary	Section 3.3.3, Closed Water Systems
CRDM HVAC Cooling Coils	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Damper Housings	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems
Ductwork	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems
ESGR HVAC Cooling Coils	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Expansion Joints	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems
		Section 3.3.2, Open Water Systems
Fan/Blower Housings	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems
Filters/Strainers	Provides pressure boundary, Provides filtration	Section 3.3.6, Ventilation and Vacuum Systems
		Section 3.3.2, Open Water Systems
Flexible connections	Provides pressure boundary	Section 3.3.2, Open Water Systems
		Section 3.3.3, Closed Water Systems

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Table 2.3.3-21 Heating and Ventilation (HV)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Flow Elements	Provides pressure boundary, Restricts flow	Section 3.3.2, Open Water Systems
		Section 3.3.3, Closed Water Systems
Heaters	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems
		Section 3.3.5, Air and Gas Systems
Instrumentation[1]	Provides pressure boundary	Section 3.3.2, Open Water Systems
		Section 3.3.3, Closed Water Systems
		Section 3.3.6, Ventilation and Vacuum Systems
Level Indicators	Provides pressure boundary	Section 3.3.3, Closed Water Systems
MCR Chiller Condensers	Provides for heat transfer, Provides pressure boundary	Section 3.3.2, Open Water Systems
MCR Chiller Evaporators	Provides pressure boundary	Section 3.3.3, Closed Water Systems
MCR HVAC Cooling Coils	Provides pressure boundary	Section 3.3.3, Closed Water Systems

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Table 2.3.3-21 Heating and Ventilation (HV)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Pipe	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
		Section 3.3.2, Open Water Systems
		Section 3.3.6, Ventilation and Vacuum Systems
Pump Casings	Provides pressure boundary	Section 3.3.2, Open Water Systems
		Section 3.3.3, Closed Water Systems
Restricting Orifices	Provides pressure boundary, Restricts flow	Section 3.3.5, Air and Gas Systems
Tanks	Provides pressure boundary	Section 3.3.3, Closed Water Systems
Thermowells	Provides pressure boundary	Section 3.3.2, Open Water Systems
Tubing	Provides pressure boundary	Section 3.3.6, Ventilation and Vacuum Systems

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Table 2.3.3-21 Heating and Ventilation (HV)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Valve Bodies	Provides pressure boundary	Section 3.3.3, Closed Water Systems
		Section 3.3.5, Air and Gas Systems
		Section 3.3.2, Open Water Systems
		Section 3.3.6, Ventilation and Vacuum Systems

1. This component group includes miscellaneous in-line instrumentation that performs a PB function.

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Table 2.3.3-22 Boron Recovery (BR)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bellows	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Bolting	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Distillate Coolers and Stripper Trim Cooler	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Filters/Strainers	Provides pressure boundary, Provides filtration	Section 3.3.7, Drain and Liquid Processing Systems
Heaters	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Overhead Condensers	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Pipe	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Pump Casings	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Stripper Vent Chillers	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Stripper Vent Condensers	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Valve Bodies	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems

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Table 2.3.3-23 Drains - Aerated (DA)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Pipe	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Valve Bodies	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems

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Table 2.3.3-24 Drains - Building Services (DB)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Pipe	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Pump Casings	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Valve Bodies	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems

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Table 2.3.3-25 Drains - Gaseous (DG)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Pipe	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Primary Drain Transfer Tank Coolers	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Valve Bodies	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems

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Table 2.3.3-26 Liquid and Solid Waste (LW)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
S/G Blowdown Heat Exchangers	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems
Valve Bodies[1]	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems

1. The piping associated with these components is included in the radwaste (RW) system.

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Table 2.3.3-27 Radwaste (RW)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Pipe[1]	Provides pressure boundary	Section 3.3.7, Drain and Liquid Processing Systems

1. The valves associated with these components are included in the liquid and solid waste (LW) system.

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Table 2.3.3-28 Post Accident Hydrogen Removal (HC)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Expansion Joints	Provides pressure boundary	Section 3.3.8, Vent and Gaseous Processing Systems
Fan/Blower Housings	Provides pressure boundary	Section 3.3.8, Vent and Gaseous Processing Systems
Filters/Strainers	Provides filtration	Section 3.3.8, Vent and Gaseous Processing Systems
Flexible Connections	Provides pressure boundary	Section 3.3.8, Vent and Gaseous Processing Systems
Flow Element	Provides pressure boundary, Restricts flow	Section 3.3.8, Vent and Gaseous Processing Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.3.8, Vent and Gaseous Processing Systems
Pipe	Provides pressure boundary	Section 3.3.8, Vent and Gaseous Processing Systems
Recombiner	Provides pressure boundary	Section 3.3.8, Vent and Gaseous Processing Systems

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Table 2.3.3-28 Post Accident Hydrogen Removal (HC)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Tanks	Provides pressure boundary	Section 3.3.8, Vent and Gaseous Processing Systems
Tubing	Provides pressure boundary	Section 3.3.8, Vent and Gaseous Processing Systems
Valve Bodies	Provides pressure boundary	Section 3.3.8, Vent and Gaseous Processing Systems

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Table 2.3.3-29 Radiation Monitoring (RM)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Pipe	Provides pressure boundary	Section 3.3.8, Vent and Gaseous Processing Systems
Valve Bodies	Provides pressure boundary	Section 3.3.8, Vent and Gaseous Processing Systems

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Table 2.3.3-30 Vents - Gaseous (VG)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Pipe	Provides pressure boundary	Section 3.3.8, Vent and Gaseous Processing Systems
Valve Bodies	Provides pressure boundary	Section 3.3.8, Vent and Gaseous Processing Systems

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Table 2.3.3-31 Fire Protection (FP)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
CO2 Tank Cooling Coils	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Compressor Casings	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Filters/Strainers	Provides filtration, Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Fire Hydrants	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Flame Arrestors	Provides rated fire barrier to confine or retard a fire from spreading to or from adjacent areas of the plant	Section 3.3.9, Fire Protection and Supporting Systems
Flexible connections	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Flow Orifices	Provides pressure boundary, Restricts flow	Section 3.3.9, Fire Protection and Supporting Systems
Gas Bottles	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Hose Racks	Provides structural support	Section 3.5.10, General Structural Supports
Instrument Valve Assemblies	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Level Indicators	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Nozzles	Provides spray pattern	Section 3.3.9, Fire Protection and Supporting Systems

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Table 2.3.3-31 Fire Protection (FP)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Pipe	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Pump Casings	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Diesel Fire Pump Radiators	Provides for heat transfer, Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Rupture Disks	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Sprinkler heads	Provides pressure boundary, Provides spray pattern	Section 3.3.9, Fire Protection and Supporting Systems
Tanks	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Tubing	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems
Valve Bodies	Provides pressure boundary	Section 3.3.9, Fire Protection and Supporting Systems

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Steam and Power Conversion Systems Screening Results Tables

Text enclosed in border indicates technical information specific to **NORTH ANNA.**

Table 2.3.4-1 Auxiliary Steam (AS)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Valve Bodies[1]	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems

1. The piping associated with these components is included in the main steam (MS) system.

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Table 2.3.4-2 Blowdown (BD)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Flow Elements	Provides pressure boundary, Restricts flow	Section 3.4, Aging Management of Steam and Power Conversion Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Pipe	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
S/G Blowdown Vent Condensers	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Tubing	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Valve Bodies	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems

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Table 2.3.4-3 Condensate (CN)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Instrument Valve Assemblies	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Pipe	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Tanks	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Tubing	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems

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Table 2.3.4-4 Feedwater (FW)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Filters/Strainers	Provides pressure boundary, Provides filtration	Section 3.4, Aging Management of Steam and Power Conversion Systems
Flow Elements	Provides pressure boundary, Restricts flow	Section 3.4, Aging Management of Steam and Power Conversion Systems
Gas Bottles	Provides pressure boundary	Section 3.3.5, Air and Gas Systems
Instrumentation	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Pipe	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Pump Casings	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Pump Lube Oil Coolers	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Restricting Orifices	Provides pressure boundary, Restricts flow	Section 3.4, Aging Management of Steam and Power Conversion Systems
Tanks	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems

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Table 2.3.4-4 Feedwater (FW)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Tubing	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
		Section 3.3.5, Air and Gas Systems
Turbine Casings	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Valve Bodies	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
		Section 3.3.5, Air and Gas Systems

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Table 2.3.4-5 Main Steam (MS)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Flow Elements	Provides pressure boundary, Restricts flow	Section 3.4, Aging Management of Steam and Power Conversion Systems
Instrument Valve Assemblies	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Pipe	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Steam Traps	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Tubing	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Valve Bodies	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems

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Table 2.3.4-6 Steam Drains (SD)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Pipe	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems

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Table 2.3.4-7 Steam Generator Water Treatment (WT)

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bolting	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Pipe	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems
Valve Bodies	Provides pressure boundary	Section 3.4, Aging Management of Steam and Power Conversion Systems

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Structures Screening Results Tables

Table 2.4.1-1 Containment

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Access doors		SSR					SNS				
Columns		SSR					SNS				
Columns and baseplates		SSR					SNS				
Concrete beams		SSR					SNS				
Concrete blocks (shielding)			EN								
Concrete dikes							SNS	FLB			
Concrete jet impingement barriers										JIS	
Containment dome		SSR	EN	FB		MB	SNS				EQB
Containment dome plug							SNS				
Containment liner	PB	SSR									
Containment sump liner	PB[5]	SSR									
Containment sump trash racks							SNS				

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See Section 1.4.2 for function code definitions.

Table 2.4.1-1 Containment

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Containment wall (exterior)	PB	SSR	EN	FB		MB	SNS				EQB
Door locking mechanism[1]	PB						SNS				
Electrical penetration sleeves	PB	SSR									
Embedded steel		SSR					SNS				
Equipment hatch	PB	SSR	EN			MB					EQB
Equipment hatch air lock doors	PB	SSR	EN			MB					EQB
Equipment hatch platform		SSR									
Equipment pads		SSR					SNS				
Expansion joint[2]	PB						SNS				
Flood curbs and barriers							SNS	FLB			
Floor slabs		SSR	EN			MB	SNS				
Footing and grade beam		SSR									
Foundation mat slabs		SSR					SNS				

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See Section 1.4.2 for function code definitions.

Table 2.4.1-1 Containment

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Fuel transfer tube	PB	SSR									
Fuel transfer tube enclosure protection shield			EN				SNS				
Fuel transfer tube gate valve	PB[3]						SNS				
Grout		SSR					SNS				
Hinges and pins[1]	PB	SSR									
Mechanical penetrations	PB	SSR									
Missile barriers (internal)		SSR	EN			MB					
Missile shields		SSR				MB					
Missile barrier (external)		SSR				MB					
O-rings	PB						SNS				
Personnel hatch	PB	SSR	EN	FB							EQB
Pipe[4]	PB	SSR									
Reactor cavity liner	PB[5]						SNS				

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See Section 1.4.2 for function code definitions.

Table 2.4.1-1 Containment

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Reactor cavity seal	PB[5]						SNS				
Spare penetrations	PB	SSR									
Stairs, platforms, grating, and ladders (including supports)		SSR					SNS				
Steel beams		SSR					SNS				
Valve bodies[6]	PB	SSR									
Walls		SSR	EN			MB	SNS			JIS	EQB

1. Equipment hatch escape air lock outer door only.
2. Expansion joint bellows for the fuel transfer tube in the fuel transfer canal.
3. Pressure boundary for spent fuel pool integrity when the spent fuel pool keyway gates are removed during fuel handling.
4. Piping related to the pressure equalization function of the Containment access hatches.
5. Not for Containment pressure boundary, but for system pressure boundary.
6. Valves related to the pressure equalization function of the Containment access hatches.

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See Section 1.4.2 for function code definitions.

Table 2.4.2-1 Auxiliary Building Structure

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Access doors							SNS				
Bracing		SSR					SNS				
Columns		SSR					SNS				
Columns and baseplates		SSR					SNS				
Concrete beams		SSR					SNS				
Concrete blocks (shielding)		SSR	EN			MB					
Concrete dikes							SNS	FLB			
Concrete floor support framing and decking		SSR					SNS				
Concrete hatches			EN			MB	SNS				
Duct banks		SSR	EN			MB					
Embedded steel		SSR					SNS				
Equipment pads		SSR					SNS				
Flood barriers				FB			SNS	FLB			

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See Section 1.4.2 for function code definitions.

Table 2.4.2-1 Auxiliary Building Structure

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Flood curbs and barriers							SNS	FLB			
Floor slabs		SSR	EN	FB			SNS				EQB
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
Masonry block walls		SSR	EN	FB			SNS				EQB
Missile barriers (internal)		SSR				MB					
Missile protection doors		SSR				MB					
Missile shields		SSR	EN			MB					
Roof framing and decking		SSR					SNS				
Roof slabs		SSR	EN			MB	SNS				EQB
Stairs, platforms, grating, and ladders (including supports)							SNS				
Steel beams		SSR					SNS				
Steel hatches			EN				SNS				

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See Section 1.4.2 for function code definitions.

Table 2.4.2-1 Auxiliary Building Structure

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Walls		SSR	EN	FB		MB	SNS	FLB			EQB
Walls (external)		SSR	EN	FB		MB	SNS				EQB

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See Section 1.4.2 for function code definitions.

Table 2.4.3-1 Other Class I Structures — Safeguards Building

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Bracing		SSR					SNS				
Columns		SSR					SNS				
Columns and baseplates		SSR					SNS				
Concrete beams		SSR					SNS				
Concrete floor support framing and decking		SSR					SNS				
Concrete hatches		SSR	EN			MB	SNS				
Embedded steel		SSR					SNS				
Equipment pads		SSR					SNS				
Floor slabs		SSR	EN				SNS				
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
Roof framing and decking		SSR					SNS				
Roof slabs		SSR	EN			MB	SNS				

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See Section 1.4.2 for function code definitions.

Table 2.4.3-1 Other Class I Structures — Safeguards Building

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Stairs, platforms, grating, and ladders (including supports)							SNS				
Steel beams		SSR					SNS				
Walls		SSR					SNS				
Walls (external)		SSR		FB		MB	SNS				EQB

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See Section 1.4.2 for function code definitions.

Table 2.4.3-2 Other Class I Structures — Main Steam Valve House

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Access doors			EN				SNS				
Bracing		SSR					SNS				
Columns		SSR					SNS				
Columns and baseplates		SSR					SNS				
Concrete beams		SSR					SNS				
Concrete floor support framing and decking		SSR					SNS				
Concrete hatches		SSR	EN	FB		MB	SNS				
Embedded steel		SSR					SNS				
Equipment pads		SSR					SNS				
Floor slabs		SSR		FB			SNS	FLB[1]			
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
Masonry block walls		SSR	EN				SNS				

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See Section 1.4.2 for function code definitions.

Table 2.4.3-2 Other Class I Structures — Main Steam Valve House

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Missile protection doors		SSR				MB					
Roof framing and decking		SSR					SNS				
Roof slabs		SSR	EN			MB	SNS				
Stairs, platforms, grating, and ladders (including supports)							SNS				
Steel beams		SSR					SNS				
Walls		SSR		FB			SNS				
Walls (external)		SSR	EN	FB		MB	SNS	FLB[2]		JIS	EQB

1. The floor penetration seals perform a flood barrier intended function.
2. Some exterior walls are designated as flood barrier walls since they have penetration seals that perform a flood barrier intended function.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.3-3 Other Class I Structures — Quench Spray Pump House

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Access doors			EN								
Bracing		SSR					SNS				
Columns		SSR					SNS				
Columns and baseplates		SSR					SNS				
Concrete beams		SSR					SNS				
Concrete floor support framing and decking		SSR					SNS				
Concrete hatches			EN				SNS				
Embedded steel		SSR					SNS				
Equipment pads		SSR					SNS				
Floor slabs		SSR	EN			MB	SNS				
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
Roof framing and decking		SSR					SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.3-3 Other Class I Structures — Quench Spray Pump House

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Stairs, platforms, grating, and ladders (including supports)							SNS				
Steel beams		SSR					SNS				
Walls		SSR		FB			SNS				
Walls (external)		SSR	EN	FB			SNS	FLB[1]			EQB

1. Some exterior walls are designated as flood barrier walls since they have penetration seals that perform a flood barrier intended function.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.3-4 Other Class I Structures — Fuel Oil Pump House

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Equipment pads		SSR					SNS				
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
Roof slabs		SSR				MB	SNS				
Slabs on grade		SSR					SNS				
Walls		SSR		FB			SNS				
Walls (external)		SSR		FB		MB					

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.3-5 Other Class I Structures — Auxiliary Feedwater Pump House

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Columns		SSR					SNS				
Concrete beams		SSR					SNS				
Concrete hatches		SSR				MB	SNS				
Equipment pads		SSR					SNS				
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
Roof slabs		SSR				MB	SNS				
Walls		SSR		FB			SNS				
Walls (external)		SSR		FB		MB	SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.3-6 Other Class I Structures — Auxiliary Feedwater Tunnel

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Equipment pads		SSR					SNS				
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
Manway covers		SSR				MB	SNS				
Roof slabs		SSR				MB	SNS				
Steel beams		SSR					SNS				
Walls (external)		SSR					SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.3-7 Other Class I Structures — Casing Cooling Pump House

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Columns		SSR					SNS				
Columns and baseplates		SSR					SNS				
Concrete beams		SSR					SNS				
Equipment pads		SSR					SNS				
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
Roof framing and decking							SNS				
Roof slabs							SNS				
Steel beams		SSR					SNS				
Walls (external)		SSR					SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.3-8 Other Class I Structures — Service Water Pump House

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Bracing		SSR					SNS				
Columns		SSR					SNS				
Columns and baseplates		SSR					SNS				
Concrete beams		SSR					SNS				
Concrete floor support framing and decking		SSR					SNS				
Concrete hatches		SSR				MB	SNS				
Embedded steel		SSR					SNS				
Equipment pads		SSR					SNS				
Floor slabs		SSR					SNS				
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
Missile protection doors		SSR				MB					
Roof framing and decking		SSR					SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.3-8 Other Class I Structures — Service Water Pump House

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Roof slabs		SSR				MB	SNS				
Steel beams		SSR					SNS				
Walls		SSR					SNS				
Walls (external)		SSR				MB	SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.3-9 Other Class I Structures — Service Water Pipe Expansion Joint Enclosure

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Manway covers		SSR				MB					
Roof slabs		SSR				MB					
Slabs on grade		SSR									
Walls (external)		SSR				MB					

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.3-10 Other Class I Structures — Service Water Valve House

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Columns		SSR					SNS				
Columns and baseplates		SSR					SNS				
Concrete beams		SSR					SNS				
Concrete floor support framing and decking		SSR					SNS				
Concrete hatches		SSR				MB	SNS				
Equipment pads		SSR					SNS				
Floor slabs		SSR					SNS				
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
Missile protection doors		SSR				MB					
Roof framing and decking		SSR					SNS				
Roof slabs		SSR				MB	SNS				
Stairs, platforms, grating, and ladders (including supports)							SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.3-10 Other Class I Structures — Service Water Valve House

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Steel beams		SSR					SNS				
Walls		SSR					SNS				
Walls (external)		SSR				MB	SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.3-11 Other Class I Structures — Service Water Tie-in Vault

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Columns and baseplates		SSR					SNS				
Concrete hatches		SSR				MB	SNS				
Equipment pads		SSR					SNS				
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
Manway covers		SSR				MB	SNS				
Roof framing and decking		SSR					SNS				
Roof slabs		SSR				MB	SNS				
Stairs, platforms, grating, and ladders (including supports)							SNS				
Steel beams		SSR					SNS				
Walls		SSR					SNS				
Walls (external)		SSR				MB	SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.4-1 Fuel Building

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Blow-off metal siding			EN								
Bracing		SSR					SNS				
Columns and baseplates		SSR					SNS				
Concrete beams		SSR					SNS				
Embedded steel		SSR					SNS				
Equipment pads		SSR					SNS				
Floor slabs		SSR	EN				SNS				
Foundation mat slabs		SSR	EN				SNS				
Grout		SSR					SNS				
Masonry block walls			EN				SNS				
New fuel racks assembly		SSR	EN								
Roof framing and decking		SSR					SNS				
Roof trusses		SSR					SNS				
Spent fuel pool liner plates	PB	SSR	EN				SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.4-1 Fuel Building

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Spent fuel storage racks		SSR	EN								
Stairs, platforms, grating, and ladders (including supports)							SNS				
Steel beams		SSR					SNS				
Steel gates or doors	PB	SSR	EN								
Walls		SSR	EN				SNS				
Walls (external)		SSR	EN	FB		MB	SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.5-1 Miscellaneous Structures — Turbine Building

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Access doors			EN				SNS				
Bracing							SNS				
Columns and baseplates							SNS				
Concrete dikes				FB			SNS	FLB			
Concrete floor support framing and decking							SNS				
Embedded steel							SNS				
Equipment pads							SNS				
Expansion joint							SNS				
Flood barriers							SNS	FLB			
Floor slabs							SNS				
Footing and grade beam							SNS				
Grout							SNS				
Masonry block walls				FB			SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.5-1 Miscellaneous Structures — Turbine Building

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Roof framing and decking							SNS				
Roof trusses							SNS				
Slabs on grade							SNS				
Stairs, platforms, grating, and ladders (including supports)							SNS				
Steel beams							SNS				
Walls				FB			SNS				
Walls (external)							SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.5-2 Miscellaneous Structures — Service Building

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Access doors		SSR	EN				SNS				
Bracing		SSR					SNS				
Columns and baseplates		SSR					SNS				
Concrete dikes				FB			SNS	FLB			
Concrete floor support framing and decking		SSR					SNS				
Control room ceiling							SNS				
Control room ceiling supports							SNS				
Embedded steel		SSR					SNS				
Equipment pads		SSR					SNS				
Exhaust penthouse roof slabs and walls		SSR	EN			MB					
Expansion joint							SNS				
Flood barriers							SNS	FLB			
Floor slabs	PB[1]	SSR		FB			SNS				EQB

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.5-2 Miscellaneous Structures — Service Building

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Footing and grade beam		SSR					SNS				
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
Louvers roof							SNS				
Masonry block walls		SSR		FB			SNS				
Missile protection doors		SSR				MB	SNS				
Missile shields		SSR				MB					
Missile barrier (external)		SSR				MB					
Roof framing and decking		SSR					SNS				
Roof slabs		SSR	EN	FB		MB	SNS				EQB
Slabs on grade		SSR					SNS				
Stairs, platforms, grating, and ladders (including supports)		SSR					SNS				
Steel beams		SSR					SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.5-2 Miscellaneous Structures — Service Building

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Walls	PB[1]	SSR		FB		MB	SNS	FLB			EQB
Walls (external)		SSR	EN	FB		MB	SNS				

1. Control Room envelope pressure boundary only.

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See Section 1.4.2 for function code definitions.

Table 2.4.5-3 Miscellaneous Structures — SBO Building

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Bracing							SNS				
Columns and baseplates							SNS				
Concrete dikes				FB			SNS	FLB			
Equipment pads							SNS				
Footing and grade beam							SNS				
Grout							SNS				
Masonry block walls							SNS				
Roof framing and decking							SNS				
Slabs on grade							SNS				
Steel beams							SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.5-4 Miscellaneous Structures — Security Diesel Building

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Foundation mat slabs							SNS				
Roof slabs							SNS				
Walls (external)							SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.6-1 Intake Structures — Intake Structure

	Passive Function(s)										
Structural Member	**PB**	**SSR**	**EN**	**FB**	**SCW**	**MB**	**SNS**	**FLB**	**HS**	**JIS**	**EQB**
Bracing		SSR					SNS				
Columns							SNS				
Concrete beams		SSR					SNS				
Equipment pads		SSR					SNS				
Floor slabs		SSR					SNS				
Footing and grade beam		SSR					SNS				
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
H-piles		SSR					SNS				
Intake tunnel headers		SSR					SNS				
Masonry block walls							SNS				
Missile shields		SSR				MB					
Roof Access Cover							SNS				
Roof slabs		SSR				MB	SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.6-1 Intake Structures — Intake Structure

	Passive Function(s)										
Structural Member	**PB**	**SSR**	**EN**	**FB**	**SCW**	**MB**	**SNS**	**FLB**	**HS**	**JIS**	**EQB**
Slabs on grade		SSR					SNS				
Stairs, platforms, grating, and ladders (including supports)							SNS				
Steel beams		SSR					SNS				
Trash racks		SSR					SNS				
Walls		SSR					SNS				
Walls (external)		SSR				MB	SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.6-2 Intake Structures — Discharge Tunnels and Seal Pit

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Concrete tunnels and seal pit[1]	PB	SSR					SNS				

1. The discharge tunnels share a common seal pit.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.7-1 Yard Structures — Tank Foundations and Missile Barriers

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Buried Fuel Oil Tank Missile Barrier											
Slabs on grade		SSR				MB					
Chemical Addition Tank Foundation											
Grout		SSR									
Foundation mat slabs		SSR									
Emergency Condensate Storage Tank Foundation and Missile Barrier											
Foundation mat slabs		SSR									
Missile shields		SSR				MB					
Roof slabs		SSR				MB					
Walls (external)		SSR				MB					

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.7-1 Yard Structures — Tank Foundations and Missile Barriers

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Refueling Water Storage Tank Foundation											
Foundation mat slabs		SSR									
Grout		SSR									
Casing Cooling Tank Foundation											
Foundation mat slabs		SSR									
Grout		SSR									

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.7-2 Yard Structures — Manholes

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Concrete hatches		SSR				MB	SNS				
Foundation mat slabs		SSR					SNS				
Grout		SSR					SNS				
Manway covers		SSR				MB	SNS				
Roof slabs		SSR				MB	SNS				
Walls		SSR					SNS				
Walls (external)		SSR					SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.7-3 Yard Structures — Dikes and Firewalls

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Fuel Oil Storage Tank Dike											
Spread footing							SNS				
Walls				FB				FLB			

Transformer Firewalls/Dikes											
Spread footing							SNS				
Walls				FB				FLB			

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.7-4 Yard Structures — Duct Banks

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Duct banks		SSR					SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.7-5 Yard Structures — Security Lighting Poles

Structural Member	Passive Function(s)										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Lighting pole foundation							SNS				
Grout							SNS				
Lighting Poles							SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.7-6 Yard Structures — Domestic Water Treatment Building

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Foundation mat slabs							SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.7-7 Yard Structures — Auxiliary Service Water Expansion Joint Enclosure

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Concrete hatches		SSR				MB					
Foundation mat slabs		SSR									
Manway covers		SSR				MB					
Roof slabs		SSR				MB					
Walls (external)		SSR				MB					

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.7-8 Yard Structures — Yard Valve Pit

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Concrete hatches		SSR				MB					
Foundation mat slabs		SSR									
Roof slabs		SSR				MB					
Stairs, platforms, grating, and ladders (including supports)		SSR					SNS				
Walls (external)		SSR				MB					

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.8-1 Earthen Structures — Service Water Reservoir

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Clay liner		SSR			SCW		SNS		HS		
Concrete liners							SNS				
Earthen dike and embankment		SSR			SCW		SNS		HS		
Spread footing		SSR					SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.8-2 Earthen Structures — Floodwall West of the Turbine Building

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Culverts								FLB			
Earthen dike and embankment								FLB			

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.9-1 NSSS Equipment Supports

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Bearing plate		SSR									
High strength bolting		SSR									
High strength hardware		SSR									
Neutron shield tank		SSR									
Neutron shield tank support structure		SSR									
RCP, SG, and PZR, support structure		SSR									
Sliding foot assembly		SSR									
Structural hardware		SSR									

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.10-1 General Structural Supports

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Battery Racks		SSR					SNS				
Control Rod Drive Mechanism Restraints		SSR									
Electrical Conduit and Cable trays		SSR					SNS				
Bearing Plate		SSR					SNS				
Structural support subcomponents such as plate and structural shapes		SSR	EN				SNS				
Vendor supplied specialty items such as spring hangers and struts		SSR					SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.11-1 Miscellaneous Structural Commodities

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Bus duct enclosure			EN								
Cable tray cover				FB			SNS				
Electrical Component supports (within panels and cabinets)		SSR					SNS				
Fire barrier penetration seals	PB[1]	SSR		FB			SNS	FLB			
Fire doors and/or EQ barrier doors[2]	PB[1]	SSR		FB			SNS				EQB
Fire stops				FB			SNS				
Fire Wraps				FB			SNS				
Fire Wraps bands							SNS				
Firestops supports							SNS				
Gaskets in junction, terminal, and pull boxes			EN								
Gypsum boards				FB			SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.11-1 Miscellaneous Structural Commodities

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Junction, terminal, and pull boxes			EN								
Panels and Cabinets		SSR	EN				SNS				
Radiant energy shield				FB			SNS				
Seismic gap covers				FB			SNS				
Seismic gap materials							SNS				
Switchgear enclosures			EN								

1. Control Room pressure boundary only.
2. Includes bullet-proof door in the Control Room.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 2.4.12-1 Load Handling Cranes and Devices

Structural Member	Passive Function										
	PB	SSR	EN	FB	SCW	MB	SNS	FLB	HS	JIS	EQB
Fuel elevator structural beams, columns, rails, baseplates and anchors for attachment to structures							SNS				
Structural crane components such as structural beams, girders, columns, trolley rails, baseplates and anchors for attachment to structures, and retaining clips		SSR					SNS				

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Electrical and Instrumentation & Controls Systems Screening Results Tables

Text enclosed in border indicates technical information specific to **NORTH ANNA.**

Table 2.5.1-1 Bus Duct

Component Group	Passive Function(s)	LRA Section Containing AMR Results
Bus Assembly	Conducts electricity	Section 3.6.1, Bus Duct
Bus Support Assembly	Provides structural and/or functional support for in-scope equipment.	Section 3.6.1, Bus Duct

Table 2.5.2-1 Cables and Connectors

Commodity Group	Passive Function(s)	LRA Section Containing AMR Results
Cables and Connectors	Conducts electricity	Section 3.6.2, Cables and Connectors[1]
		Section 4.4, Environmental Qualification (EQ) of Electric Equipment[2]

1. Non-environmentally qualified cables and connectors.
2. Cables and connectors within the scope of 10 CFR 50.49, Environmental Qualification.

3.0 AGING MANAGEMENT REVIEW RESULTS

This section provides the results of the aging management review for those structures and components identified in Section 2.0 as being subject to aging management review. The methodology used for performing aging management reviews including the process for identifying the aging effects requiring management is explained in Appendix C, Aging Management Review Methodology.

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, Internal Service Environments and Table 3.0-2, External Service Environments. The environments used in the aging management reviews are listed in the Environment column and details related to the environment are provided in the Description column of these tables.

Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences.

A listing of the abbreviations used in these tables is provided in Section 1.4.1.

Table 3.0-1 Internal Service Environments

Environment	Description
Air	Includes dry/filtered compressed air (identified as Dry Air), non-dried compressed air, and atmospheric air (when internal to components such as ventilation system components, components open to atmosphere, etc.). Moisture-laden air conditions are noted, when applicable.
Gas	Includes nitrogen, oxygen, hydrogen, carbon dioxide, helium, freon, or Halon gases. Also includes vent gases from process systems.
Lubricating Oil	This environment includes all lubricating oils used for in-scope plant equipment.
Fuel Oil	This environment includes all fuel oils used for in-scope plant equipment.
Raw Water[1]	Raw water enters the plant from a lake, reservoir, or groundwater source. Raw water is not demineralized or chemically treated to any significant extent. In general, raw water is rough filtered to remove large particles. The results of recent groundwater analyses are discussed in Appendix C. Biocides may be added to raw water to control micro-organisms or macro-organisms. Other designations of raw water include water that leaks from any system and condensation.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Table 3.0-1 Internal Service Environments

Environment	Description
Treated water[1] Steam	Treated water is demineralized water or chemically purified water which is the source for water that may require further processing, such as for the primary or secondary coolant system. Treated water can be de-aerated, can include corrosion inhibitors, biocides, or boric acid, or can include a combination of treatments. Steam generated from treated water is included in this environment category. Examples of designations that are used to identify treated water in the Environment description sections of the aging management review results include: • treated water (borated water) - applies to primary systems water that is treated and monitored for quality under the Chemistry Control Program for Primary Systems • treated water (component cooling) - applies to component cooling system water that is treated and monitored for quality under the Chemistry Control Program for Primary Systems scope • treated water (bearing cooling/chilled water) - applies to bearing cooling system and chilled water system water that is treated and monitored for quality under the Chemistry Control Program for Secondary Systems scope • treated water (diesel cooling) - applies to local, self-contained diesel engine cooling water systems water that is treated and monitored for quality under the Chemistry Control Program for Secondary Systems scope • treated water (secondary) - applies to secondary systems water that is within the scope of the Chemistry Control Program for Secondary Systems and controlled for protection of steam generators Other treated water applications use chemistry-controlled treated water as source water, but the water is not maintained as chemistry-controlled water.

1. While these are considered internal environments for plant systems, they may also be identified as external environments for certain structural members and system components that are submerged.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Table 3.0-2 External Service Environments

Environment[1]	Description
Air	Includes indoor air environments as described below: Sheltered Air - The sheltered air environment includes atmospheric air inside covered structures that provide protection from precipitation and wind. This environment is defined by a bulk average air temperature range of 32°F to 120°F and a 60-year maximum design ionizing dose of $2x10^8$ rads. Containment Air - The Containment air environment is defined by a bulk average air temperature range of 75°F to 125°F at subatmospheric pressures between 9.0 psia and 11.1 psia and a 60-year maximum design ionizing dose of $4.5x10^7$ rads inside the crane wall and $4.5x10^4$ rads outside the crane wall. An exception is the area around the reactor vessel inside the primary shield wall for which the 60-year maximum design ionizing dose is $7.2x10^9$ rads. NOTES 1. Certain structures or components may experience environmental conditions that deviate from the stated ranges or maximum values. The actual environmental condition(s) for these structures or components were used in the aging evaluation when the condition could affect the results, and, in those cases, the actual values are identified in the Environment description of the applicable LRA subsection. 2. Structural members may be associated with mechanical system components that may have the potential for condensation or intermittent wetting. Therefore, structural members have been conservatively assumed to be intermittently wetted in an air environment. 3. Mechanical components are assumed to be in an air environment that is not subject to intermittent wetting. Intermittently wetted conditions are noted, when applicable, such as from condensation.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Table 3.0-2 External Service Environments

Environment[1]	Description
Atmosphere / Weather	The outdoor air environment outside covered structures and includes precipitation and wind. Therefore, components and structures in this environment are subject to intermittent wetting. The outdoor air environment also includes exposure to ultraviolet radiation and ozone. This environment is bounded by a bulk average air temperature range of -12°F to 105°F and a 60-year maximum design ionizing dose of 390 rads.
Borated Water Leakage	The borated water leakage environment applies in all plant areas that contain borated coolant components and systems which may leak on nearby components or structures. This environment is specified in the aging management review results only for materials susceptible to boric acid wastage (carbon steel, low-alloy steels, and copper alloys). This environment is not considered for in-scope cables and connectors since cables are insulated, splices are sealed, and terminations are protected by enclosures.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Table 3.0-2 External Service Environments

Environment[1]	Description
Soil	The external environment for structures and components buried in the ground. Buried components (pipe and valves) are exposed to a soil environment and may be exposed to groundwater if they are located below the local groundwater elevation. The soil is assumed to entrain raw water and buried components are evaluated for the effects of corrosion. Concrete structural members below grade elevation are exposed to a soil environment and may be exposed to groundwater if they are located below the local groundwater elevation. The site groundwater is non-aggressive to concrete as determined by recent groundwater analyses (discussed in Appendix C). Steel piles are driven in undisturbed soil such that the soil environment surrounding the piles is deficient in oxygen at depths of a few feet below grade or below the water table. Therefore, the soil environment is not considered corrosive to steel piles (Reference 2, Section 3.5).

1. For certain structural members and system components that are submerged, the applicable environment identified in Table 3.0-1, Internal Service Environments, is specified in the aging management review results.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

3.1 Aging Management of Reactor Coolant System

This section provides the results of the aging management review for those components identified in Section 2.3.1, Reactor Coolant System, as being subject to aging management review. The methodology used for performing aging management reviews including the process for identifying the aging effects requiring management is explained in Appendix C, Aging Management Review Methodology.

Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences. The only differences identified in this section (including the tables) are the differences in materials, environments, aging effects requiring management, and aging management activities. Plant-specific scoping and screening differences (such as name differences, additional systems, and additional in-scope long-lived passive component groups) have already been identified in the scoping and screening results sections of the application, and are not identified again in this section.

A listing of the abbreviations used in this section is provided in Section 1.4.1.

3.1.1 Reactor Coolant System

The results of the aging management review for the reactor coolant (RC) system provided in Section 3.1.1 excludes the major reactor coolant system components. The aging management review information for these components is provided in the following sections:

- Reactor Vessel (Section 3.1.2)
- Reactor Vessel Internals (Section 3.1.3)
- Pressurizer (Section 3.1.4)
- Steam Generator (Section 3.1.5)

Table 3.1.1-1 summarizes the results of the aging management review of the RC system. The table provides the following information related to each component group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the RC System is provided in Section 2.3.1.

Confirmation of Topical Report Applicability

The Westinghouse Owners' Group Life Cycle Management & License Renewal Program has prepared topical report, WCAP-14575-A, *Aging Management Evaluation for Class 1 Piping and Associated Pressure Boundary Components*, December 2000 (Reference 1),

which has been utilized in the aging management review of the ASME Class 1 piping and reactor coolant pumps. The scope of the RC components described in the topical report bounds the reactor coolant system with the following clarifications:

- The topical report assumes that the primary system chemistry control program is in place and does not recognize this program in the management of loss of material or cracking from stress corrosion. For the aging management review of the reactor coolant system presented here, the Chemistry Control Program for Primary Systems manages these aging effects.
- The topical report considers wear, which is defined as damage to a solid surface caused by removal or plastic displacement of material by way of mechanical contact characterized by a loss of material during relative motion or sliding, as an aging effect that requires management. In the aging management review results of the reactor coolant system presented in this section, wear will not result in an aging effect requiring management. A discussion on the treatment of wear is presented in Appendix C, Section C3.1.7, Wear.
- In addition to the functions identified in WCAP-14575-A, an additional function, restrict flow, for flow restricting orifices has been identified.
- The topical report specifically addresses ASME Class 1 piping and associated pressure boundary components that support the operation of the RC system. The aging management review results of the reactor coolant system presented in this section consider Class 1, 2, and 3 RC system components as identified on the License Renewal Drawings in Section 2.3.1.1.

A reconciliation of the final SER applicant action items is provided in the following table:

Table 3.1.1-W1, WCAP-14575-A FSER Response to Applicant Action Items

Materials

The RC piping, fittings, and components that are subject to aging management review have been designed to meet the requirements of USAS B31.7 Code for Pressure Piping or ASME Boiler and Pressure Vessel Code, Section III. Specific RC component code requirements are indicated in UFSAR Table 5.2-3, Equipment Code and Classification List.

The predominant material of construction for the RC system components subject to aging management review is stainless steel, including cast austenitic stainless steel, with carbon steel, low-alloy steels, and copper alloys used to a lesser extent.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Design considerations in the selection of materials for RC components, including small bore pipe, reduce the potential for stress corrosion cracking.

Environment

Internal

The RC system components that require aging management review are internally exposed to different types of treated water (i.e., borated water, primary grade water, component cooling (CC) water, and distilled-deaerated water) and lubricating oil (motor coolers). However, the system is predominately internally exposed to treated water (borated water) at approximately 600°F and 2235 psig.

The CC system provides cooling water for the RCP motor's lower and upper bearing oil coolers, and the RCP motor's stator coolers. The RCP motor's lower bearing oil cooler is a coiled tube design. The tube is coiled in the lower oil reservoir and is exposed to oil on the outside of the tube in the reservoir, air on the outside of the tube outside of the reservoir, and treated water (component cooling) on the inside of the tube. The RCP motor's upper bearing oil cooler is a tube and shell design. Treated water (component cooling) is on the tube side and lube oil is on the shell side. The RCP motor's stator cooler is a fin and tube design with treated water (component cooling) inside the tube and air on the outside of the tube.

The reactor vessel's level instrumentation system (RVLIS) is a stagnant system with bellows used to separate the primary reactor coolant from the treated water (i.e., distilled de-aerated water).

External

The RC system components that require aging management review are located in the Containment and the Auxiliary Building and are externally exposed to an air environment. The Containment air environment and the sheltered air environment used for areas outside Containment are as indicated in Table 3.0-2, External Service Environments.

External surfaces of the reactor coolant system piping and components may also be exposed to borated water leakage conditions.

Aging Effects Requiring Management

The following aging effects, associated with the RC system, require management:

- Cracking of stainless steel components (including CASS) in treated water or steam environments (note: components interfacing with the pressurizer steam space may be exposed to a steam environment).
- Cracking of copper alloy components in an air environment.

- Loss of material from carbon steel, low-alloy steel, and copper alloy components in treated water, air, lubricating oil, or steam environments.
- Loss of material from carbon steel, low-alloy steel, and copper alloy components in a borated water leakage environment.
- Reduction in fracture toughness of CASS pumps and valves in a high-temperature treated water or steam environment.
- Loss of pre-load of ASME Class 1 bolting in an air environment.

Time-Limited Aging Analysis

The time-limited aging analyses (TLAA) identified below are associated with reactor coolant system components. The section of the LRA that contains the TLAA review results is indicated in parenthesis.

- Thermal fatigue of RC piping (Section 4.3, Metal Fatigue)
- Leak-before break (Section 4.7.3, Leak-Before-Break)
- RCP fatigue (Section 4.7.6, Reactor Coolant Pump - Code Case N-481)

Conclusion

The following programs and activities manage the aging effects on the components of the reactor coolant system:

- Chemistry Control Program for Primary Systems
- Boric Acid Corrosion Surveillance
- General Condition Monitoring Activities
- Work Control Process
- Augmented Inspection Activities
- ISI Program - Component and Component Support Inspections

A description of these aging management activities 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 RC system components will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

3.1.2 Reactor Vessel

The results of the aging management review of the reactor vessel are provided in this section and summarized in Table 3.1.2-1. The table provides the following information related to each subcomponent: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the reactor vessel (RV) is provided in Section 2.3.1.2.

Materials

The RV is an ANSI Safety Class 1 component, designed and fabricated to Section III of the ASME Boiler and Pressure Vessel Code, as indicated in UFSAR RequirementsTable 5.2-3, Equipment Code and Classification List.

The materials of construction for the RV subcomponents that are subject to aging management review are carbon steel, low-alloy steel, stainless steel (including cast austenitic stainless steel), and nickel-based alloy.

The reactor vessel shell is constructed from forged rings that are joined by circumferential weld seams.

The hot-leg and cold-leg reactor coolant loop piping from each of the three loops attaches to the primary nozzles that have safe ends of stainless steel buttering.

Minimum preheat requirements were established for pressure boundary welds using low-alloy weld material. Preheat requirements were also added for the stainless steel cladding. Limitations on preheat requirements are precautionary measures that decrease the probability of weld cracking by decreasing temperature gradients, lowering susceptibility to brittle transformation, preventing hydrogen embrittlement, and reducing peak hardness.

The surfaces of the carbon steel and low-alloy steel reactor vessel pressure boundary subcomponents that are in contact with the borated water are clad with a weld overlay of stainless steel with the exception of selected locations that are clad with nickel-based alloy. The cladding is a design feature for corrosion control.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Environment

Internal

The internal wetted surfaces of the RV are exposed to treated water (borated water). The operating pressure of the reactor coolant system is 2235 psig.

The maximum operating temperature of the reactor coolant water (100% power) is 621.2°F

External

The RV subcomponents that require aging management review are externally exposed to the Containment air environment indicated in Table 3.0-2, External Service Environments.

External surfaces of the RV may also be exposed to borated water leakage conditions.

The RV subcomponents are exposed to different levels of high-energy neutron irradiation; however, the RV beltline region exposure is the most limiting.

Aging Effects Requiring Management

The following aging effects, associated with RV subcomponents, require management:

- Cracking of stainless steel (including CASS), carbon steel, low-alloy steel, and nickel-based alloy subcomponents in treated water or air environments.
- Loss of material from stainless steel (including CASS) and nickel-based alloy subcomponents in a treated water environment.
- Loss of material from carbon steel and low-alloy steel subcomponents in a borated water leakage environment.
- Loss of pre-load of ASME Class 1 closure studs in an air environment.
- Reduction of fracture toughness of CASS subcomponents in a high-temperature treated water environment.
- Reduction in fracture toughness of carbon steel and low-alloy steel subcomponents in an air environment.

Time-Limited Aging Analysis

The time-limited aging analyses (TLAA) identified below are associated with the reactor vessel subcomponents. Indicated in parenthesis is the section of the LRA that contains the TLAA review results.

- Fatigue (Section 4.3, Metal Fatigue)
- Tensioning and Detensioning of Studs (Section 4.3, Metal Fatigue)
- Pressurized Thermal Shock (Section 4.2.2, Pressurized Thermal Shock)

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- Upper Shelf Energy (Section 4.2.1, Upper Shelf Energy)
- Pressure-Temperature Limits (Section 4.2.3, Pressure-Temperature Limits)
- Reactor Vessel Underclad Cracking (Section 4.3.2, Reactor Vessel Underclad Cracking)

Conclusion

The following programs and activities manage the aging effects on the subcomponents of the reactor vessel:

- Chemistry Control Program for Primary Systems
- Boric Acid Corrosion Surveillance
- ISI Program - Reactor Vessel
- Reactor Vessel Integrity Management

A description of these aging management activities 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 RV subcomponents 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.

3.1.3 Reactor Vessel Internals

The results of the aging management review of the reactor vessel internals are provided in this section and summarized in Table 3.1.3-1. The table provides the following information related to each subcomponent: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the reactor vessel internals is provided in Section 2.3.1.3.

Confirmation of Topical Report Applicability

The Westinghouse Owners' Group Life Cycle Management & License Renewal Program has prepared topical report, WCAP-14577, *License Renewal Evaluation: Aging Management for Reactor Internals*, March 2001 (Reference 2), which has been utilized in the aging management review of the reactor vessel internals. The scope of the reactor

vessel internals described in the topical report bounds the reactor vessel internals with the following clarifications:

- The topical report assumes that the primary system chemistry control program is in place and does not recognize this program in the management of loss of material or cracking from stress corrosion. For the aging management review of the reactor vessel internals presented here, the Chemistry Control Program for Primary Systems manages these aging effects.
- The topical report considers wear, which is defined as damage to a solid surface caused by removal or plastic displacement of material by way of mechanical contact characterized by a loss of material during relative motion or sliding, as an aging effect that requires management. In the aging management review results of the reactor vessel internals presented in this section, wear will not result in an aging effect requiring management. A discussion on the treatment of wear is presented in Appendix C, Section C3.1.7, Wear.
- The topical report includes an evaluation of the flux thimble tubes. The flux thimble tubes are evaluated for the effects of aging with the reactor vessel and the results are provided in Section 3.1.2, Reactor Vessel.
- The topical report discusses IASCC and SCC aging mechanisms separately while the aging management review of the reactor vessel internals combines the discussion of these mechanisms as part of the cracking aging effect.
- The topical report credits the loose parts monitoring program and the neutron noise monitoring program as aging management programs to manage cracking, the loss of material and the loss of pre-load. These specific programs are not credited for managing the effects of aging for the reactor vessel internals herein. Rather, the thorough inspection requirements identified in Reactor Vessel Internals Inspection are credited.
- The topical report identifies that primary water stress corrosion cracking (PWSCC) can occur in nickel-based alloys that are subjected to high stress. In the aging management review of the reactor vessel internals, all nickel-based alloys are conservatively treated as being susceptible to PWSCC regardless of the stresses within the subcomponents.

A reconciliation of the final SER applicant action items is provided in the following table:

Table 3.1.3-W1, WCAP-14577, Rev. 1-A, FSER Response to Applicant Action Items

Materials

The materials of construction for the reactor vessel internals subcomponents subject to aging management review are stainless steel (including cast austenitic stainless steel), and nickel-based alloy.

Environment

The reactor vessel internals subcomponents are in contact with treated water (borated water) and are exposed to a normal operating pressure of 2235 psig.

The maximum operating temperature of the reactor coolant water (100% power) is 621.2°F

The stainless steel and nickel-based alloy subcomponents of the reactor vessel internals are exposed to different levels of high-energy neutron irradiation and the end-of-life fluence level for the subcomponents varies. The internals components that are nearest to the reactor core receive the highest levels of neutron irradiation and remotely located components receive significantly less neutron exposure.

Aging Effects Requiring Management

The following aging effects, associated with the reactor vessel internals subcomponents, require management:

- Cracking of stainless steel (including CASS) and nickel-based alloy subcomponents in a treated water environment.
- Loss of material from stainless steel (including CASS), and nickel-based alloy subcomponents in a treated water environment.
- Loss of pre-load of stainless steel bolting and the core barrel holddown spring in a treated water environment.
- Reduction in fracture toughness of stainless steel (including CASS) subcomponents in a high-temperature treated water environment.

Note: Change in dimensions due to void swelling is a potential aging effect requiring management; however, this is not specifically identified in Table 3.1.3-1. A license renewal industry position on void swelling is being developed. Dominion will follow this issue and evaluate appropriate changes to the Reactor Vessel Internals Inspection, as identified in Appendix B, once an industry position has been established. A more detailed discussion of void swelling is provided in Section C3.9.1, Void Swelling.

Conclusion

The following programs and activities manage the aging effects on the subcomponents of the reactor vessel internals:

- Reactor Vessel Internals Inspection
- Chemistry Control Program for Primary Systems

A description of these aging management activities is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the reactor vessel internals subcomponents 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.

3.1.4 Pressurizer

The results of the aging management review of the pressurizer are provided in this section and summarized in Table 3.1.4-1. The table provides the following information related to each subcomponent: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the pressurizer is provided in Section 2.3.1.4.

Confirmation of Topical Report Applicability

The Westinghouse Owners' Group Life Cycle Management & License Renewal Program has prepared topical report, WCAP-14574-A, *Aging Management Evaluation for Pressurizers*, December 2000 (Reference 3), which has been utilized as the primary reference in developing the aging management review for the pressurizers. The scope of the pressurizer described in the topical report bounds the pressurizer with the following clarifications:

- The topical report assumes that the primary system chemistry control program is in place and does not recognize this program in the management of loss of material or cracking from stress corrosion. For the aging management review of the pressurizer presented here, the Chemistry Control Program for Primary Systems manages these aging effects.
- In general, cracking of pressurizer subcomponents (regardless of the aging mechanism) is managed with ISI Program - Component and Component Support Inspections.

- The topical report does not recognize loss of pre-load due to stress relaxation as an aging effect requiring management. Loss of pre-load due to stress relaxation is considered an aging effect requiring management for the pressurizers and is managed with the ISI Program - Component and Component Support Inspections.
- Nickel-based alloy (alloy 82/182) weld metal has been used as a buttering on the pressurizer surge, spray, relief, and safety nozzles. The topical report states that SCC/PWSCC of Alloy 82/182 weld-metal does not require aging management. In the aging management review results for the pressurizers presented here, cracking in nickel-based alloys due to SCC/PWSCC is considered as an aging effect requiring management and is managed with the Chemistry Control Program for Primary Systems.
- The topical report does not present boric acid wastage as an aging mechanism. In the aging management evaluation of the pressurizers, boric acid wastage is considered as an aging mechanism and is managed with the Boric Acid Corrosion Surveillance activities.
- With the exception of SCC/PWSCC, the topical report does not identify any additional corrosion mechanisms for stainless steel in a treated water and/or steam environment. Dominion believes crevice corrosion/under deposit attack and pitting corrosion require aging management for stainless steel in treated water. These aging mechanisms are managed with the Chemistry Control Program for Primary Systems.
- The topical report identifies valve support bracket lugs as subcomponents within the scope of license renewal. The installed pressurizers are not equipped with valve support bracket lugs.

A reconciliation of the final SER applicant action items is provided in the following table:

Table 3.1.4-W1, WCAP-14574-A FSER Response to Applicant Action Items

Materials

The pressurizer is designed and fabricated to Section III of the ASME Boiler and Pressure Vessel Code, as indicated in UFSAR Table 5.2-3, Equipment Code and Classification List.

The materials of construction for the pressurizer subcomponents that are subject to aging management review are stainless steel, low-alloy steel, and carbon steel.

The pressurizer surge, spray, relief, and safety nozzles were buttered with nickel-based alloy (Alloy 82/182).

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

The surfaces of the carbon steel and low-alloy steel pressurizer subcomponents that are in contact with the borated water are clad with a weld overlay of stainless steel. The cladding is a design feature for corrosion control.

Environment

Internal
The pressurizer internals subcomponents subject to aging management review are in contact with treated water (borated water) and steam at 653°F and 2235 psig.

External
The pressurizer is located in the Containment and is exposed to the Containment air environment indicated in Table 3.0-2, External Service Environments. External surfaces of the pressurizer subcomponents may also be exposed to borated water leakage conditions.

Aging Effects Requiring Management

The following aging effects, associated with the pressurizer subcomponents, require management:

- Cracking of carbon steel and low-alloy steel pressurizer subcomponents in an air environment and stainless steel pressurizer subcomponents in a treated water/steam environment.
- Cracking and loss of material from nickel-based alloy pressurizer subcomponents in a treated water/steam environment.
- Loss of material from stainless steel pressurizer subcomponents in a treated water/ steam environment.
- Loss of material from carbon steel and low-alloy steel pressurizer subcomponents in a borated water leakage environment.
- Loss of pre-load of the pressurizer low-alloy steel manway cover bolting.

Time-Limited Aging Analysis

Cracking due to fatigue is evaluated as a time-limited aging analysis in Section 4.3, Metal Fatigue.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Conclusion

The following programs and activities manage the aging effects on the subcomponents of the pressurizer:

- Chemistry Control Program for Primary Systems
- ISI Program - Component and Component Support Inspections
- Boric Acid Corrosion Surveillance

A description of these aging management activities 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 pressurizer subcomponents 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.

3.1.5 Steam Generator

The results of the aging management review of the steam generator are provided in this section and summarized in Table 3.1.5-1. The table provides the following information related to each subcomponent: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the steam generator is provided in Section 2.3.1.5.

Materials

The steam generators are designed and fabricated to Section III of the ASME Boiler and Pressure Vessel Code, as indicated in UFSAR Table 5.2-3, Equipment Code and Classification List.

The materials of construction for the steam generator subcomponents that are subject to aging management review are carbon steel, low-alloy steel, stainless steel, and nickel-based alloy. The internal surfaces of the steam generator pressure boundary subcomponents that are in contact with the borated water are clad with stainless steel or nickel-based alloy. The cladding is a design feature for corrosion control.

Environment

Internal

The steam generator primary-side subcomponents subject to aging management review are in contact with treated water (borated water). The steam generator secondary-side

subcomponents are exposed to treated water (secondary), steam, or a combination of treated water and steam.

The operating temperatures and pressures for the steam generator subcomponents are identified below:

Primary Side Components

Pressure - 2235 psig
Temperature (Inlet/Outlet) - 621.2°F/552.0°F

Secondary Side Components

Steam Pressure - 835 psig
Steam Temperature - 525.2°F
Feedwater Temperature - 440°F

External

The steam generator is located in the Containment and is exposed to the Containment air environment indicated in Table 3.0-2, External Service Environments. External surfaces of the steam generator subcomponents may also be exposed to borated water leakage conditions.

Aging Effects Requiring Management

The following aging effects, associated with the steam generator subcomponents, require management:

- Cracking of carbon steel, low-alloy steel, stainless steel, and nickel-based alloy subcomponents in treated water, steam, or air environments.
- Loss of material from carbon steel, low-alloy steel, stainless steel and nickel-based alloy subcomponents in treated water or steam environments.
- Loss of material from low-alloy steel subcomponents in a borated water leakage environment.
- Loss of pre-load of ASME Class 1 low-alloy steel bolting in an air environment.

Time-Limited Aging Analysis

Cracking due to fatigue is evaluated as a time-limited aging analysis in Section 4.3, Metal Fatigue.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Conclusion

The following programs and activities manage the aging effects on the subcomponents of the steam generator:

- Chemistry Control Program for Primary Systems
- Chemistry Control Program for Secondary Systems
- Boric Acid Corrosion Surveillance
- Steam Generator Inspections

A description of these aging management activities 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 generator subcomponents 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.

Section 3.1 References (Reactor Coolant System)

1. WCAP-14575-A, *Aging Management Evaluation for Class I Piping and Associated Pressure Boundary Components*, Westinghouse Energy Systems, December, 2000.
2. WCAP-14577, Rev. 1-A, *Aging Management Evaluation for Reactor Internal*s, Westinghouse Energy Systems, March, 2001.
3. WCAP-14574-A, *Aging Management Evaluation for Pressurizers*, Westinghouse Electric Corporation, December, 2000.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

3.2 Aging Management of Engineered Safety Features Systems

This section provides the results of the aging management review for those components identified in Section 2.3.2, Engineered Safety Features Systems, as being subject to aging management review. The methodology used for performing aging management reviews including the process for identifying the aging effects requiring management is explained in Appendix C, Aging Management Review Methodology.

Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences. The only differences identified in this section (including the tables) are the differences in materials, environments, aging effects requiring management, and aging management activities. Plant-specific scoping and screening differences (such as name differences, additional systems, and additional in-scope long-lived passive component groups) have already been identified in the scoping and screening results sections of the application, and are not identified again in this section.

A listing of the abbreviations used in this section is provided in Section 1.4.1.

The results of the aging management review of the following systems, or portions of systems, are provided in this section. The systems are described in the indicated sections.

- Quench spray (QS) system (Section 2.3.2.1)
- Fuel pit cooling (FC) system (Section 2.3.2.2)
- Recirculation spray (RS) system (Section 2.3.2.3)
- Residual heat removal (RH) system (Section 2.3.2.4)
- Safety injection (SI) system (Section 2.3.2.5)

A summary of the results of the aging management review for the Engineered Safety Features (ESF) systems is provided in the following tables. The tables provide the following information related to each component group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.2-1, Engineered Safety Features Systems — Quench Spray

Table 3.2-2, Engineered Safety Features Systems — Fuel Pit Cooling

Table 3.2-3, Engineered Safety Features Systems — Recirculation Spray

Table 3.2-4, Engineered Safety Features Systems — Residual Heat Removal

Table 3.2-5, Engineered Safety Features Systems — Safety Injection

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Materials

The predominant material of construction utilized for ESF systems is stainless steel, including the use of cast austenitic stainless steel for some components. Other materials used in the construction of ESF components are carbon steel, low-alloy steel, and copper alloys. Carbon steel and low-alloy steel component surfaces that are normally in contact with borated water are clad with a stainless steel weld overlay for corrosion protection.

Environment

Internal

A description of internal environments is provided in Table 3.0-1, Internal Service Environments. The normal operating conditions for the ESF components that require aging management review are described below:

QS system - The refueling water storage tank (RWST) contains low-temperature, treated water (borated water). The water is considered to be oxygen saturated since the tank is vented to atmosphere. The chemical addition tank (CAT) contains an approximately 17% sodium hydroxide solution at ambient temperature. The QS piping and components from the RWST to the inside Containment check valves are subject to treated water (borated water). The QS system components downstream of the check valves to the spray header nozzles are dry and are exposed to Containment air.

FC system - The FC system components are exposed to treated water (borated water) with potentially higher dissolved oxygen concentration. The spent fuel pit cooler shell-side is exposed to the low-temperature, treated water (component cooling).

RS system - The RS pumps and suction piping (for the outside Containment RS pumps) are exposed to raw water in the Containment sump. The pump discharge piping, RS coolers, spray rings, and nozzles for both the inside and outside Containment RS systems are dry and exposed to Containment air. The pump seal coolers are in a treated water environment.

The casing cooling components of the RS system are exposed to low-temperature, treated water (borated water).

RH system - The RH system components are exposed to treated water (borated water), with the majority of components limited to thermal conditions of 350°F. The RH system components near the connection to the reactor coolant system can be subject to normal reactor coolant system temperature. The shell side of the RH heat exchanger is exposed to the low-temperature, treated water (component cooling).

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

SI system - The SI components are predominately exposed to stagnant, treated water (borated water) from the RWST. In addition, the SI accumulators are also exposed to a nitrogen environment in the upper area of the tank and a portion of the LHSI pump suction piping is exposed to raw water from the Containment recirculation sump. Most of the system is at ambient temperature, however, components near the connection to the reactor coolant loop piping could be subject to normal operating temperatures for the reactor coolant system.

External

The ESF systems components that require aging management review are located in the Containment and other indoor areas of the plant, and outdoors. These components are exposed to an air environment. The Containment air environment, and the sheltered air and outdoor (atmosphere/weather) environments, are as indicated in Table 3.0-2, External Service Environments.

Certain ESF systems components could be exposed to condensation externally and are evaluated for an intermittent wetting external environment. Additionally, portions of the ESF systems piping are buried and are evaluated in a soil external environment.

External surfaces of ESF systems components may also be exposed to borated water leakage conditions.

Aging Effects Requiring Management

The following aging effects, associated with the ESF systems, require management:

- Cracking of stainless steel (including CASS) components in a treated water environment.
- Loss of material from carbon steel, low-alloy steel, and stainless steel (including CASS) components in air, raw water, treated water, atmosphere/weather, or soil (buried) environments.
- Loss of material from carbon steel and low-alloy steel components in a borated water leakage environment.
- Loss of pre-load of Class 1 bolting exposed to an air environment.
- Reduction in fracture toughness of CASS components in a high-temperature treated water environment.

Time-Limited Aging Analysis

The time-limited aging analysis (TLAA) identified below is associated with ESF systems components. The section that contains the TLAA review results is indicated in parenthesis.

- Thermal fatigue of piping (Section 4.3, Metal Fatigue)

Conclusion

The following aging management activities manage aging effects for the ESF systems:

- Boric Acid Corrosion Surveillance
- Buried Piping and Valve Inspection Activities
- Chemistry Control Program for Primary Systems
- General Condition Monitoring Activities
- Infrequently Accessed Area Inspection Activities
- ISI Program - Component and Component Support Inspections
- Tank Inspection Activities
- Work Control Process

A description of these aging management programs and activities is provided in Appendix B, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the ESF 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.

3.3 Aging Management of Auxiliary Systems

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 methodology used for performing aging management reviews including the process for identifying the aging effects requiring management is explained in Appendix C, Aging Management Review Methodology.

Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences. The only differences identified in this section (including the tables) are the differences in materials, environments, aging effects requiring management, and aging management activities. Plant-specific scoping and screening differences (such as name differences, additional systems, and additional in-scope long-lived passive component groups) have already been identified in the scoping and screening results sections of the application, and are not identified again in this section.

A listing of the abbreviations used in this section is provided in Section 1.4.1.

3.3.1 Primary Process Systems

The results of the aging management review of the following systems, or portions of systems, are provided in this section. The systems are described in the indicated sections.

- Chemical and volume control (CH) system (Section 2.3.3.1)
- High radiation sampling system (HRSS) (Section 2.3.3.2)
- Incore instrumentation (IC) system (Section 2.3.3.3) isolation valves.
- Refueling purification (RP) system (Section 2.3.3.4)
- Sampling system (SS) (Section 2.3.3.5)

A summary of the results of the aging management review for the Primary Process Systems (PPS) is provided in the following tables. The tables provide the following information related to each component group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.3.1-1, Primary Process Systems — Chemical and Volume Control

Table 3.3.1-2, Primary Process Systems — High Radiation Sampling System

Table 3.3.1-3, Primary Process Systems — Incore Instrumentation

Table 3.3.1-4, Primary Process Systems — Refueling Purification

Table 3.3.1-5, Primary Process Systems — Sampling System

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Materials

The predominant material of construction for the primary process systems is stainless steel (including cast austenitic stainless steel) with carbon steel, low-alloy steel, cast iron, and copper alloys used.

Environment

Internal

A description of internal environments is provided in Table 3.0-1, Internal Service Environments. The normal operating conditions for the PPS components that require aging management review are described below.

The CH, SS, and RP system components subject to aging management review are exposed to treated water (borated water) originating in systems that are controlled for water quality. Some CH system components are exposed to a gas environment.

An exception is the charging pump lubricating oil cooler, which is exposed to raw water and lubricating oil.

Certain SS, HRS and CH components are also exposed to treated water (component cooling). Other SS components are exposed to gaseous or steam sample environments.

Portions of the CH and SS systems are subject to normal reactor coolant system operating conditions and experience large temperature variations (cycles) during plant operation.

The IC system isolation valves are exposed to ambient air conditions.

External

The PPS components that are subject to aging management review are located in various indoor areas of the plant, including the Containment, and are exposed to an air environment. The Containment air environment, and the sheltered air environment, are as indicated in Table 3.0-2, External Service Environments.

Certain PPS components could be exposed to condensation externally and are evaluated for an intermittent wetting external environment. Additionally, external surfaces of PPS components may also be exposed to borated water leakage conditions.

Aging Effects Requiring Management

The following aging effects, associated with PPS components, require management:

- Change in material properties of copper alloy components in a raw water environment.

- Cracking of stainless steel (including CASS) components in treated water, steam, or oil environments.
- Loss of material from carbon steel, low-alloy steel, cast iron, copper alloy, and stainless steel (including CASS) components in raw water, treated water, steam, oil, or air environments.
- Loss of material from carbon steel, low-alloy steel, cast iron, and copper alloy components in a borated-water leakage environment.
- Heat transfer degradation of heat transfer surfaces in a raw water environment.
- Loss of pre-load of Class 1 bolting exposed to an air environment.
- Reduction in fracture toughness of CASS components in a high-temperature treated water environment.

Time-Limited Aging Analysis

The time-limited aging analysis (TLAA) identified below is associated with PPS components. The section that contains the TLAA review results is indicated in parenthesis.

- Thermal fatigue of piping (Section 4.3, Metal Fatigue)

Conclusion

The following aging management activities manage aging effects for the PPS components:

- Boric Acid Corrosion Surveillance
- Chemistry Control Program for Secondary Systems
- Chemistry Control Program for Primary Systems
- General Condition Monitoring Activities
- ISI Program - Component and Component Support Inspections
- Work Control Process

A description of these aging management programs and activities is provided in Appendix B, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the primary process 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.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

3.3.2 Open Water Systems

The results of the aging management review of the following systems, or portions of systems, are provided in this section. The systems are described in the indicated sections.

- Heating and ventilation (HV) system (Section 2.3.3.21) components comprising the main control room and emergency switchgear room air conditioning chiller condenser and associated condenser cooling water subsystem.
- Instrument air (IA) system (Section 2.3.3.14) compressor cooler.
- Service water (SW) system (Section 2.3.3.6)

A summary of the results of the aging management review for the open water systems is provided in the following tables. The tables provide the following information related to each component group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.3.2-1, Open Water Systems — Heating And Ventilation

Table 3.3.2-2, Open Water Systems — Instrument Air

Table 3.3.2-3, Open Water Systems — Service Water

Materials

The materials of construction for the open water systems components are carbon steel, low-alloy steel, cast iron, stainless steel, copper alloys, and elastomers (rubber).

Environment

Internal

A description of internal environments is provided in Table 3.0-1, Internal Service Environments. The open water systems components that require aging management review are exposed to raw water, air, gas (refrigerant), or treated water internally.

The source of water for the SW system (including HV system chiller condenser cooling water and instrument air compressor cooling water) is the service water reservoir which is raw water (fresh water) that is treated to inhibit biological growth and minimize corrosion.

External

The open water systems components that require aging management review are located in the Containment and other indoor areas of the plant. These components are exposed

to an air environment. The Containment air environment, and the sheltered air environment, are as indicated in Table 3.0-2, External Service Environments.

Some open water system components are located outdoors. The outdoor (atmosphere/weather) environment is as indicated in Table 3.0-2, External Service Environments.

External surfaces of open water systems components may be exposed to borated water leakage conditions. Additionally, portions of the open water systems piping are buried in soil or encased in concrete.

Portions of the SW system piping at the service water reservoir are continually submerged, and other piping and components are intermittently wetted by evaporative cooling spray.

Aging Effects Requiring Management

The following aging effects, associated with the open water systems components, require management:

- Change in material properties and cracking of elastomeric components in an air environment.
- Change in material properties of copper alloy components in a raw water environment.
- Loss of material from carbon steel, low-alloy steel, cast iron, stainless steel, or copper alloy components in raw water or air environments.
- Loss of material from buried carbon steel or low-alloy steel components in a soil environment.
- Heat transfer degradation of heat transfer surfaces in a raw water environment.
- Loss of material from stainless steel components in a treated water environment.
- Loss of material from copper alloy components in an atmosphere/weather environment.
- Loss of material from carbon steel, low-alloy steel, and copper alloy components in a borated water leakage environment.

Conclusion

The following aging management activities manage aging effects for the open water systems components:

- Boric Acid Corrosion Surveillance

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- Buried Piping and Valve Inspection Activities
- General Condition Monitoring Activities
- Infrequently Accessed Area Inspection Activities
- Service Water System Inspections
- Work Control Process

A description of these aging management activities 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 open water 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.

3.3.3 Closed Water Systems

The results of the aging management review of the following systems, or portions of systems, are provided in this section. The systems are described in the indicated sections.

- Chilled water (CD) system (Section 2.3.3.7)
- Component cooling (CC) system (Section 2.3.3.8)
- Containment vacuum (CV) system (Section 2.3.3.17) pump seal water heat exchanger.
- Heating and ventilation (HV) system (Section 2.3.3.21) components that comprise the main control room and emergency switchgear room (MCR/ESGR) air-conditioning chilled water system and the cooling coils in the containment ventilation system.
- Neutron shield tank cooling (NS) system (Section 2.3.3.9)
- Reactor coolant (RC) system (Section 2.3.1.1) neutron shield tank.

A summary of the results of the aging management review for the closed water systems is provided in the following tables. The tables provide the following information related to each component group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.3.3-1, Closed Water Systems — Chilled Water

Table 3.3.3-2, Closed Water Systems — Component Cooling

Table 3.3.3-3, Closed Water Systems — Containment Vacuum

Table 3.3.3-4, Closed Water Systems — Heating And Ventilation

Table 3.3.3-5, Closed Water Systems — Neutron Shield Tank Cooling

Table 3.3.3-6, Closed Water Systems — Reactor Coolant

Materials

The materials of construction for the closed water systems components that are subject to aging management review are carbon steel, low-alloy steel, cast iron, stainless steel, copper alloys, and titanium.

Environment

Internal
A description of internal environments is provided in Table 3.0-1, Internal Service Environments. The closed water systems components that are subject to aging management review are exposed to treated water (bearing cooling/chilled water), treated water (component cooling), raw water, and gas (refrigerant).

External
The closed water systems components that require aging management review are located in the Containment and other indoor areas of the plant, and are exposed to an air environment. The Containment air environment, and the sheltered air environment used for indoor areas outside Containment, are as indicated in Table 3.0-2, External Service Environments.

External surfaces of closed water systems components may also be exposed to borated water leakage conditions.

Aging Effects Requiring Management

The following aging effects, associated with the closed water systems components, require management:

- Loss of material from carbon steel, low-alloy steel, cast iron, stainless steel, titanium, and copper alloy components in treated water or air environments.
- Loss of material from carbon steel and low-alloy steel components in a raw water environment.
- Loss of material from stainless steel and copper alloy components in a raw water environment.
- Loss of material from carbon steel, low-alloy steel, cast iron, and copper alloy components in a borated-water leakage environment.
- Heat transfer degradation of heat transfer surfaces in a raw water environment.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Conclusion

The following aging management activities manage aging effects for the closed water systems components:

- Boric Acid Corrosion Surveillance
- Chemistry Control Program for Secondary Systems
- Chemistry Control Program for Primary Systems
- General Condition Monitoring Activities
- Infrequently Accessed Area Inspection Activities
- Service Water System Inspections
- Work Control Process

A description of these aging management programs and activities is provided in Appendix B, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the closed water 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.

3.3.4 Diesel Generator Support Systems

The results of the aging management review of the following systems, or portions of systems, are provided in this section. The systems are described in the indicated sections.

- Alternate AC (AAC) diesel generator systems (Section 2.3.3.10)
- Emergency diesel generator (EDG) systems (Section 2.3.3.11)
- Security (SEC) system (Section 2.3.3.12)

A summary of the results of the aging management review for the diesel generator support systems is provided in the following tables. The tables provide the following information related to each component group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.3.4-1, Diesel Generator Support Systems — Alternate AC (AAC) Diesel Generator Systems

Table 3.3.4-2, Diesel Generator Support Systems — Emergency Diesel Generator (EDG) Systems

Table 3.3.4-3, Diesel Generator Support Systems — Security

Materials

The materials of construction for the DGSS are carbon steel, low-alloy steel, cast iron, stainless steel, copper alloys, and aluminum.

Environment

Internal
A description of internal environments is provided in Table 3.0-1, Internal Service Environments. The DGSS components are exposed to one or more of the following internal environments:

- compressed air
- lubricating or fuel oil
- treated water (diesel cooling)
- raw water
- ambient air

External
The DGSS components that require aging management review are located in indoor and outdoor areas of the plant. These components are exposed to air and atmosphere/weather environments. The sheltered air and outdoor (atmosphere/weather) environments, are as indicated in Table 3.0-2, External Service Environments.

Portions of DGSS piping are buried in soil and are exposed to a soil environment.

Aging Effects Requiring Management

The following aging effects, associated with DGSS components, require management:

- Cracking of copper alloy components in an air environment.
- Loss of material from carbon steel, low-alloy steel, cast iron, stainless steel, and copper alloy components in oil, air, treated water, raw water, soil, or atmosphere/weather environments.

Conclusion

The following aging management activities manage aging effects for the DGSS components:

- Buried Piping and Valve Inspection Activities
- Chemistry Control Program for Secondary Systems

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- Fuel Oil Chemistry
- General Condition Monitoring Activities
- Tank Inspection Activities
- Work Control Process

A description of these aging management programs and activities is provided in Appendix B, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the DGSS 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.

3.3.5 Air and Gas Systems

The results of the aging management review of the following systems, or portions of systems, are provided in this section. The systems are described in the indicated sections.

- Compressed air (CA) system (Section 2.3.3.13)
- Feedwater (FW) system (Section 2.3.4.4) components that provide the control air for selected feedwater valves.
- Heating and ventilation (HV) system (Section 2.3.3.21) components comprising the main control room/emergency switchgear room (MCR/ESGR) bottled air system.
- Instrument air (IA) system (Section 2.3.3.14)
- Primary and secondary plant gas supply (GN) system (Section 2.3.3.15)
- Reactor coolant (RC) system (Section 2.3.1.1) components associated with the control air for the pressurizer power operated relief valves (PORVs).
- Service air (SA) system (Section 2.3.3.16)

A summary of the results of the aging management review for the air and gas systems is provided in the following tables. The tables provide the following information related to each component group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.3.5-1, Air and Gas Systems — Compressed Air

Table 3.3.5-2, Air and Gas Systems — Feedwater

Table 3.3.5-3, Air and Gas Systems — Heating and Ventilation

Table 3.3.5-4, Air and Gas Systems — Instrument Air

Table 3.3.5-5, Air and Gas Systems — Primary and Secondary Plant Gas Supply

Table 3.3.5-6, Air and Gas Systems — Reactor Coolant

Table 3.3.5-7, Air and Gas Systems — Service Air

Materials

The materials of construction for the air and gas systems components that are subject to aging management review include rubber, copper alloys, carbon steel, low-alloy steel, aluminum, and stainless steel.

Environment

Internal
The internal environment for the air and gas systems components is compressed dry air or gas, with the exception of SA system components environment which is considered moisture-laden air since there are no dryers in the system. A description of internal environments is provided in Table 3.0-1, Internal Service Environments.

External
The air and gas systems components that require aging management review are located in the Containment and other indoor areas of the plant, and are exposed to an air environment. The Containment air environment, and the sheltered air environment used for areas outside Containment, are as indicated in Table 3.0-2, External Service Environments.

External surfaces of air and gas systems components may also be exposed to borated water leakage conditions.

Aging Effects Requiring Management

The following aging effects, associated with the air and gas systems, require management:

- Cracking and change in material properties of rubber components in an air environment.
- Loss of material from stainless steel components in an air environment.
- Loss of material from carbon steel, low-alloy steel, and copper alloy components in a borated water leakage environment.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Conclusion

The following aging management activities manage aging effects for the air and gas systems:

- Boric Acid Corrosion Surveillance
- General Condition Monitoring Activities
- Work Control Process

A description of these aging management activities is provided in Appendix B, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the air and gas systems 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.

3.3.6 Ventilation and Vacuum Systems

The results of the aging management review of the following systems, or portions of systems, are provided in this section. The systems are described in the indicated sections.

- Containment vacuum (CV) system (Section 2.3.3.17)
- Leakage monitoring (LM) system (Section 2.3.3.18)
- Secondary vent (SV) system (Section 2.3.3.19)
- Vacuum priming (VP) system (Section 2.3.3.20)
- Heating and ventilation (HV) system (Section 2.3.3.21)

A summary of the results of the aging management review for the ventilation and vacuum systems is provided in the following tables. The tables provide the following information related to each component group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.3.6-1, Ventilation and Vacuum Systems — Containment Vacuum

Table 3.3.6-2, Ventilation and Vacuum Systems — Leakage Monitoring

Table 3.3.6-3, Ventilation and Vacuum Systems — Secondary Vents

Table 3.3.6-4, Ventilation and Vacuum Systems — Vacuum Priming

Table 3.3.6-5, Ventilation and Vacuum Systems — Heating And Ventilation

Materials

The materials of construction for the ventilation and vacuum systems components that are subject to aging management review include carbon steel, low-alloy steel, copper alloys, stainless steel, and elastomeric (rubber) materials.

Aluminum is also used in ventilation and vacuum systems components.

Environment

Internal
The internal environment for the ventilation and vacuum systems components is air, with the exception of the HV system chiller compressors which are subjected to a refrigerant (freon gas) internal environment. A description of internal environments is provided in Table 3.0-1, Internal Service Environments.

External
The ventilation and vacuum systems components that require aging management review are located in the Containment and other indoor areas of the plant, and outdoors. These components are exposed to an air environment. The Containment air environment, and the sheltered air and outdoor (atmosphere/weather) environments, are as indicated in Table 3.0-2, External Service Environments.

External surfaces of ventilation and vacuum systems components may also be exposed to borated water leakage conditions.

Aging Effects Requiring Management

The following aging effects, associated with the ventilation and vacuum systems, require management:

- Loss of material from carbon steel, low-alloy steel, and copper alloy components in a borated water leakage environment.
- Loss of material from carbon steel and low-alloy steel components in an air or atmosphere/weather environment.
- Cracking and change in material properties of rubber components in an air or atmosphere/weather environment.

Conclusion

The following aging management activities manage aging effects for the ventilation and vacuum systems:

- Boric Acid Corrosion Surveillance

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- General Condition Monitoring Activities
- Work Control Process

A description of these aging management activities is provided in Appendix B, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the ventilation and vacuum systems 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.

3.3.7 Drain and Liquid Processing Systems

The results of the aging management review of the following systems, or portions of systems, are provided in this section. The systems are described in the indicated sections.

- Boron recovery (BR) system (Section 2.3.3.22)
- Drains - aerated (DA) system (Section 2.3.3.23)
- Drains - building services (DB) system (Section 2.3.3.24)
- Drains - gaseous (DG) system (Section 2.3.3.25)
- Liquid and solid waste (LW) system (Section 2.3.3.26)
- Radwaste (RW) system (Section 2.3.3.27)

A summary of the results of the aging management review for the drains and liquid processing systems (DLPS) is provided in the following tables. The tables provide the following information related to each component group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.3.7-1, Drain and Liquid Processing Systems — Boron Recovery

Table 3.3.7-2, Drain and Liquid Processing Systems — Drains-Aerated

Table 3.3.7-3, Drain and Liquid Processing Systems — Drains-Building Services

Table 3.3.7-4, Drain and Liquid Processing Systems — Drains-Gaseous

Table 3.3.7-5, Drain and Liquid Processing Systems — Liquid And Solid Waste

Table 3.3.7-6, Drain and Liquid Processing Systems — Radwaste

Materials

The materials of construction for the DLPS piping and components that are subject to aging management review are stainless steel, carbon steel, and low-alloy steel.

Environment

Internal

The internal operating conditions for the DLPS include raw water, treated water (component cooling), treated water (borated water), steam, air, and gas.

A description of internal environments is provided in Table 3.0-1, Internal Service Environments.

External

The DLPS components that require aging management review are located in the Containment and other indoor areas of the plant, and are exposed to an air environment. The Containment air environment, and the sheltered air environment used for areas outside Containment, are as indicated in Table 3.0-2, External Service Environments.

External surfaces of DLPS components may also be exposed to borated water leakage conditions.

Aging Effects Requiring Management

The following aging effect, associated with the DLPS components, requires management:

- Cracking of stainless steel components in a steam environment.
- Loss of material from carbon steel, low-alloy steel, and stainless steel components in air, gas, raw water, steam, or treated water environments.
- Loss of material from carbon steel and low-alloy steel components in a borated water leakage environment.

Conclusion

The following aging management activities manage aging effects for the DLPS:

- Boric Acid Corrosion Surveillance
- Chemistry Control Program for Secondary Systems
- Chemistry Control Program for Primary Systems
- General Condition Monitoring Activities
- Work Control Process

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

A description of these aging management programs and activities is provided in Appendix B, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the DLPS 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.

3.3.8 Vent and Gaseous Processing Systems

The results of the aging management review of the following systems, or portions of systems, are provided in this section. The systems are described in the indicated sections.

- Post accident hydrogen removal (HC) system (Section 2.3.3.28)
- Radiation monitoring (RM) system (Section 2.3.3.29)
- Vents - gaseous (VG) system (Section 2.3.3.30)

A summary of the results of the aging management review for the vent and gaseous processing systems (VGPS) is provided in the following tables. The tables provide the following information related to each component group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.3.8-1, Vent and Gaseous Processing Systems — Post-Accident Hydrogen Removal

Table 3.3.8-2, Vent and Gaseous Processing Systems — Radiation Monitoring

Table 3.3.8-3, Vent and Gaseous Processing Systems — Vents-Gaseous

Materials

The materials of construction for the VGPS components that are subject to aging management review are stainless steel, carbon steel, and low-alloy steel.

Environment

Internal

The internal environments for VGPS components are air and vent gases from various process systems, and air from the Containment atmosphere. A description of internal environments is provided in Table 3.0-1, Internal Service Environments.

External

The VGPS components that require aging management review are located in the Containment and other indoor areas of the plant, and are exposed to an air environment.

The Containment air environment, and the sheltered air environment used for indoor areas outside Containment, are as indicated in Table 3.0-2, External Service Environments.

External surfaces of VGPS components may also be exposed to borated water leakage conditions.

Aging Effects Requiring Management

The following aging effect, associated with the VGPS, requires management:

- Loss of material from carbon steel and low-alloy steel components in a borated water leakage environment.

Conclusion

The following aging management activities manage aging effects for the VGPS:

- Boric Acid Corrosion Surveillance
- General Condition Monitoring Activities

A description of these aging management programs and activities is provided in Appendix B, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the VGPS 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.

3.3.9 Fire Protection and Supporting Systems

The results of the aging management review of the following systems, or portions of systems, are provided in this section. The systems are described in the indicated sections.

- Fire protection (FP) system (Section 2.3.3.31)
- Reactor coolant (RC) system (Section 2.3.1.1) components that comprise the reactor coolant pump (RCP) motor oil collection system.

A summary of the results of the aging management review for the fire protection and supporting systems (FPSS) is provided in the following tables. The tables provide the following information related to each component group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.3.9-1, Fire Protection and Supporting Systems — Fire Protection

Table 3.3.9-2, Fire Protection and Supporting Systems — Reactor Coolant

Materials

The materials of construction for the FPSS components that are subject to aging management review are carbon steel, low-alloy steel, cast iron, stainless steel, and copper alloys.

Environment

Internal
The internal environments for FPSS components are raw water, treated water (diesel cooling), gas, air, lubricating oil, and fuel oil. A description of internal environments is provided in Table 3.0-1, Internal Service Environments.

External
The FPSS components that require aging management review are located in the Containment and other indoor areas of the plant, and outdoors. These components are exposed to an air or atmosphere/weather environment. The Containment air environment, and the sheltered air and outdoor (atmosphere/weather) environments, are as indicated in Table 3.0-2, External Service Environments.

Portions of FPSS piping and valves are buried and are exposed to a soil environment.

External surfaces of FPSS components may also be exposed to borated water leakage conditions.

Aging Effects Requiring Management

The following aging effects, associated with the FPSS, require management:

- Loss of material from carbon steel, low-alloy steel, cast iron, stainless steel and copper alloy components in raw water, treated water, oil, gas, air, atmosphere/weather, or soil environments.
- Loss of material from carbon steel, low-alloy steel, and copper alloy components in a borated water leakage environment.
- Heat transfer degradation of heat transfer surfaces in a raw water environment.

Conclusion

The following aging management activities manage aging effects for the FPSS:

- Boric Acid Corrosion Surveillance
- Buried Piping and Valve Inspection Activities

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- Fire Protection Program
- Fuel Oil Chemistry
- General Condition Monitoring Activities
- Tank Inspection Activities

A description of these aging management programs and activities is provided in Appendix B, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the FPSS 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.

3.4 Aging Management of Steam and Power Conversion Systems

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 methodology used for performing aging management reviews including the process for identifying the aging effects requiring management is explained in Appendix C, Aging Management Review Methodology.

Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences. The only differences identified in this section (including the tables) are the differences in materials, environments, aging effects requiring management, and aging management activities. Plant-specific scoping and screening differences (such as name differences, additional systems, and additional in-scope long-lived passive component groups) have already been identified in the scoping and screening results sections of the application, and are not identified again in this section.

A listing of the abbreviations used in this section is provided in Section 1.4.1.

The results of the aging management review of the following systems, or portions of systems, are provided in this steam and power conversion systems (SPCS) section. The systems are described in the indicated sections.

- Auxiliary steam (AS) system (Section 2.3.4.1)
- Blowdown (BD) system (Section 2.3.4.2)
- Condensate (CN) system (Section 2.3.4.3)
- Feedwater (FW) system (Section 2.3.4.4)
- Main steam (MS) system (Section 2.3.4.5)
- Steam drains (SD) system (Section 2.3.4.6)
- Steam generator water treatment (WT) system (Section 2.3.4.7)

A summary of the results of the aging management review for the SPCS is provided in the following tables. The tables provide the following information related to each component group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific activities that manage the identified aging effects.

Table 3.4-1, Steam and Power Conversion Systems — Auxiliary Steam

Table 3.4-2, Steam and Power Conversion Systems — Blowdown

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Table 3.4-3, Steam and Power Conversion Systems — Condensate

Table 3.4-4, Steam and Power Conversion Systems — Feedwater

Table 3.4-5, Steam and Power Conversion Systems — Main Steam

Table 3.4-6, Steam and Power Conversion Systems — Steam Drains

Table 3.4-7, Steam and Power Conversion Systems — Steam Generator Water Treatment

Materials

The materials of construction for the SPCS piping and components that are subject to aging management review include carbon steel, low-alloy steel, and stainless steel.

Copper alloys and nickel-based alloy materials are also used.

Environment

Internal

The normal operating conditions for the SPCS piping and components that require aging management review are listed below. A description of internal environments is provided in Table 3.0-1, Internal Service Environments.

Condensate and auxiliary feedwater components are exposed to treated water with saturated oxygen concentrations at ambient temperature with typically stagnant flow conditions. Auxiliary feedwater lubricating oil components are exposed to oil at ambient temperature during auxiliary feedwater standby conditions, but may experience elevated temperatures during system operation. Low points in the system may experience water-pooling.

Main feedwater and blowdown components are exposed to treated water (secondary) with low oxygen concentrations at high temperature and typically high flowrate conditions.

The blowdown system vent condenser is exposed to low temperature, low oxygen concentration treated water (component cooling).

Steam generator water treatment components are exposed to treated water (secondary) with low oxygen concentrations at ambient temperature with typically stagnant flow conditions.

Main steam, steam drains, and auxiliary steam components are exposed to steam with low oxygen concentrations at high temperature.

External

The SPCS components that require aging management review are located in the Containment and other indoor areas of the plant, and outdoors. These components are exposed to an air or atmosphere/weather environment. The Containment air environment, and the sheltered air and outdoor (atmosphere/weather) environments, are as indicated in Table 3.0-2, External Service Environments.

External surfaces of SPCS components may also be exposed to borated water leakage conditions.

Aging Effects Requiring Management

The following aging effects, associated with the SPCS components, require management:

- Cracking of carbon steel, low-alloy steel, and stainless steel components in treated water, steam, or potentially water-contaminated lubricating oil environments.
- Cracking of nickel-based alloys in a steam environment, and copper alloys in an air environment.
- Loss of material from carbon steel, low-alloy steel, and stainless steel components in a treated water, steam, or potentially water-contaminated lubricating oil environment.
- Loss of material from carbon steel and low-alloy steel components exposed to atmosphere/weather.
- Loss of material from carbon steel and low-alloy steel components in an air environment.
- Loss of material from nickel-based alloy in a steam environment and copper alloy components in a treated water environment.
- Loss of material from carbon steel and low-alloy steel components resulting from potential borated water leakage onto the external surface of the components.

Conclusion

The following aging management activities manage aging effects for the SPCS:

- Augmented Inspection Activities
- Boric Acid Corrosion Surveillance
- Chemistry Control Program for Primary Systems
- Chemistry Control Program for Secondary Systems

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- General Condition Monitoring Activities
- Infrequently Accessed Area Inspection Activities
- ISI Program - Component and Component Support Inspections
- Secondary Piping and Component Inspection
- Tank Inspection Activities
- Work Control Process

A description of these aging management programs and activities is provided in Appendix B, along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the SPCS 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.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

3.5 Aging Management of Structures and Component Supports

This section provides the results of the aging management review for those structures and structural components identified in Section 2.4, as being subject to aging management review. The methodology used for performing aging management reviews including the process for identifying the aging effects requiring management is explained in Appendix C, Aging Management Review Methodology.

Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences. The only differences identified in this section (including the tables) are the differences in materials, environments, aging effects requiring management, and aging management activities. Plant-specific scoping and screening differences (such as name differences, additional systems, and additional in-scope long-lived passive component groups) have already been identified in the scoping and screening results sections of the application, and are not identified again in this section.

A listing of the abbreviations used in this section is provided in Section 1.4.1.

To optimize the aging management review, structures that are attached to or contained within larger structures, have been reviewed with the larger structure. The following structures have been determined to be subject to aging management review and the aging management review results are provided in this section:

- Containment
- Auxiliary Building Structure, which includes the following:
  - Auxiliary Building
  - Cable vault
  - Cable tunnel
  - Pipe tunnel
  - Hydrogen recombiner vault
  - Rod drive room
- Other Class I Structures, which include the following:
  - Safeguards Building
  - Main Steam Valve House
  - Quench Spray Pump House

  - Fuel Oil Pump House
  - Auxiliary Feedwater Pump House
  - Auxiliary Feedwater Tunnel
  - Casing Cooling Pump House
  - Service Water Pump House
  - Service Water Pipe Expansion Joint Enclosure
  - Service Water Valve House
  - Service Water Tie-in Vault
- Fuel Building, which includes
  - Fuel Building structure
  - New fuel storage area
  - Fuel pool, including transfer canals
  - Spent fuel storage racks
- Miscellaneous Structures, which include the following:
  - Turbine Building
  - Service Building
  - SBO Building
  - Security Diesel Building
- Intake Structures, which include the following:
  - Intake Structure
  - Discharge tunnel and seal pit
- Yard Structures, which include the following:
  - Tank Foundations and Missile Barriers
  - Manholes
  - Fuel Oil Storage Tank Dike
  - Transformer Firewalls/Dikes
  - Duct banks
  - Security lighting poles
  - Domestic Water Treatment Building

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

  - Auxiliary service water expansion joint enclosure
  - Yard valve pit
- Earthen Structures, which include the following:
  - Service water reservoir
  - Floodwall west of the Turbine Building
- NSSS Equipment Supports

General structural supports and other miscellaneous structural components such as cable tray covers, fire/EQ barrier doors, fire penetration materials, seismic gap covers, cabinets, panels, and benchboards have been evaluated as plant commodities. The AMR results for these structural commodities are presented in the following subsections:

1. Section 3.5.10, General Structural Supports
2. Section 3.5.11, Miscellaneous Structural Commodities

The AMR results for structures do not list structural commodities since these items have their own AMR evaluations. NSSS equipment supports, and load handling cranes and devices also have their own AMR evaluations and are not identified in the AMR results for structures.

Structural bolting has been dispositioned generically as explained in Section C2.2, Identification of In-scope Passive Subcomponents. Embedded steel (including embedded bolting) has been dispositioned generically as explained in Section C2.4, Identification of Materials and Environments.

3.5.1 Containment

The results of the aging management review of the Containment are provided in this section and summarized in Table 3.5.1-1. The table provides the following information related to each structural member: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the Containment is provided in Section 2.4.1.

Materials

The materials of construction for the Containment structural members that are subject to aging management review are concrete, carbon steel, low-alloy steel, stainless steel, and elastomers.

Neoprene is also used as a material of construction for the reactor cavity seal.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

The Containment structure has been designed and constructed in accordance with ACI 318-63. The cement used in the concrete is ASTM C150, Type II, high-density, low-permeability, low-alkali cement. Aggregates in the concrete mix conform to ASTM C33 and air entrainment of 3% to 5% has been used. The concrete reinforcement used the proper arrangement and distribution of reinforcement to control cracking in accordance with ACI 201.2R-67. Similar concrete materials are used for the grout.

Testing of the aggregates used in the concrete has been performed in accordance with the test methods identified in ASTM C295 or ASTM C227.

Porous concrete is used under the base mat to provide drainage for the Containment structure. Type II, low-alkali, portland cement (and not calcium aluminate cement) is used in porous concrete. Use of this type of cement prevents any erosion from concrete and minimizes settlement.

Leaching of calcium hydroxide is non-significant for Class I concrete structures not exposed to flowing water; and for structures that are exposed to flowing water but are constructed using the guidance of ACI 201.2R-67 to provide dense, well-cured concrete with low permeability and control cracking through proper arrangement & distribution of reinforcement. The Containment structure is not exposed to flowing water.

Environment

The structural members evaluated for aging management of the Containment that require aging management review are exposed to atmosphere/weather, soil, treated water (borated water), raw water, Containment air, and the sheltered air environment used for areas inside buildings other than Containment. With the exception of localized temperatures described below, these environments are as indicated in Table 3.0-2, External Service Environments.

The air temperature varies throughout the Containment according to location and elevation. General air temperatures in some specific areas can be found to be higher than 125°F, but not greater than 150°F. The Containment hot pipe penetrations may be subject to elevated localized temperatures, but not greater than 200°F, and these temperatures do not affect the overall integrity of the Containment.

Structures and structural members may be exposed to groundwater if they are located below the local groundwater elevation. The results of recent groundwater analyses discussed in Appendix C indicate that the groundwater chemistry is non-aggressive.

The fuel transfer tube and its enclosure (including expansion joints) normally are exposed to ambient air. When the fuel transfer tube blind flange is removed and the refueling cavity

is flooded, the fuel transfer tube is exposed to treated water (borated water). The temperature of the treated water (borated water) is maintained less than 140°F.

Additionally, systems within the Containment contain borated water. Therefore, structural members and penetrations in the Containment could be exposed to a borated water leakage environment.

Aging Effects Requiring Management

The following aging effects, associated with the Containment structural members, require management:

- Change in material properties and cracking of elastomers in an air environment.
- Loss of material from carbon steel and low-alloy steel structural members in an air or atmosphere/weather environments
- Loss of material from stainless steel structural members in treated water (borated water) or raw water environments.
- Loss of material from carbon steel and low-alloy steel structural members in a borated water leakage environment.

Conclusion

The following programs and activities manage the aging effects on the structural members of the Containment:

- Civil Engineering Structural Inspection
- Boric Acid Corrosion Surveillance
- Chemistry Control Program for Primary Systems
- ISI Program - Containment Inspection
- General Condition Monitoring Activities
- Infrequently Accessed Area Inspection Activities
- Work Control Process

A description of these aging management activities 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 Containment 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.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

3.5.2 Auxiliary Building Structure

The results of the aging management review of the following structures are provided in this section, and a description of these structures is provided in Section 2.4.2:

- Auxiliary Building
- Cable vault
- Cable tunnel
- Pipe tunnel
- Hydrogen recombiner vault
- Rod drive room

Table 3.5.2-1 summarizes the results of the aging management review of the Auxiliary Building. The table provides the following information related to each structural member: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Materials

The materials of construction for the Auxiliary Building Structure structural members that are subject to aging management review are concrete, carbon steel, and low-alloy steel.

The concrete structures have been designed and constructed in accordance with ACI 318-63 and ACI 301-66. The cement used in the concrete was ASTM C150, Type II, high-density, low-permeability, low-alkali cement. Aggregates in the concrete mix conformed to ASTM C33 and air entrainment of 3% to 5% was used. The concrete reinforcement used the proper arrangement and distribution of reinforcement to control cracking in accordance with ACI 201.2R-67. Similar concrete materials were used in the grouting and masonry walls.

Testing of the aggregates used in the concrete has been performed in accordance with the test methods identified in ASTM C295 or ASTM C227.

Environment

The Auxiliary Building Structure structural members subject to aging management review are exposed to atmosphere/weather, sheltered air, and soil environments.

Additionally, some of the systems within the Auxiliary Building contain borated water. Therefore, structural members in the Auxiliary Building Structure could be exposed to a borated water leakage environment.

The atmosphere/weather, sheltered air, and soil environments are as indicated in Table 3.0-2, External Service Environments.

Aging Effects Requiring Management

The following aging effects, associated with the Auxiliary Building Structure structural members, require management:

- Cracking of masonry block walls in an air environment.
- Loss of material from carbon steel and low-alloy steel structural members in air, atmosphere/weather, or borated water leakage environments.

Conclusion

The following programs and activities manage the aging effects associated with the structural members of the Auxiliary Building Structure:

- Civil Engineering Structural Inspection
- General Condition Monitoring Activities

A description of these aging management activities 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 Building Structure 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.

3.5.3 Other Class I Structures

The results of the aging management review of the following structures are provided in this section, and a description of these structures is provided in Section 2.4.3:

- Safeguards Building
- Main Steam Valve House
- Quench Spray Pump House
- Fuel Oil Pump House
- Auxiliary Feedwater Pump House
- Auxiliary Feedwater Tunnel
- Casing Cooling Pump House
- Service Water Pump House
- Service Water Pipe Expansion Joint Enclosure
- Service Water Valve House
- Service Water Tie-in Vault

The following tables summarize the results of the aging management review of the Other Class I Structures. The tables provide the following information related to each structural member: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.5.3-1, Other Class I Structures — Safeguards Building

Table 3.5.3-2, Other Class I Structures — Main Steam Valve House

Table 3.5.3-3, Other Class I Structures — Quench Spray Pump House

Table 3.5.3-5, Other Class I Structures — Auxiliary Feedwater Pump House

Table 3.5.3-4, Other Class I Structures — Fuel Oil Pump House

Table 3.5.3-6, Other Class I Structures — Auxiliary Feedwater Tunnel

Table 3.5.3-7, Other Class I Structures — Casing Cooling Pump House

Table 3.5.3-8, Other Class I Structures — Service Water Pump House

Table 3.5.3-9, Other Class I Structures — Service Water Pipe Expansion Joint Enclosure

Table 3.5.3-10, Other Class I Structures — Service Water Valve House

Table 3.5.3-11, Other Class I Structures — Service Water Tie-in Vault

Materials

The materials of construction for the Other Class I Structures structural members that are subject to aging management review are concrete, carbon steel, and low-alloy steel.

The concrete structures have been designed and constructed in accordance with ACI 318-63 and ACI 301-66. The cement used in the concrete is ASTM C150, Type II, high-density, low-permeability, low-alkali cement. Aggregates in the concrete mix conform to ASTM C33 and air entrainment of 3% to 5% has been used. The concrete reinforcement used the proper arrangement and distribution of reinforcement to control cracking in accordance with ACI 201.2R-67. Similar concrete materials were used in the grouting and masonry walls.

Testing of the aggregates used in the concrete has been performed in accordance with the test methods identified in ASTM C295 or ASTM C227.

Environment

The Other Class I Structures are exposed to atmosphere/weather, sheltered air, and soil environments.

Structural members of the Service Water Pump House are also exposed to a raw water (Service Water Reservoir) environment.

Additionally, some of the Other Class I Structures house systems that contain borated water. Therefore, structural members in these buildings could be exposed to a borated water leakage environment.

With the exception of the maximum temperature in the upper level of the Main Steam Valve House, the atmosphere/weather, sheltered air, soil, and raw water (Service Water Reservoir) environments are as indicated in Table 3.0-2, External Service Environments.

The maximum temperature in the upper level of either units Main Steam Valve House is 160°F.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Aging Effects Requiring Management

The following aging effect, associated with the Other Class I Structures structural members, require management:

- Loss of material from carbon steel and low-alloy steel structural members in air, atmosphere/weather, or borated water leakage environments.
- Cracking of masonry block walls in an air environment.
- Cracking of concrete in soil.

Conclusion

The following programs and activities manage the aging effects associated with the structural members of the Other Class I Structures:

- Civil Engineering Structural Inspection
- General Condition Monitoring Activities
- Infrequently Accessed Area Inspection Activities

A description of these aging management activities 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 Other Class I Structures 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.

3.5.4 Fuel Building

The results of the aging management review of the Fuel Building are provided in this section and summarized in Table 3.5.4-1. The table provides the following information related to each structural member: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the Fuel Building is provided in Section 2.4.4.

Materials

The materials of construction for the Fuel Building structural members that are subject to aging management review are concrete, carbon steel, low-alloy steel, and stainless steel.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

The concrete structures have been designed and constructed in accordance with ACI 318-63 and ACI 301-66. The cement used in the concrete is ASTM C150, Type II, high-density, low-permeability, low-alkali cement. Aggregates in the concrete mix conform to ASTM C33 and air entrainment of 3% to 5% has been used. The concrete reinforcement used the proper arrangement and distribution of reinforcement to control cracking in accordance with ACI 201.2R-67. Similar concrete materials are used for the masonry walls and the grouting.

Testing of the aggregates used in the concrete has been performed in accordance with the test methods identified in ASTM C295 or ASTM C227.

Environment

The Fuel Building structural members subject to aging management review are exposed to atmosphere/weather, sheltered air, and soil environments.

Additionally, some systems in the Fuel Building contain borated water. Therefore, structural members in the Fuel Building could be exposed to a borated water leakage environment.

The atmosphere/weather, sheltered air, and soil environments are as indicated in Table 3.0-2, External Service Environments.

The spent fuel pool contains treated water (borated water). The spent fuel pool's cooling system maintains the temperature of the spent fuel pool water below 140°F.

Aging Effects Requiring Management

The following aging effects, associated with the Fuel Building structural members, require management:

- Cracking of masonry block walls in an air environment.
- Loss of material from carbon steel and low-alloy steel structural members in air, atmosphere/weather, or borated water leakage water environments.
- Loss of material from stainless steel structural members in the treated water (borated water) environment of the spent fuel pool.

Conclusion

The following programs and activities manage the aging effects on the structural members of the Fuel Building:

- Civil Engineering Structural Inspection
- Chemistry Control Program for Primary Systems

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

- General Condition Monitoring Activities

A description of these aging management activities 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 Fuel Building 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.

3.5.5 Miscellaneous Structures

The results of the aging management review of the following structures are provided in this section, and a description of these structures is provided in Section 2.4.5:

- Turbine Building
- Service Building
- Station Blackout (SBO) Building
- Security Diesel Building

The following tables summarize the results of the aging management review of the Miscellaneous Structures. The tables provide the following information related to each structural member: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.5.5-1, Miscellaneous Structures — Turbine Building

Table 3.5.5-2, Miscellaneous Structures — Service Building

Table 3.5.5-3, Miscellaneous Structures — SBO Building

Table 3.5.5-4, Miscellaneous Structures — Security Diesel Building

Materials

The materials of construction for the miscellaneous structures structural members that are subject to aging management review are concrete, carbon steel, low-alloy steel, stainless steel, and aluminum.

The concrete structures have been designed and constructed in accordance with ACI 318-63 and ACI 301-66. The cement used in the concrete is ASTM C150, Type II, high-density, low-permeability, low-alkali cement. Aggregates in the concrete mix conform to ASTM C33 and air entrainment of 3% to 5% has been used. The concrete

reinforcement used the proper arrangement and distribution of reinforcement to control cracking in accordance with ACI 201.2R-67. Similar concrete materials were used for the masonry block walls and the grouting.

Testing of the aggregates used in the concrete has been performed in accordance with the test methods identified in ASTM C295 or ASTM C227.

Environment

The miscellaneous structures are exposed to atmosphere/weather, sheltered air, and soil environments.

With the exception of the minimum temperature in the emergency diesel generator room, the atmosphere/weather, sheltered air, and soil environments are as indicated in Table 3.0-2, External Service Environments.

The minimum temperature in the emergency diesel generator room can be as low as 20°F when the outside temperature is at the design minimum value and the diesel generator is operating.

Aging Effects Requiring Management

The following aging effects, associated with the miscellaneous structures structural members, require management:

- Cracking of masonry block walls in an air environment.
- Loss of material from carbon steel and low-alloy steel structural members in an air environment.

Conclusion

The following programs and activities manage the aging effects on the structural members of the miscellaneous structures:

- Civil Engineering Structural Inspection
- General Condition Monitoring Activities

A description of these aging management activities 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 miscellaneous structures 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.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

3.5.6 Intake Structures

The results of the aging management review of the following structures are provided in this section, and a description of these structures is provided in Section 2.4.6:

- Intake Structure (including the circulating water intake tunnel header, Auxiliary Service Water Pump House, Fire Pump House, and Intake Structure Control House)
- Discharge Tunnels & Seal Pit

The following tables summarize the results of the aging management review of the intake structures. The tables provide the following information related to each structural member: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.5.6-1, Intake Structures — Intake Structure

Table 3.5.6-2, Intake Structures — Discharge Tunnels and Seal Pit

Materials

The materials of construction for the intake structures structural members that are subject to aging management review are concrete, carbon steel, and low-alloy steel.

Aluminum is also used as a material of construction for the Fire Pump House roof access cover.

The concrete structures have been designed and constructed in accordance with ACI 318-63 and ACI 301-66. The cement used in the concrete is ASTM C150, Type II, high-density, low-permeability, low-alkali cement. Aggregates in the concrete mix conform to ASTM C33 and air entrainment of 3% to 5% has been used. Similar concrete materials were used for the masonry block walls and the grouting.

Testing of the aggregates used in the concrete has been performed in accordance with the test methods identified in ASTM C295 or ASTM C227.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Environment

The Intake Structures are exposed to atmosphere/weather, sheltered air, soil, and raw water environments. These environments are as indicated in Table 3.0-2, External Service Environments.

The velocity of the water inside the intake tunnel header is approximately 10 ft/sec. The velocity of the water inside the Intake Structure bay is approximately 1 ft/sec.

Additionally, the water velocity inside the discharge tunnel is calculated to be approximately 12 fps.

Aging Effects Requiring Management

The following aging effects, associated with the Intake Structures structural members, require management:

- Loss of material from carbon steel and low-alloy steel structural members in a raw water environment.
- Cracking of concrete in an air or atmosphere/weather environments.
- Loss of material from carbon steel and low-alloy steel structural members in air or atmosphere/weather environments.

Conclusion

The Civil Engineering Structural Inspection activities manage the aging effects for the structural members of the Intake Structures.

A description of these aging management activities is provided in Appendix B along with the demonstration that the identified aging effects will be effectively managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the intake structures 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.

3.5.7 Yard Structures

The results of the aging management review of the following structures are provided in this section, and a description of these structures is provided in Section 2.4.7:

- Tank Foundations and Missile Barriers, which include the following:
  - Buried fuel oil tank missile barrier

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

  - Chemical addition tank foundation
  - Emergency condensate storage tank foundation and missile barrier
  - Refueling water storage tank foundation
  - Casing Cooling tank foundation
- Manholes
- Fuel Oil Storage Tank Dike
- Transformer Firewalls/Dikes
- Duct banks
- Security lighting poles
- Domestic Water Treatment Building
- Auxiliary service water expansion joint enclosure
- Yard valve pit

The following tables summarize the results of the aging management review of the yard structures. The tables provide the following information related to each structural member: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.5.7-1, Yard Structures — Tank Foundations and Missile Barriers

Table 3.5.7-2, Yard Structures — Manholes

Table 3.5.7-3, Yard Structures — Fuel Oil Storage Tank Dike

Table 3.5.7-4, Yard Structures — Transformer Firewalls/Dikes

Table 3.5.7-5, Yard Structures — Duct Banks

Table 3.5.7-6, Yard Structures — Security Lighting Poles

Table 3.5.7-7, Yard Structures — Domestic Water Treatment Building

Table 3.5.7-8, Yard Structures — Auxiliary Service Water Expansion Joint Enclosure

Table 3.5.7-9, Yard Structures — Yard Valve Pit

Materials

The materials of construction for the structural members of the yard structures that are subject to aging management review are concrete, carbon steel, and low-alloy steel.

Galvanized steel is also used as a material of construction for the security lighting poles.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

The concrete structures have been designed and constructed in accordance with ACI 318-63 and ACI 301-66. The cement used in the concrete is ASTM C150, Type II, high-density, low-permeability, low-alkali cement. Aggregates in the concrete mix conform to ASTM C33 and air entrainment of 3% to 5% has been used. The concrete reinforcement used the proper arrangement and distribution of reinforcement to control cracking in accordance with ACI 201.2R-67. Similar concrete materials were used in the grouting.

Testing of the aggregates used in the concrete has been performed in accordance with the test methods identified in ASTM C295 or ASTM C227..

The cement used in the refueling water storage tank foundation conforms to ASTM C150, Type II, low-alkali cement with a water-cement ratio of 0.80. Air entrainment was used to resist the effects of freeze-thaw cycling on the concrete. Aggregates in the concrete mix conform to ASTM C33.

Environment

The yard structures are exposed to atmosphere/weather, sheltered air, and soil environments. These environments are as indicated in Table 3.0-2, External Service Environments.

Aging Effects Requiring Management

The following aging effects, associated with the yard structures structural members, require management:

- Loss of material from concrete in an atmosphere/weather environment.
- Loss of material from galvanized steel structural members in an atmosphere/weather environment.
- Loss of material from carbon steel and low-alloy steel structural members in air or atmosphere/weather environments.
- Cracking of concrete in atmosphere/weather environments.

Conclusion

The following programs and activities manage the aging effects for the structural members of the yard structures:

- Civil Engineering Structural Inspection
- Infrequently Accessed Area Inspection Activities

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

A description of these aging management activities 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 yard structures 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.

3.5.8 Earthen Structures

The results of the aging management review of the following structures are provided in this section, and a description of these structures is provided in Section 2.4.8:

- Service Water Reservoir
- Floodwall West of the Turbine Building

The following tables summarize the results of the aging management review of the earthen structures. The tables provide the following information related to each structural member: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

Table 3.5.8-1, Earthen Structures — Service Water Reservoir

Table 3.5.8-2, Earthen Structures — Floodwall West of the Turbine Building

Materials

The materials of construction for the earthen structures structural members that require aging management review are soil and concrete.

Carbon steel is used as a material of construction for the floodwall drain pipe.

The soil and concrete are defined as follows:

Soil (SWR)

- Random fill used to construct the SWR dike embankment consists of a mixture of clay, silt, sand and some gravel sized particles consisting of residual soil.
- Select fill used to construct the clay liner consists of a mixture of fine sand, silt, and clay. Select fill consists of finer more plastic material, as compared to the random fill.
- Fine filter used in the construction of the internal drains consisted of a washed natural sand and gravel.
- Coarse Filter used in the construction of the internal drains consists of natural sand and gravel, crushed rock, and screenings from crushed rock or gravel.
- Rockfill used in the construction of the downstream shell and protection on the upstream slope has been obtained from the excavation of granite gneiss.
- Coarse aggregate used for the road surfacing material is a Size No. 21 aggregate, and a Size No. 57 has been used to prevent liner erosion during winter bypass operation for the spray piping system.

Soil (Floodwall)

- Random fill used to construct the floodwall embankment consists of a mixture of clay, silt, sand, and some gravel-size particles.

Concrete (SWR)

- ASTM C150, Type II, low-alkali cement with air entrainment 3% to 5% and a water-cement ratio of 0.50. Aggregates in the concrete mix conform to ASTM C33. (This concrete is used for the service water reservoir liner at the service water pump house, which is designed and constructed in accordance with ACI 318-63 and ACI 301-66).

  Testing of the aggregates used in the concrete has been performed in accordance with the test methods identified in ASTM C295 or ASTM C227.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Concrete (SWR) (continued)

- ASTM C150, Type II, and low-alkali cement. Aggregates in the concrete mix conform to ASTM C33. The proportioning of structural concrete conforms to ACI 211.1 and ACI 349. Air entrainment is in accordance with ACI 318-83. (This concrete is used for the service water reservoir spray piping spread footings, which are designed and constructed in accordance with ACI 318-83 and ACI 301-84).

  Testing of the aggregates used in the concrete has been performed in accordance with the test methods identified in ASTM C295 or ASTM C227.

Concrete (Floodwall)

- ASTM C150, Type II, cement-mortar that includes a non-shrink additive such as Intrusion Aid, manufactured by Intrusion-Prepakt, Inc.

Environment

Earthen structures have portions that are submerged and portions that are exposed to the atmosphere/weather. The service water reservoir (SWR) waterside slope (clay liner) is protected with two feet of rockfill to the top of the embankment crest. The remaining exposed soil is protected with vegetation and rip-rap.

The floodwall west of the Turbine Building is an earthen structure that functions as a water retention structure only during extreme flooding conditions. The exposed soil is protected with vegetation and rip-rap.

The service water reservoir and the floodwall west of the Turbine Building are exposed to atmosphere/weather, soil and raw water environments.

The atmosphere/weather, soil, and raw water environments are as indicated in Table 3.0-2, External Service Environments.

Aging Effects Requiring Management

The following aging effects, associated with the earthen structures structural members, require management:

- Loss of material and loss of form of soil in an atmosphere/weather environment.
- Loss of material from carbon steel and low-alloy steel in a soil environment.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Conclusion

The following programs and activities manage the aging effects on the structural members of the earthen structures:

- Civil Engineering Structural Inspection
- Buried Piping and Valve Inspection Activities

A description of these aging management activities 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 earthen structures 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.

3.5.9 NSSS Equipment Supports

The results of the aging management review of the NSSS equipment supports are provided in this section and summarized in Table 3.5.9-1. The table provides the following information related to each structural member: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the NSSS equipment supports is provided in Section 2.4.9.

Confirmation of Topical Report Applicability

The Westinghouse Owners' Group Life Cycle Management & License Renewal Program has drafted topical report, WCAP-14422, *License Renewal Evaluation: Aging Management for Reactor Coolant System Supports*, December 2000 (Reference 1), outlining the aging management evaluation of NSSS equipment supports for a number of plants including the configuration for Surry. Therefore, the topical report is directly applicable, and has been utilized in the aging management review of the NSSS supports. The scope of the NSSS supports described in the topical report bounds the installed NSSS supports with the following clarifications:

- The topical report is a generic document that addresses the domestic nuclear plants that utilize the Westinghouse Nuclear Supply System. Therefore, environments, component temperatures, materials, and support configurations were addressed on a generic basis within the report. For the aging management review of the NSSS equipment supports presented here, plant specific design basis documentation has

been used to determine actual values and configurations applicable to the installed NSSS equipment supports. The generic parameters stated in the topical report for NSSS equipment supports were not relied upon during the aging management review. Therefore, any questions, anomalies, and conflicts within the topical report with regards to these aspects do not impact Dominion's aging management review for the NSSS equipment supports.

- The topical report for RCS supports included the Pressurizer (PZR) surge line supports. The pressurizer surge line is evaluated for the effects of aging with the general structural supports and the results are provided in Section 3.5.10, General Structural Supports.
- The topical report states that NSSS equipment supports are not generally designed to specifically use bolted joint connections requiring pre-load. Dominion's review has determined that this is generally a true statement, but there are situations where pre-loading has been utilized and has been evaluated accordingly.

A reconciliation of the final SER applicant action items is provided in the following table:

Table 3.5.9-W1, WCAP-14422, Rev. 2-A, FSER Response to Applicant Action Items

Materials

The materials of construction for the NSSS support structural members that are subject to aging management review are carbon steel, low-alloy steel, maraging steel, stainless steel, and bronze.

Some of the NSSS support structural members have been impregnated with a low-friction lubricant (Lubrite).

Environment

Internal

The only NSSS equipment support structural members within the scope of license renewal that is in contact with fluids is the internal surfaces of the NST annular tank. The tank is filled with treated water (component cooling). The operating temperature of the NST is approximately 120°F.

External

The NSSS equipment supports are located in the Containment and exposed to the Containment air environment indicated in Table 3.0-2, External Service Environments. External surfaces of the NSSS equipment supports may also be exposed to borated water leakage conditions.

Aging Effects Requiring Management

The following aging effects, associated with the NSSS equipment supports structural members, require management:

- Loss of material from carbon steel, low-alloy steel, maraging steel, and bronze structural members in a borated water leakage environment.
- Loss of material from carbon steel, low-alloy steel, and maraging steel structural members in treated water or air environments.
- Cracking of high strength maraging steel bolting in an air environment.

Conclusion

The following programs and activities manage the aging effects for the structural members of the NSSS equipment supports:

- Infrequently Accessed Area Inspection Activities
- Chemistry Control Program for Primary Systems
- ISI Program - Component and Component Support Inspections
- Boric Acid Corrosion Surveillance

A description of these aging management activities 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 NSSS equipment supports 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.

3.5.10 General Structural Supports

The results of the aging management review of the general structural supports are provided in this section and summarized in Table 3.5.10-1, General Structural Supports. The table provides the following information related to each structural member: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

A description of the general structural supports is provided in Section 2.4.10, General Structural Supports.

Materials

The materials and fabrication methods used for general structural supports conform to standard industry practices. General structural supports are fabricated primarily from carbon steel and low-alloy steel, however, stainless steel, aluminum, and copper alloys are also used.

Typical structural support items fabricated from carbon steel and low-alloy steel include structural shapes, plates, sheet steel, clamps, brackets, cable trays, conduits, and vendor-designed specialty items, such as struts and spring hangers. Associated connection hardware, such as bolts, nuts, washers, and pins, are also included.

Aluminum is used for cable trays and conduits inside buildings, except for Containment. Cable trays and conduits located inside Containment or in outside areas are fabricated from galvanized carbon steel.

There are limited applications of stainless steel in the construction of structural supports. For example, the ball and casing for "monoball" supports used in certain engineered sliding pipe supports are fabricated from stainless steel. Additionally, supports submerged in borated water are fabricated from stainless steel.

Certain engineered pipe supports utilize a graphite-based lubricant (Lubrite) that has been impregnated into the sliding components to provide a low-friction surface. The sliding surfaces are fabricated from a bronze (copper alloy) plate. The bronze plate contains trepanned holes into which the Lubrite is injected.

Environment

The general structural supports that require aging management review are located in the Containment and other indoor areas of the plant, and outdoors. These components are exposed to an air or atmosphere/weather environment. The Containment air environment, and the sheltered air and outdoor (atmosphere/weather) environments, are as indicated in Table 3.0-2, External Service Environments.

The surfaces of certain general structural supports may also be exposed to borated water leakage conditions.

Some structural supports are attached to the liner of the spent fuel pool and are submerged in treated (borated) water.

Structural supports for the service water (SW) system spray piping and components are submerged in the raw water of the service water reservoir, or are intermittently wetted by SW spray.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Aging Effects Requiring Management

The following aging effect, associated with the general structural supports, requires management:

- Loss of material from carbon steel and low-alloy steel support components in an air or atmosphere/weather environment.
- Loss of material from carbon steel and low-alloy steel support components in a raw water environment.
- Loss of material from stainless steel supports in a treated water (borated water) environment.
- Loss of material from carbon steel and low-alloy steel support components in a borated water leakage environment.

Conclusion

The following programs and activities manage the aging effects for the structural members of the general structural supports:

- Augmented Inspection Activities
- Battery Rack Inspections
- Boric Acid Corrosion Surveillance
- Chemistry Control Program for Primary Systems
- ISI Program - Component and Component Support Inspections
- General Condition Monitoring Activities
- Infrequently Accessed Area Inspection Activities

A description of these aging management activities 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 general structural supports 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.

3.5.11 Miscellaneous Structural Commodities

The results of the aging management review of the miscellaneous structural commodities are provided in this section and summarized in Table 3.5.11-1. The table provides the

following information related to each commodity group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific activities that manage those aging effects.

A description of the miscellaneous structural commodities is provided in Section 2.4.11.

Materials

The materials of construction for the miscellaneous structural commodities that require aging management review are carbon steel, low-alloy steel, galvanized steel, stainless steel, aluminum, ceramics and polymers, and elastomers. The ceramics and polymers, and elastomers are identified as follows:

Ceramics and Polymers

- Silicone foam
- 3M Caulk
- FS 601/605
- Maranite
- Polyethylene foam
- Gypsum
- Monokote-5
- Thermo-lag
- 3M E53A Mats
- Mineral-wool Batts
- Polystyrene Foam

Elastomers

- Neoprene

Environment

The miscellaneous structural commodities are exposed to atmosphere/weather, sheltered air, and Containment air. A description of these environments is provided in Table 3.0-2, External Service Environments.

In addition, miscellaneous structural commodities may be located in areas with piping systems that contain boric acid and could be exposed to a borated water leakage environment.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Aging Effects Requiring Management

The following aging effects, associated with the miscellaneous structural commodities, require management:

- Change in material properties of ceramics and polymers in an air environment
- Change in material properties of elastomers in an atmosphere/weather environment.
- Cracking of elastomers in an atmosphere/weather environment.
- Loss of material from carbon steel and low-alloy steel components in air, atmosphere/weather, or borated water leakage environments.
- Loss of material from ceramics and polymers in an air environment.
- Separation and cracking/delamination of ceramics and polymers in an air environment.

Conclusion

The following programs and activities manage the aging effects on the miscellaneous structural commodities:

- Fire Protection Program
- Boric Acid Corrosion Surveillance
- General Condition Monitoring Activities
- Work Control Process

A description of these aging management programs and activities 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 miscellaneous structural commodities 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.

3.5.12 Load-handling Cranes and Devices

The results of the aging management review of the load-handling cranes and devices are provided in this section and summarized in Table 3.5.12-1, Load-handling Cranes and Devices. The table provides the following information related to each structural member: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific aging management activities that manage those aging effects.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

A description of the load-handling cranes and devices is provided in Section 2.4.12, Load-handling Cranes and Devices.

Materials

The materials of construction and fabrication methods used for load-handling cranes and devices conform to standard industry specifications and practices. Load-handling cranes and devices are fabricated from carbon steel, low-alloy steel, and stainless steel.

Environment

The load-handling cranes and devices that require aging management review are located in the Containment and other indoor areas of the plant, and outdoors. These components are exposed to an air or atmosphere/weather environment. The Containment air environment, and the sheltered air and outdoor (atmosphere/weather) environments, are as indicated in Table 3.0-2, External Service Environments.

The surfaces of certain load-handling cranes and devices may also be exposed to borated water leakage conditions.

The new fuel transfer elevator is attached to the liner of the spent fuel pool and is submerged in treated water (borated water). The spent fuel pool cooling system maintains the temperature of the spent fuel pool water between 75°F and 100°F.

Aging Effects Requiring Management

The following aging effect, associated with the load-handling cranes and devices, requires management:

- Loss of material from carbon steel and low-alloy steel load-handling cranes and devices components in an air or atmosphere/weather environment.
- Loss of material from stainless steel components in a treated water environment
- Loss of material from carbon steel and low-alloy steel components in a borated water leakage environment.

Conclusion

The following programs and activities manage the aging effects for load-handling cranes and devices:

- General Condition Monitoring Activities
- Boric Acid Corrosion Surveillance
- Chemistry Control Program for Primary Systems

- Inspection Activities - Load Handling Cranes and Devices

A description of these aging management programs and activities 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 load-handling cranes and devices 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.

Section 3.5 References (Structures and Component Supports)

1. WCAP-14422, Rev. 2-A, *License Renewal Evaluation: Aging Management for Reactor Coolant System Supports*, Westinghouse Electric Corporation, December 2000.
2. EPRI TR-103842, *Class 1 Structures License Renewal Industry Report*; Revision 1, Electric Power Research Institute, July 1994.

3.6 Aging Management of Electrical and Instrument and Controls

This section provides the results of the aging management review for those electrical and instrumentation and control (I&C) components identified in Section 2.5, as being subject to aging management review. The methodology used for performing aging management reviews including the process for identifying the aging effects requiring management is explained in Appendix C, Aging Management Review Methodology.

Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences. The only differences identified in this section (including the tables) are the differences in materials, environments, aging effects requiring management, and aging management activities. Plant-specific scoping and screening differences (such as name differences, additional systems, and additional in-scope long-lived passive component groups) have already been identified in the scoping and screening results sections of the application, and are not identified again in this section.

A listing of the abbreviations used in this section is provided in Section 1.4.1.

3.6.1 Bus Duct

Table 3.6.1-1 identifies the bus duct components that have been evaluated for aging management. The table provides the following information related to each component group: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific activities that manage those aging effects.

Materials

The materials of construction for the bus duct components that are subject to aging management review are organic compounds and metals. The specific types of organic compounds and the metal used for the metal conductors are identified below.

Organic Compounds

- Fiberglass reinforced polyester resin (glastic)

Metal Conductors

- Aluminum bars

The bus duct construction is in compliance with ANSI C37.20, which specifies an allowable hottest-spot conductor and splice temperature rise of 65°C (117°F) in a 40°C (104°F) ambient environment.

NOTE: Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

The bus assembly bars are covered with molded insulation. The connection areas are silver-plated and use stainless steel bolting. All bus connections are insulated with splice boots, without the use of tape or filler material.

Environment

The bus ducts subject to aging management review are installed within two areas in the Service Building; the emergency switchgear room and the normal switchgear room, and are exposed to an air environment. The sheltered air environment used for areas outside Containment is as indicated in Table 3.0-2, External Service Environments; however, the specific environmental conditions for these areas are described below.

The emergency switchgear room temperature varies between 70°F and 85°F and the relative humidity is normally 50%.

The normal switchgear room temperature varies between 70°F and 120°F.

The 60-year design, ionizing dose is 390 rads during normal operation.

This temperature range includes worst-case upper limits that are not typical of "normal" operation. "Normal" ambient temperature in a sheltered air environment is not in excess of 40°C/104°F. Higher temperatures would be expected only during periods when outside ambient air is at seasonal highs and, then, only when area ventilation is not operating. In fact, bus ducts in sheltered air environments will operate in an ambient temperature below 40°C/104°F for a significant portion of their 60-year operating life. This ambient value has been used to determine the 60-year serviceability of bus ducts.

Aging Effects Requiring Management

Based on a review of the environment of the bus duct installation and the materials of construction, there are no aging effects requiring management during the period of extended operation for the bus ducts within the scope of license renewal.

Conclusion

There are no aging effects on the bus ducts within the scope of license renewal that require management during the period of extended operation. Therefore, the intended function(s) of the bus ducts will be maintained consistent with the current licensing basis during the period of extended operation.

3.6.2 Cables and Connectors

The results of the aging management review for non-environmentally qualified cables and associated connectors, are provided in this section and summarized in Table 3.6.2-1. The

table provides the following information for cables and connectors: (1) the passive function, (2) the material group, (3) the environment, (4) the aging effects requiring management, and (5) the specific activities that manage those aging effects.

Descriptions of cables and connectors are provided in Section 2.5.2, Cables and Connectors.

Cables and connectors have been evaluated for cracking, crazing, and embrittlement using the worst-case material-environment combinations considering environmental design values for normal operation. Additionally, medium voltage cables have been evaluated for formation of water trees. Each cable group has been evaluated for 60-year serviceability, using the insulation materials that are most susceptible to aging and the plant cable environments and/or service conditions that are the most severe considering environmental design values for normal operation.

The aging management review of cables and connectors has been performed for two cable groups: power cables, and instrument and control (I&C) cables.

The Ogden Environmental and Energy Services, Inc. contractor report, SAND 96-0344, *Aging Management Guideline for Commercial Nuclear Power Plants-Electrical Cable and Terminations*, prepared for the U.S. Department of Energy, and the Electric Power Research Institute (Reference 1), has been used as the primary reference in developing the aging management review of cables and connectors. This report describes the commodities approach and areas approach used for the aging evaluation of cables and connectors and appropriately identifies the types of aging mechanisms that impact cable systems.

Materials

The materials of construction for cables and connectors are grouped into organic compounds and metals. The specific types of organic compounds and the metals used for the metal conductors are identified below.

<u>Organic Compounds</u>

- Cross-linked polyethylene (XLPE)
- Ethylene propylene rubber (EPR)
- Kevlar (fiber optic)
- Phenolic
- Polyamide (nylon)
- Polyolefin (Raychem)

- Polyimide (Kapton)
- Polysulfone
- Polyvinyl chloride (PVC)
- Silicone rubber (SiR)
- Cellulose-filled Melamine
- Mylar

Metal Conductors

- Copper/copper alloys
- Aluminum/aluminum alloys
- Copper-constantan
- Iron-constantan
- Chromel-alumel

Environment

Cables and connectors are installed throughout plant buildings and yard areas in various raceway configurations and/or direct buried; therefore, they are exposed to atmosphere/weather, Containment air, sheltered air, and soil environments.

As indicated, the aging management review for power and I&C cables and connectors has used the most severe plant cable environments considering design values for normal operation in each group's evaluation.

Table 3.0-2, External Service Environments, provides environmental conditions for areas containing cables and conductors with the following exceptions:

1). The upper radiation limit of 2 x 10^8 rads indicated in Table 3.0-2 for a sheltered air environment is applicable to the volume control tank area of the Surry Auxiliary Building only. The highest integrated dose for cables installed at North Anna is 4.5x10^7 rads. This value has been used to evaluate the 60-year serviceability of cables operating in radiation environments.

2). The maximum temperature in the upper elevation of Main Steam Valve House can potentially be as high as 71.1°C (160°F). Accounting for localized adverse environments, self heating, and ambient conditions, the maximum potential operating temperature of any continuously loaded power cable has been determined to be 72.5°C (162.5°F). For I&C cables, the maximum potential operating temperature has been determined to be 71.1°C (160°F).

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Ambient temperature ranges shown in Table 3.0-2 for sheltered air environments include worst-case upper limits that are not typical of "normal" operation. "Normal" ambient temperature in a sheltered air environment is not in excess of 40°C/104°F. Higher temperatures would be expected only during periods when outside ambient air is at seasonal highs and, then, only when area ventilation is not operating. In fact, cables in sheltered air environments will operate in an ambient temperature below 40°C/104°F for a significant portion of their 60-year operating life.

This ambient value has been used to determine the 60-year serviceability of cables in all areas except the Containment and Main Steam Valve House (MSVH).

Aging Effects Requiring Management

The 60-year exposure of cable and connectors to the effects of heat, radiation and operating environments has been evaluated.

The ability of cable and connection materials to perform their intended function(s) throughout the extended period of operation has been determined through review of radiation test data to evaluate radiation aging effects and Arrhenius methodology to evaluate thermal aging effects.

The review has determined that none of the cable materials supporting intended functions are exposed to 60-year thermal or radiation operating environments that are in excess of the material 60-year thermal or radiation service limits. Therefore, there are no aging effects requiring management that result from heat or radiation.

Medium-voltage cables have been evaluated for the formation of water trees. Water treeing can occur in energized cables that are subjected to long-term wetting.

There are no continuously energized medium voltage cables in the scope of license renewal subject to long term wetting. Therefore, there are no aging effects associated with formation of water trees that require aging management through the period of extended operation.

A review of plant specific operating experience at Dominion's North Anna and Surry stations has been conducted to identify any cable and connector aging effects that had not previously been addressed. The review did not identify any additional aging effects. There were no Licensee Event Reports identified.

Conclusion

There are no aging effects on cables or connectors installed at the plant that require management during the period of extended operation. Therefore, the intended function(s)

of cables and connectors will be maintained consistent with the current licensing basis during the period of extended operation.

Section 3.6 References (Electrical and Instrumentation & Controls)

1. SAND 96-0344, UC-523, *Aging Management Guideline for Commercial Nuclear Power Plants-Electrical Cable and Terminations*, U.S. Department of Energy and Electric Power Research Institute, September 1996.

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Section 3.0 Aging Management Review Results Tables

Reactor Coolant System AMR Results Tables

Text enclosed in border indicates technical information specific to **NORTH ANNA.**

Table 3.1.1-1 Reactor Coolant System

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bellows (RVLIS)	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	Loss of Pre-Load[1]	ISI Program - Component and Component Support Inspections
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities[2]
Flexible connections / hoses	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Flow Elements	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Pipe[3]	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Augmented Inspection Activities[4]
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.1-1 Reactor Coolant System

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe[5]	PB	Stainless Steel (CASS)	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water/Steam[6]	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
Pump Casings	PB	Stainless Steel (CASS)	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
				Reduction in Fracture Toughness	ISI Program - Component and Component Support Inspections

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See Section 1.4.2 for function code definitions.

Table 3.1.1-1 Reactor Coolant System

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
RCP Motor Lower Bearing Oil Coolers[7]	PB	Copper-Nickel	(E) Air[8]	Cracking	Work Control Process
				Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(E) Lubricating Oil	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
RCP Motor Stator Coolers[7]	PB	Copper-Nickel	(E) Air[8]	Cracking	Work Control Process
				Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.1-1 Reactor Coolant System

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
RCP Motor Upper Bearing Oil Coolers	PB	Brass (tubes)	(E) Lubricating Oil	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Carbon Steel and Low-alloy Steel (channel head)	(E) Air[8]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Carbon Steel and Low-alloy Steel (shell)	(E) Air[8]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Lubricating Oil	Loss of Material	Work Control Process
		Carbon Steel and Low-alloy Steel (tubesheet)	(E) Lubricating Oil	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Restricting Orifices	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Thermowells	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.1-1 Reactor Coolant System

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies[3]	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel (CASS)	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
				Reduction in Fracture Toughness	ISI Program - Component and Component Support Inspections[9]
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water/Steam[5]	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.1-1 Reactor Coolant System

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Stainless Steel (CASS)	(E) Air	None	None Required
			(I) Treated Water/Steam[5]	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
				Reduction in Fracture Toughness	ISI Program - Component and Component Support Inspections[8]

1. Applicable to ASME Class 1 only.
2. Only for bolts on the PG supply line valves outside Containment.
3. Aging of the RV flange O-ring leak monitoring lines is not addressed because flow to these lines is provided by a hole in the reactor vessel flange that is less than 1/4-inch in diameter; therefore, the reactor coolant system pressure could be maintained based on the capacity of the charging pump if the lines were to fail. (Reference NUREG-1723, closure of Open Item 3.4.3.3.9).
4. These Augmented Inspection Activities will be specifically developed to detect cracking of the pressurizer surge line weld at the RC system hot leg pipe connection. (See Appendix B)
5. Loss of fracture toughness due to thermal embrittlement of the CASS pipe and elbows is not an aging effect requiring management because the results of the Leak-Before-Break TLAA in Section 4.7.3 demonstrated that there was a large margin between detectable flaw size and flaw instability.
6. RC components interfacing with the pressurizer steam space may be exposed to a steam environment.
7. Coolers do not have a shell side or a tubesheet. The RCP motor lower bearing oil cooler is a coiled tube design.
8. These components are subject to intermittent wetting.
9. Only ASME Class I components greater than 482°F.

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See Section 1.4.2 for function code definitions.

Table 3.1.2-1 Reactor Vessels

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bottom Mounted Instrumentation Flux Thimble Tubes	PB	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
			(I)Air	None	None Required
Bottom Mounted Instrumentation Guide Tubes	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems
Bottom Head Dome and Torus (and cladding)	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Reactor Vessel
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Closure Head Dome and Flange (and cladding)	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Reactor Vessel
			(E)Borated Water Leakage	Loss of Material	ISI Program - Reactor Vessel
		Stainless Steel	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.2-1 Reactor Vessels

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Closure Studs, Nuts, and Washers	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Reactor Vessel
				Loss of Pre-Load	ISI Program - Reactor Vessel
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Core Support Lugs	SS	Nickel-based Alloy	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
CRDM Housing Flanges	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems
CRDM Housing Tubes	PB	Nickel-based Alloy	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.2-1 Reactor Vessels

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
CRDM Latch Housings	PB	Stainless Steel (CASS)	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems
				Reduction in Fracture Toughness	ISI Program - Reactor Vessel
CRDM Rod Travel Housings	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems
Seal Table Fittings	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems
Instrumentation Port Assemblies	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.2-1 Reactor Vessels

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Instrumentation Tubes	PB	Nickel-based Alloy	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems
Instrumentation Tubes Safe End	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems
Lifting Lugs	SS	Carbon Steel and Low-alloy Steel	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Primary Nozzles and Support Pads (and cladding)	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Reactor Vessel
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Primary Nozzles' Safe End	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.2-1 Reactor Vessels

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Refueling Seal Ledge	SS	Carbon Steel and Low-alloy Steel	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Seal Table	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems
Vent Pipe	PB	Nickel-based Alloy	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Reactor Vessel
				Loss of Material	Chemistry Control Program for Primary Systems
Ventilation Shroud Support Ring	SS	Carbon Steel and Low-alloy Steel	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	ISI Program - Reactor Vessel

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See Section 1.4.2 for function code definitions.

Table 3.1.2-1 Reactor Vessels

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Vessel Flange and Core Support Ledge (and cladding)	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Reactor Vessel
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Vessel Shell (Upper, Intermediate and Lower - and cladding)	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Reactor Vessel
				Reduction in Fracture Toughness	Reactor Vessel Integrity Management
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.3-1 Reactor Vessel Internals

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Baffle and Former Assembly	FD; SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Reactor Vessel Internals Inspection
				Loss of Material	Chemistry Control Program for Primary Systems
				Reduction in Fracture Toughness[1]	Reactor Vessel Internals Inspection
Bolting (Baffle/Former and Barrel/Former)	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Reactor Vessel Internals Inspection
				Loss of Material	Chemistry Control Program for Primary Systems
				Loss of Pre-Load	Reactor Vessel Internals Inspection
				Reduction in Fracture Toughness[1]	Reactor Vessel Internals Inspection
Control Rod Guide Tube Split Pins	SS	Nickel-Based Alloy	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Reactor Vessel Internals Inspection
				Loss of Material	Chemistry Control Program for Primary Systems
Control Rod Guide Tubes	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Reactor Vessel Internals Inspection
				Loss of Material	Chemistry Control Program for Primary Systems
					Reactor Vessel Internals Inspection

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See Section 1.4.2 for function code definitions.

Table 3.1.3-1 Reactor Vessel Internals

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Core Barrel	FD; SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Reactor Vessel Internals Inspection
				Loss of Material	Chemistry Control Program for Primary Systems
				Reduction in Fracture Toughness[1]	Reactor Vessel Internals Inspection
Core Barrel Holddown Spring	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
				Loss of Pre-Load	Reactor Vessel Internals Inspection
Head and Vessel Alignment Pins	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Head Cooling Spray Nozzles	FD	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Instrument Guide Tubes	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Lower Core Plate	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Reactor Vessel Internals Inspection
				Loss of Material	Chemistry Control Program for Primary Systems
				Reduction in Fracture Toughness[1]	Reactor Vessel Internals Inspection

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See Section 1.4.2 for function code definitions.

Table 3.1.3-1 Reactor Vessel Internals

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Lower Support Plate and Columns	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Reactor Vessel Internals Inspection
				Loss of Material	Chemistry Control Program for Primary Systems
Radial Support Clevis Inserts	SS	Nickel-Based Alloy	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
					Reactor Vessel Internals Inspection
Radial Support Keys	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Reactor Vessel Internals Inspection
				Loss of Material	Chemistry Control Program for Primary Systems
					Reactor Vessel Internals Inspection
Secondary Support Assembly	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Thermal Shield	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Upper Core Plate	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Upper Core Plate Alignment Pins	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
					Reactor Vessel Internals Inspection

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.1.3-1 Reactor Vessel Internals

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Upper Instrument Columns	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Upper Support Column	SS	Stainless Steel (CASS)	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
				Reduction in Fracture Toughness[1]	Reactor Vessel Internals Inspection
Upper Support Plate	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Reactor Vessel Internals Inspection
				Loss of Material	Chemistry Control Program for Primary Systems

1. Reduction in fracture toughness is managed with the leading indicator approach described in the Reactor Vessel Internals Inspection Activities in Appendix B.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.1.4-1 Pressurizers

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Heater Well and Heater Sheath	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
Instrument Nozzles	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
Lower Head (and cladding)	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Manway (includes Pad and cladding)	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel	(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.4-1 Pressurizers

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Manway Cover Bolts	PB	Carbon Steel and Low-alloy Steel	(E)Air	Loss of Pre-Load	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Manway Cover w/Insert	PB	Carbon Steel and Low-alloy Steel	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel[1]	(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Relief Nozzle (and cladding)[2]	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Nickel-Based Alloy	(E)Air	None	None Required
			(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel	(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Relief Nozzle Safe End	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.4-1 Pressurizers

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Safety Nozzle (and cladding)[2]	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Nickel-Based Alloy	(E)Air	None	None Required
			(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel	(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Safety Nozzle Safe End	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
Sample Line Nozzle	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
Seismic Support Lugs	SS	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance

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See Section 1.4.2 for function code definitions.

Table 3.1.4-1 Pressurizers

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Shell (and cladding)	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Spray Nozzle (and cladding)[2]	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Nickel-Based Alloy	(E)Air	None	None Required
			(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel	(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Spray Nozzle Safe End	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
Spray Nozzle Thermal Sleeve[3]	PB	Stainless Steel	(E)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.4-1 Pressurizers

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Support Skirt and Flange	SS	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Surge Nozzle (and cladding)[2]	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Nickel-Based Alloy	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Surge Nozzle Safe End	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
Surge Nozzle Thermal Sleeve[3]	PB	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.4-1 Pressurizers

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Upper Head (and cladding)	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel	(I)Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

1. The manway cover insert is stainless steel for corrosion protection of the manway cover.
2. The pressurizer nozzles were buttered with nickel-based alloy to provide a transition to the stainless steel safe ends.
3. The thermal sleeves are a design feature which provide thermal shielding to minimize nozzle low-cycle thermal fatigue.

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See Section 1.4.2 for function code definitions.

Table 3.1.5-1 Steam Generators

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Anti-vibration Bars	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
Channel Head (and cladding)	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	Steam Generator Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Nickel-Based Alloy	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Channel Head Divider Plate	FD	Nickel-based alloy	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Feedwater Inlet Nozzle	PB	Carbon Steel and Low-alloy Steel	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I)Treated Water	Cracking	Chemistry Control Program for Secondary Systems
					Steam Generator Inspections
				Loss of Material	Chemistry Control Program for Secondary Systems
Primary Inlet and Outlet Nozzle Safe Ends	PB	Stainless Steel	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Steam Generator Inspections
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.5-1 Steam Generators

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Primary Inlet and Outlet Nozzles (and cladding)	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	Steam Generator Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Nickel-Based Alloy	(E)Air	None	None Required
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Primary Manway (includes Pad and cladding)	PB	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	Steam Generator Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Primary Manway Cover and Insert	PB	Carbon Steel and Low-alloy Steel	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Primary Manway Cover Bolting	PB	Carbon Steel and Low-alloy Steel	(E)Air	Loss of Pre-Load[1]	Steam Generator Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance

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See Section 1.4.2 for function code definitions.

Table 3.1.5-1 Steam Generators

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Secondary Closure Cover Bolting	PB	Carbon Steel and Low-alloy Steel	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Secondary Closure Covers	PB	Carbon Steel and Low-alloy Steel	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I)Treated Water/Steam	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
Secondary Manway (includes Pad)	PB	Carbon Steel and Low-alloy Steel	(E)Air	None	N/A
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I)Treated Water/Steam	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
Secondary Side Shell Penetrations	PB	Carbon Steel and Low-alloy Steel	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I)Treated Water/Steam	Cracking	Chemistry Control Program for Secondary Systems
					Steam Generator Inspections
				Loss of Material	Chemistry Control Program for Secondary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.5-1 Steam Generators

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Secondary Side Shell (Head, Upper Shell, Lower Shell, Transition Cone, and Girth Weld)	PB	Carbon Steel and Low-alloy Steel	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I)Treated Water/Steam	Cracking	Chemistry Control Program for Secondary Systems
					Steam Generator Inspections
				Loss of Material	Chemistry Control Program for Secondary Systems
Stay Rod	SS	Carbon Steel and Low-alloy Steel	(E)Treated Water	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
Steam Flow Limiter	RF	Nickel-Based Alloy	(E)Steam	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
Steam Outlet Nozzle	PB	Carbon Steel and Low-alloy Steel	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I)Steam	Cracking	Chemistry Control Program for Secondary Systems
					Steam Generator Inspections
				Loss of Material	Chemistry Control Program for Secondary Systems
Support Pads	SS	Carbon Steel and Low-alloy Steel	(E)Air	Cracking	Steam Generator Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Tube Bundle Wrapper	SS	Carbon Steel and Low-alloy Steel	(E)Treated Water	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems

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See Section 1.4.2 for function code definitions.

Table 3.1.5-1 Steam Generators

Subcomponent	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tube Plugs	PB	Nickel-based Alloy	(E)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Steam Generator Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
Tube Support Plates	SS	Stainless Steel	(E)Treated Water	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
Tubesheet (and cladding)	PB	Carbon Steel and Low-alloy Steel	(E)Treated Water	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
		Nickel-based Alloy	(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Steam Generator Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
U-Tubes	PB	Nickel-based Alloy	(E)Treated Water	Cracking	Chemistry Control Program for Secondary Systems
					Steam Generator Inspections
				Loss of Material	Chemistry Control Program for Secondary Systems
					Steam Generator Inspections
			(I)Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

1. Applicable to ASME Class 1 only.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Engineered Safety Features AMR Results Tables

Text enclosed in border indicates technical information specific to **NORTH ANNA.**

Table 3.2-1 Engineered Safety Features Systems — Quench Spray

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Filters/Strainers	PB;FLT	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Flow Elements	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Instrument Valve Assemblies	PB	Stainless Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Nozzles	SP	Brass	(E) Air	None	None Required
			(I) Air	None	None Required
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Pipe	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.2-1 Engineered Safety Features Systems — Quench Spray

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Stainless Steel	(E) Soil	Loss of Material	Buried Piping and Valve Inspection Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Stainless Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pump Casings	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Restricting Orifices	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Tanks	PB	Stainless Steel	(E) Atmosphere / Weather	Loss of Material	Tank Inspection Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
					Tank Inspection Activities
Thermowells	PB	Stainless Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Tubing	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.2-1 Engineered Safety Features Systems — Quench Spray

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tubing	PB	Stainless Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

1. These components are subject to intermittent wetting.

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See Section 1.4.2 for function code definitions.

Table 3.2-2 Engineered Safety Features Systems — Fuel Pit Cooling

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Expansion Joints	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pump Casings	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.2-2 Engineered Safety Features Systems — Fuel Pit Cooling

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Spent Fuel Pit Coolers	PB	Carbon Steel and Low-alloy Steel (shell)	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubes)	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
					Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubesheet)	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Thermowells	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.2-2 Engineered Safety Features Systems — Fuel Pit Cooling

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

1. These components are subject to intermittent wetting.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.2-3 Engineered Safety Features Systems — Recirculation Spray

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Expansion Joints	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Filters/Strainers	FLT;PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Flow Elements	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Nozzles	SP	Brass	(E) Air	None	None Required
			(I) Air	None	None Required
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.2-3 Engineered Safety Features Systems — Recirculation Spray

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
					Work Control Process
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Raw Water[2]	Loss of Material	Infrequently Accessed Area Inspection Activities
					Work Control Process
Pipe	PB	Stainless Steel	(E) Soil	Loss of Material	Buried Piping and Valve Inspection Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pump Casings	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Raw Water[2]	Loss of Material	Work Control Process
Pump Casings	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pump Seal Coolers	PB	Stainless Steel (tube)[3]	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.2-3 Engineered Safety Features Systems — Recirculation Spray

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Recirculation Spray Coolers	PB	Stainless Steel (channel head)	(E) Air	None	None Required
			(I) Air	None	None Required
		Stainless Steel (shell)	(E) Air	None	None Required
			(I) Air	None	None Required
		Stainless Steel (tubes)	(E) Air	None	None Required
			(I) Air	None	None Required
		Stainless Steel (tubesheet)	(E) Air	None	None Required
			(I) Air	None	None Required
Restricting Orifices	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Restricting Orifices	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Sump Screens	FLT	Stainless Steel	(E) Raw Water[2]	Loss of Material	Infrequently Accessed Area Inspection Activities
Tanks	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Work Control Process
Tanks	PB	Stainless Steel	(E) Atmosphere / Weather	Loss of Material	Tank Inspection Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
					Tank Inspection Activities

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See Section 1.4.2 for function code definitions.

Table 3.2-3 Engineered Safety Features Systems — Recirculation Spray

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Thermowells	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Thermowells	PB	Stainless Steel	(E) Atmosphere / Weather	Loss of Material	Tank Inspection Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
					Tank Inspection Activities
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
					Work Control Process
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Raw Water[2]	Loss of Material	Work Control Process

1. These components are dry, but are intermittently wetted during periodic flow testing.
2. These components are exposed to water in the Containment recirculation sump.
3. The pump seal coolers are finned-tube type heat exchangers.

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See Section 1.4.2 for function code definitions.

Table 3.2-4 Engineered Safety Features Systems — Residual Heat Removal

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	Loss of Pre-Load[1]	ISI Program - Component and Component Support Inspections
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Flow Elements	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Stainless Steel	(E) Soil	Loss of Material	Buried Piping and Valve Inspection Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pump Casings	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.2-4 Engineered Safety Features Systems — Residual Heat Removal

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pump Seal Coolers	PB	Carbon Steel and Low-alloy Steel (shell)	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubes)	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubesheet)	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
					Work Control Process
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.2-4 Engineered Safety Features Systems — Residual Heat Removal

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
RHR Heat Exchangers	PB	Carbon Steel and Low-alloy Steel (shell)	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubes)	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
					Work Control Process
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubesheet)	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Thermowells	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.2-4 Engineered Safety Features Systems — Residual Heat Removal

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel (CASS)	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
				Reduction in Fracture Toughness	ISI Program - Component and Component Support Inspections[3]

1. Applicable to ASME Class 1 only.
2. These components are subject to intermittent wetting.
3. ASME Class 1 greater than 482°F.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.2-5 Engineered Safety Features Systems — Safety Injection

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Accumulators (and cladding)	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel	(I) Gas	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	Loss of Pre-Load[1]	ISI Program - Component and Component Support Inspections
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Flow Elements	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Stainless Steel	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(I) Gas	None	None Required

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.2-5 Engineered Safety Features Systems — Safety Injection

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Gas	None	None Required
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Raw Water[3]	Loss of Material	Infrequently Accessed Area Inspection Activities
					Work Control Process
Pipe	PB	Stainless Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
			(E) Soil	Loss of Material	Buried Piping and Valve Inspection Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pump Casings	PB	Stainless Steel	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Restricting Orifices	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Sump Screens	FLT	Stainless Steel	(E) Raw Water[3]	Loss of Material	Infrequently Accessed Area Inspection Activities

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See Section 1.4.2 for function code definitions.

Table 3.2-5 Engineered Safety Features Systems — Safety Injection

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
		Stainless Steel (cladding)	(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Tubing	PB	Stainless Steel	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(I) Gas	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel (CASS)	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
				Reduction in Fracture Toughness	ISI Program - Component and Component Support Inspections[4]

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See Section 1.4.2 for function code definitions.

Table 3.2-5 Engineered Safety Features Systems — Safety Injection

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Gas	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Raw Water[3]	Loss of Material	Work Control Process
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

1. Applicable to ASME Class 1 only.
2. These components are subject to intermittent wetting.
3. These components are exposed to water in the Containment recirculation sump.
4. ASME Class 1 greater than 482°F.

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See Section 1.4.2 for function code definitions.

Auxiliary Systems AMR Results Tables

Table 3.3.1-1 Primary Process Systems — Chemical and Volume Control

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bellows	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	Loss of Pre-Load[1]	ISI Program - Component and Component Support Inspections
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Filters/Strainers	PB;FLT	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Filters/Strainers	PB;FLT	Carbon Steel and Low-alloy Steel	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Lubricating Oil	Loss of Material	Work Control Process
Flexible connections	PB	Stainless Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Cracking	Work Control Process
				Loss of Material	Work Control Process
Flow Elements	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.1-1 Primary Process Systems — Chemical and Volume Control

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Flow Orifices	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Level Indicators	PB	Carbon Steel and Low-alloy Steel	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Lubricating Oil	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.1-1 Primary Process Systems — Chemical and Volume Control

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Non-Regenerative and Excess Letdown Heat Exchangers	PB	Carbon Steel and Low-alloy Steel (shell)	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubes)	(E) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubesheet)	(E) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.1-1 Primary Process Systems — Chemical and Volume Control

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Cracking	Work Control Process
				Loss of Material	Work Control Process
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Lubricating Oil	Loss of Material	Work Control Process
Pump Casings	PB	Cast Iron	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Lubricating Oil	Loss of Material	Work Control Process
Pump Casings	PB	Stainless Steel (CASS)	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pump Casings	PB	Bronze	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Lubricating Oil	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.1-1 Primary Process Systems — Chemical and Volume Control

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pump Lube Oil Coolers	HT;PB	Copper-Nickel (tubes)	(E) Lubricating Oil	Loss of Material	Work Control Process
			(I) Raw Water	Change in Material Properties	Work Control Process
				Heat Transfer Degradation	Work Control Process
				Loss of Material	Work Control Process
		Stainless Steel (channel head)	(E) Air	None	None Required
			(I) Raw Water	Loss of Material	Work Control Process
		Stainless Steel (shell)	(E) Air	None	None Required
			(I) Lubricating Oil	Cracking	Work Control Process
				Loss of Material	Work Control Process
		Stainless Steel (tubesheet)	(E) Lubricating Oil	Cracking	Work Control Process
				Loss of Material	Work Control Process
			(I) Raw Water	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.1-1 Primary Process Systems — Chemical and Volume Control

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
RCP Seal Water Heat Exchangers	PB	Carbon Steel and Low-alloy Steel (shell)	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubes)	(E) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubesheet)	(E) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.3.1-1 Primary Process Systems — Chemical and Volume Control

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Regenerative Heat Exchangers	PB	Stainless Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (shell)	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubes)	(E) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubesheet)	(E) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Restricting Orifices	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
					Work Control Process[3]

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.3.1-1 Primary Process Systems — Chemical and Volume Control

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tanks	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Tanks	PB	Cast Iron	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Lubricating Oil	Loss of Material	Work Control Process
Tanks	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Thermowells	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Cracking	Work Control Process
				Loss of Material	Work Control Process
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.1-1 Primary Process Systems — Chemical and Volume Control

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel (CASS)	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
				Reduction in Fracture Toughness	ISI Program - Component and Component Support Inspections[4]
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Cracking	Work Control Process
				Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.1-1 Primary Process Systems — Chemical and Volume Control

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Lubricating Oil	Loss of Material	Work Control Process

1. Applicable to ASME Class 1 only.
2. These components are subject to intermittent wetting.
3. Erosion of charging pump minimum recirculation flow orifices and letdown orifices is managed by the Work Control Process.
4. ASME Class 1 greater than 482°F.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.3.1-2 Primary Process Systems — High Radiation Sampling System

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

1. These components are subject to intermittent wetting.

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See Section 1.4.2 for function code definitions.

Table 3.3.1-3 Primary Process Systems — Incore Instrumentation

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies[1]	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required

1. Other incore instrumentation components are evaluated for the effects of aging in Section 3.1.2, Reactor Vessel.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.3.1-4 Primary Process Systems — Refueling Purification

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

1. Some piping and valves in this system are normally exposed to air internally, but are exposed to treated water when the reactor cavity is flooded during refueling operations.

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See Section 1.4.2 for function code definitions.

Table 3.3.1-5 Primary Process Systems — Sampling System

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	Loss of Pre-Load[1]	ISI Program - Component and Component Support Inspections
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.1-5 Primary Process Systems — Sampling System

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Sample Coolers	PB	Copper (outer tube)[3]	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (inner tube)[3]	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Cracking	Chemistry Control Program for Secondary Systems
					Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
					Chemistry Control Program for Primary Systems
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
			(I) Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Primary Systems
					Chemistry Control Program for Secondary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
					Chemistry Control Program for Secondary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.1-5 Primary Process Systems — Sampling System

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water/Steam	Cracking	Chemistry Control Program for Primary Systems
					Chemistry Control Program for Secondary Systems
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Primary Systems
					Chemistry Control Program for Secondary Systems
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.1-5 Primary Process Systems — Sampling System

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air[2]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems

1. Applicable to ASME Class 1 components only.
2. These components are subject to intermittent wetting.
3. The sample coolers are tube-in-tube type heat exchangers.

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See Section 1.4.2 for function code definitions.

Table 3.3.2-1 Open Water Systems — Heating And Ventilation

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Expansion Joints	PB	Rubber	(E) Air	Change in Material Properties	Work Control Process
				Cracking	Work Control Process
			(I) Raw Water	None	None Required
Filters/Strainers	FLT;PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process
Flexible connections	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process
Flow Elements	PB;RF	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process
Instrumentation	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.2-1 Open Water Systems — Heating And Ventilation

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
MCR Chiller Condensers	HT;PB	Carbon Steel and Low-alloy Steel (shell)	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Gas	None	None Required
		Carbon Steel and Low-alloy Steel (tubesheet)	(E) Gas	None	None Required
			(I) Raw Water	Loss of Material	Service Water System Inspections
		Copper (tubes)	(E) Gas	None	None Required
			(I) Raw Water	Change in Material Properties	Service Water System Inspections
				Heat Transfer Degradation	Service Water System Inspections
				Loss of Material	Service Water System Inspections
		Carbon Steel and Low-alloy Steel (channel head)	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Pump Casings	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Thermowells	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections

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See Section 1.4.2 for function code definitions.

Table 3.3.2-1 Open Water Systems — Heating And Ventilation

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Bronze	(E) Air	None	None Required
			(I) Raw Water	Change in Material Properties	Service Water System Inspections
				Loss of Material	Service Water System Inspections
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Valve Bodies	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections

1. These components are subject to intermittent wetting.

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See Section 1.4.2 for function code definitions.

Table 3.3.2-2 Open Water Systems — Instrument Air

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
IA Compressor Coolers	PB	Stainless Steel (channel head)	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
		Stainless Steel (tubes)	(E) Treated Water	Loss of Material	Work Control Process
			(I) Raw Water	Loss of Material	Service Water System Inspections
		Stainless Steel (tubesheet)	(E) Treated Water	Loss of Material	Work Control Process
			(I) Raw Water	Loss of Material	Service Water System Inspections

1. These components are subject to intermittent wetting.

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See Section 1.4.2 for function code definitions.

Table 3.3.2-3 Open Water Systems — Service Water

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Service Water Instrument Air Receivers	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air	Loss of Material	Work Control Process
Corrosion Rate Monitor	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Corrosion Rate Monitor	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Expansion Joints	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
					Infrequently Accessed Area Inspection Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Filters/Strainers	FLT;PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process
Filters/Strainers	FLT;PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process
Flexible connections	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process
Flow Elements	PB;RF	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.2-3 Open Water Systems — Service Water

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Flow Orifices	PB;RF	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process
Instrument Valve Assemblies	PB	Brass	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Change in Material Properties	Work Control Process
				Loss of Material	Work Control Process
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process
Instrumentation	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process
Spray Nozzles	SP	Bronze	(E) Atmosphere / Weather	Loss of Material	Service Water System Inspections
			(E) Raw Water	Change in Material Properties	Service Water System Inspections
				Loss of Material	Service Water System Inspections
			(I) Raw Water	Change in Material Properties	Service Water System Inspections
				Heat Transfer Degradation	Service Water System Inspections
				Loss of Material	Service Water System Inspections
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[2]	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.2-3 Open Water Systems — Service Water

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
					Infrequently Accessed Area Inspection Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Soil	Loss of Material	Buried Piping and Valve Inspection Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Raw Water	Loss of Material	Service Water System Inspections
			(I) Raw Water	Loss of Material	Service Water System Inspections
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[2]	Loss of Material	Work Control Process
Pipe	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
					Infrequently Accessed Area Inspection Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Pipe	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections

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Table 3.3.2-3 Open Water Systems — Service Water

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pump Casings	PB	Bronze	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Change in Material Properties	Service Water System Inspections
				Loss of Material	Service Water System Inspections
Pump Casings	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
					Infrequently Accessed Area Inspection Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Pump Casings	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Radiation Sensors	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process
Restricting Orifices	PB;RF	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process
Temperature Sensors	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Thermowells	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Tubing	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.2-3 Open Water Systems — Service Water

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Brass	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Change in Material Properties	Work Control Process
				Loss of Material	Work Control Process
Valve Bodies	PB	Brass	(I) Raw Water	Change in Material Properties	Work Control Process
				Loss of Material	Work Control Process
		Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process
Valve Bodies	PB	Bronze	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Change in Material Properties	Work Control Process
				Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[2]	Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
					Infrequently Accessed Area Inspection Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections

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Table 3.3.2-3 Open Water Systems — Service Water

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Valve Bodies	PB	Cast Iron	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
					Infrequently Accessed Area Inspection Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[2]	Loss of Material	Work Control Process
Valve Bodies	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Work Control Process
Valve Bodies	PB	Brass	(E) Air	None	None Required
			(I) Air[2]	Loss of Material	Work Control Process

1. These components are subject to intermittent wetting.
2. Moisture-laden air.

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See Section 1.4.2 for function code definitions.

Table 3.3.3-1 Closed Water Systems — Chilled Water

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Filters/Strainers	FLT;PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Pipe	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems

1. These components are subject to intermittent wetting.

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See Section 1.4.2 for function code definitions.

Table 3.3.3-2 Closed Water Systems — Component Cooling

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Unit No. 1 Component Cooling Heat Exchangers	HT;PB	Carbon Steel and Low-alloy Steel (channel head)	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Raw Water	Loss of Material	Service Water System Inspections
					Work Control Process
		Carbon Steel and Low-alloy Steel (shell)	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
					Service Water System Inspections
		Stainless Steel (tubes)	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
					Service Water System Inspections
					Work Control Process
			(I) Raw Water	Heat Transfer Degradation	Service Water System Inspections
					Work Control Process
				Loss of Material	Service Water System Inspections
					Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.3-2 Closed Water Systems — Component Cooling

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Unit No. 1 Component Cooling Heat Exchangers (cont.)	HT;PB	Stainless Steel (tubesheet)	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
			(I) Raw Water	Heat Transfer Degradation	Service Water System Inspections
					Work Control Process
				Loss of Material	Service Water System Inspections
					Work Control Process
Unit No. 2 Component Cooling Heat Exchangers	HT;PB	Carbon Steel and Low-alloy Steel (channel head)	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
		Carbon Steel and Low-alloy Steel (shell)	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
					Service Water System Inspections
		Titanium (channel head cladding)	(I) Raw Water	None	None Required
		Titanium (tubes)	(E) Treated Water	Loss of Material	Service Water System Inspections
					Work Control Process
			(I) Raw Water	Heat Transfer Degradation	Service Water System Inspections
					Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.3-2 Closed Water Systems — Component Cooling

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Unit No. 2 Component Cooling Heat Exchangers (cont.)	HT;PB	Titanium (tubesheet)	(E) Treated Water	None	None Required
			(I) Raw Water	Heat Transfer Degradation	Service Water System Inspections
					Work Control Process
Expansion Joints	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Filters/Strainers	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Filters/Strainers	FLT;PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Flexible Connections	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Flow Elements	PB;RF	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Flow Indicators	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.3-2 Closed Water Systems — Component Cooling

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Level Indicators	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pipe Penetration Cooling Coils	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pump Casings	PB	Cast Iron	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.3-2 Closed Water Systems — Component Cooling

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Radiation Sensors	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Thermowells	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Tubing	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Brass	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.3-2 Closed Water Systems — Component Cooling

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

1. These components are subject to intermittent wetting.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.3.3-3 Closed Water Systems — Containment Vacuum

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Containment Vacuum Heat Exchangers	PB	Brass (tubesheet)	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Cast Iron (channel head)	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Copper (tubes)	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

1. These components are subject to intermittent wetting.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.3.3-4 Closed Water Systems — Heating And Ventilation

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
CARF HVAC Cooling Coils	PB	Copper	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
CRDM HVAC Cooling Coils	PB	Copper	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
ESGR HVAC Cooling Coils	PB	Copper	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Flexible connections	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Flow Elements	PB;RF	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Instrumentation	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.3-4 Closed Water Systems — Heating And Ventilation

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Level Indicators	PB	Bronze	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
MCR Chiller Evaporators	PB	Carbon Steel and Low-alloy Steel (shell)	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
		Copper (tubes)	(E) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
			(I) Gas	None	None Required
MCR HVAC Cooling Coils	PB	Copper	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Pump Casings	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
					Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.3-4 Closed Water Systems — Heating And Ventilation

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems

1. These components are subject to intermittent wetting.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.3.3-5 Closed Water Systems — Neutron Shield Tank Cooling

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Neutron Shield Tank Coolers	PB	Stainless Steel (shell)	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubes)	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pump Casings	PB	Stainless Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	Infrequently Accessed Area Inspection Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.3-5 Closed Water Systems — Neutron Shield Tank Cooling

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

1. These components are subject to intermittent wetting.

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See Section 1.4.2 for function code definitions.

Table 3.3.3-6 Closed Water Systems — Reactor Coolant

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Neutron Shield Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air[1]	Loss of Material	General Condition Monitoring Activities
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

1. These components are subject to intermittent wetting.

Table 3.3.4-1 Diesel Generator Support Systems — Alternate AC (AAC) Diesel Generator Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Accumulators	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Raw Water	Loss of Material	Work Control Process
Air Receivers	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Tank Inspection Activities
			(I) Raw Water	Loss of Material	Tank Inspection Activities
Diesel Aftercoolers	PB	Carbon Steel and Low-alloy Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
		Carbon Steel and Low-alloy Steel (shell)	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
		Carbon Steel and Low-alloy Steel (tubes)	(E) Air[1]	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
		Carbon Steel and Low-alloy Steel (tubesheet)	(E) Air[1]	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.4-1 Diesel Generator Support Systems — Alternate AC (AAC) Diesel Generator Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Diesel Fuel Oil Coolers	PB	Carbon Steel and Low-alloy Steel (channel head)	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
		Carbon Steel and Low-alloy Steel (shell)	(E) Air	None	None Required
			(I) Air	None	None Required
		Copper (tubes)	(E) Air	Cracking	Work Control Process
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
		Copper (tubesheet)	(E) Air	Cracking	Work Control Process
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Diesel Jacket Water Radiators	PB	Carbon Steel and Low-alloy Steel (shell)	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
					Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.4-1 Diesel Generator Support Systems — Alternate AC (AAC) Diesel Generator Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Diesel Lube Oil Coolers	PB	Carbon Steel and Low-alloy Steel (channel head)	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
		Carbon Steel and Low-alloy Steel (shell)	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
		Copper (tubes)	(E) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
			(I) Lubricating Oil	Loss of Material	Work Control Process
		Copper (tubesheet)	(E) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
			(I) Lubricating Oil	Loss of Material	Work Control Process
Fan/Blower Housing	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Filters/Strainers	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Filters/Strainers	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Heaters	PB	Aluminum	(E) Air	None	None Required
			(I) Lubricating Oil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.4-1 Diesel Generator Support Systems — Alternate AC (AAC) Diesel Generator Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Heaters	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Instrument Valve Assemblies	PB	Brass	(E) Air	Cracking	Work Control Process
			(I) Lubricating Oil	Loss of Material	Work Control Process
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Level Indicators	PB	Carbon Steel and Low-alloy Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
					Work Control Process
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Oil Pans	PB	Cast Iron	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Lubricating Oil	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.4-1 Diesel Generator Support Systems — Alternate AC (AAC) Diesel Generator Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Aluminum	(E) Air	None	None Required
			(I) Air	None	None Required
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
					Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Pipe	PB	Copper	(E) Air	Cracking	Work Control Process
			(I) Air[1]	Cracking	Work Control Process
				Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.4-1 Diesel Generator Support Systems — Alternate AC (AAC) Diesel Generator Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Raw Water	Loss of Material	Work Control Process
Pump Casings	PB	Bronze	(E) Air	Cracking	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Pump Casings	PB	Bronze	(E) Air	Cracking	Work Control Process
			(I) Air[1]	Cracking	Work Control Process
				Loss of Material	Work Control Process
Pump Casings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Pump Casings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Pump Casings	PB	Cast Iron	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Pump Casings	PB	Cast Iron	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Restricting Orifices	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.4-1 Diesel Generator Support Systems — Alternate AC (AAC) Diesel Generator Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Tank Inspection Activities
			(I) Fuel Oil	Loss of Material	Tank Inspection Activities
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
					Work Control Process
			(I) Air[1]	Loss of Material	Tank Inspection Activities
			(I) Treated Water	Loss of Material	Tank Inspection Activities
Thermowells	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Tubing	PB	Copper	(E) Air	Cracking	Work Control Process
			(I) Air[1]	Cracking	Work Control Process
				Loss of Material	Work Control Process
Tubing	PB	Copper	(E) Air	Cracking	
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Valve Bodies	PB	Aluminum	(E) Air	None	None Required
			(I) Air	None	None Required
Valve Bodies	PB	Brass	(E) Air	Cracking	Work Control Process
			(I) Air[1]	Cracking	Work Control Process
				Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.4-1 Diesel Generator Support Systems — Alternate AC (AAC) Diesel Generator Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Brass	(E) Air	Cracking	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Valve Bodies	PB	Bronze	(E) Air	Cracking	Work Control Process
			(I) Air[1]	Cracking	Work Control Process
				Loss of Material	Work Control Process
Valve Bodies	PB	Bronze	(E) Air	Cracking	Work Control Process
			(I) Lubricating Oil	Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
					Work Control Process
			(I) Air[1]	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.4-1 Diesel Generator Support Systems — Alternate AC (AAC) Diesel Generator Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
					Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Valve Bodies	PB	Cast Iron	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Valve Bodies	PB	Cast Iron	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Raw Water	Loss of Material	Work Control Process
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process

1. Moisture-laden air.

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See Section 1.4.2 for function code definitions.

Table 3.3.4-2 Diesel Generator Support Systems — Emergency Diesel Generator (EDG) Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Air Receivers	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Tank Inspection Activities
			(I) Raw Water	Loss of Material	Tank Inspection Activities
Diesel Aftercoolers	PB	Carbon Steel and Low-alloy Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
		Carbon Steel and Low-alloy Steel (shell)	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
		Carbon Steel and Low-alloy Steel (tubes)	(E) Air[1]	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
		Carbon Steel and Low-alloy Steel (tubesheet)	(E) Air	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Diesel Jacket Water Radiators	PB	Brass (shell)	(E) Air	Cracking	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.4-2 Diesel Generator Support Systems — Emergency Diesel Generator (EDG) Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Diesel Lube Oil Coolers	PB	Carbon Steel and Low-alloy Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
		Carbon Steel and Low-alloy Steel (shell)	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
		Copper (tubes)	(E) Lubricating Oil	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
		Copper (tubesheet)	(E) Lubricating Oil	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Fan/Blower Housings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Filters/Strainers	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Filters/Strainers	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Flow Orifices	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.4-2 Diesel Generator Support Systems — Emergency Diesel Generator (EDG) Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Heaters	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Heaters	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Instrument Valve Assemblies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Level Indicators	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Level Indicators	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.4-2 Diesel Generator Support Systems — Emergency Diesel Generator (EDG) Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Oil Pans	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Lubricating Oil	Loss of Material	Work Control Process
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Soil	Loss of Material	Buried Piping and Valve Inspection Activities
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Raw Water	Loss of Material	Work Control Process
Pipe	PB	Copper	(E) Air	Cracking	Work Control Process
			(I) Air[1]	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.4-2 Diesel Generator Support Systems — Emergency Diesel Generator (EDG) Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Raw Water	Loss of Material	Work Control Process
Pump Casings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Pump Casings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Pump casings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Tank Inspection Activities
			(I) Fuel Oil	Loss of Material	Tank Inspection Activities
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Tank Inspection Activities
			(I) Treated Water	Loss of Material	Tank Inspection Activities
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Tank Inspection Activities
			(I) Lubricating Oil	Loss of Material	Tank Inspection Activities

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See Section 1.4.2 for function code definitions.

Table 3.3.4-2 Diesel Generator Support Systems — Emergency Diesel Generator (EDG) Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
					Work Control Process
			(E) Soil	Loss of Material	Tank Inspection Activities
			(I) Air[1]	Loss of Material	Tank Inspection Activities
			(I) Fuel Oil	Loss of Material	Tank Inspection Activities
Thermowells	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Thermowells	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Tubing	PB	Copper	(E) Air	Cracking	Work Control Process
			(I) Air[1]	Loss of Material	Work Control Process
Tubing	PB	Copper	(E) Air	Cracking	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Tubing	PB	Copper	(E) Air	Cracking	Work Control Process
			(I) Lubricating Oil	Loss of Material	Work Control Process
Tubing	PB	Copper	(E) Air	Cracking	Work Control Process
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry

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See Section 1.4.2 for function code definitions.

Table 3.3.4-2 Diesel Generator Support Systems — Emergency Diesel Generator (EDG) Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Valve Bodies	PB	Brass	(E) Air	Cracking	Work Control Process
			(I) Air[1]	Loss of Material	Work Control Process
Valve Bodies	PB	Brass	(E) Air	Cracking	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Valve Bodies	PB	Brass	(E) Air	Cracking	Work Control Process
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Valve Bodies	PB	Bronze	(E) Air	Cracking	Work Control Process
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Raw Water	Loss of Material	Work Control Process
Valve Bodies	PB	Bronze	(E) Air	Cracking	Work Control Process
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Valve Bodies	PB	Bronze	(E) Air	Cracking	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.4-2 Diesel Generator Support Systems — Emergency Diesel Generator (EDG) Systems

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Valve Bodies	PB	Cast Iron	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Raw Water	Loss of Material	Work Control Process
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry

1. Moisture-laden air.

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See Section 1.4.2 for function code definitions.

Table 3.3.4-3 Diesel Generator Support Systems — Security

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Diesel Jacket Water Radiators	PB	Carbon Steel and Low-alloy Steel (shell)	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Diesel Lube Oil Coolers	PB	Carbon Steel and Low-alloy Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
		Carbon Steel and Low-alloy Steel (shell)	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
		Copper (tubes)	(E) Lubricating Oil	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
		Copper (tubesheet)	(E) Lubricating Oil	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Fan/Blower Housing	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Heaters	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.4-3 Diesel Generator Support Systems — Security

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Oil Pans	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
			(I) Lubricating Oil	Loss of Material	Work Control Process
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Pipe	PB	Copper	(E) Air	Cracking	Work Control Process
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Pump casings	PB	Cast Iron	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Pump casings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
Pump casings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry

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See Section 1.4.2 for function code definitions.

Table 3.3.4-3 Diesel Generator Support Systems — Security

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
					Work Control Process
			(E) Soil	Loss of Material	Tank Inspection Activities
			(I) Air[1]	Loss of Material	Tank Inspection Activities
			(I) Fuel Oil	Loss of Material	Tank Inspection Activities
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Tank Inspection Activities
			(I) Fuel Oil	Loss of Material	Tank Inspection Activities
Tubing	PB	Copper	(E) Air	Cracking	Work Control Process
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry
Valve Bodies	PB	Brass	(E) Air	Cracking	Work Control Process
			(I) Fuel Oil	Loss of Material	Fuel Oil Chemistry

1. Moisture-laden air.

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See Section 1.4.2 for function code definitions.

Table 3.3.5-1 Air and Gas Systems — Compressed Air

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Tubing	PB	Copper	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Aluminum	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Bronze	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.5-2 Air and Gas Systems — Feedwater

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Gas Bottles	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Aluminum	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.5-3 Air and Gas Systems — Heating and Ventilation

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Restricting Orifices	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Bronze	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Aluminum	(E) Air	None	None Required
			(I) Dry Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.5-4 Air and Gas Systems — Instrument Air

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Gas Bottles	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Gas Bottles	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Dry Air	None	None Required
Hoses	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Hoses[1]	PB	Rubber	(E) Air	Change in Material Properties	Work Control Process
				Cracking	Work Control Process
			(I) Air	None	None Required
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Pipe	PB	Copper	(E) Air	None	None Required
			(I) Dry Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.5-4 Air and Gas Systems — Instrument Air

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Pipe	PB	Copper	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Dry Air	None	None Required
Tubing	PB	Copper	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Dry Air	None	None Required
		Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Bronze	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Brass	(E) Air	None	None Required
			(I) Dry Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.5-4 Air and Gas Systems — Instrument Air

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies[1]	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Valve Bodies[1]	PB	Brass	(E) Air	None	None Required
			(I) Air	None	None Required
Valve Bodies	PB	Brass	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Dry Air	None	None Required
Valve Bodies	PB	Bronze	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Dry Air	None	None Required
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Dry Air	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required

1. These components are stored for use associated with App. R fire scenarios.

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See Section 1.4.2 for function code definitions.

Table 3.3.5-5 Air and Gas Systems — Primary and Secondary Plant Gas Supply

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Gas Bottles	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Gas Bottles	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Gas	None	None Required
Gas Bottles	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Hoses	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
			(I) Gas[1]	None	None Required
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.5-5 Air and Gas Systems — Primary and Secondary Plant Gas Supply

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
			(I) Gas[1]	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Valve Bodies	PB	Brass	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Gas	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Gas	None	None Required

1. The Gas environment is associated with the back-up pneumatic source.

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See Section 1.4.2 for function code definitions.

Table 3.3.5-6 Air and Gas Systems — Reactor Coolant

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Brass	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Dry Air	None	None Required
			(I) Gas[1]	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Dry Air	None	None Required
			(I) Gas[1]	None	None Required

1. The Gas environment is associated with the back-up pneumatic source.

Table 3.3.5-7 Air and Gas Systems — Service Air

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process

1. Moisture-laden compressed air.

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See Section 1.4.2 for function code definitions.

Table 3.3.6-1 Ventilation and Vacuum Systems — Containment Vacuum

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air	None	None Required
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.6-2 Ventilation and Vacuum Systems — Leakage Monitoring

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.6-3 Ventilation and Vacuum Systems — Secondary Vents

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies[1]	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[2]	Loss of Material	Work Control Process

1. The piping associated with these components is included in the vacuum priming (VP) system.
2. Moisture-laden air.

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See Section 1.4.2 for function code definitions.

Table 3.3.6-4 Ventilation and Vacuum Systems — Vacuum Priming

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Air[1]	Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Air[1]	Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Work Control Process

1. Moisture-laden air.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.3.6-5 Ventilation and Vacuum Systems — Heating And Ventilation

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Damper Housings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Damper Housings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Air	None	None Required
Ductwork	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Ductwork	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Air	None	None Required
Ductwork	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
			(I) Air	None	None Required
Expansion Joints	PB	Rubber	(E) Atmosphere / Weather	Change in Material Properties	General Condition Monitoring Activities
					Work Control Process
				Cracking	General Condition Monitoring Activities
					Work Control Process
			(I) Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.6-5 Ventilation and Vacuum Systems — Heating And Ventilation

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Expansion Joints	PB	Rubber	(E) Air	Change in Material Properties	General Condition Monitoring Activities
					Work Control Process
				Cracking	General Condition Monitoring Activities
					Work Control Process
			(I) Air	None	None Required
Fan/Blower Housings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Fan/Blower Housings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Air	None	None Required
Fan/Blower Housings	PB	Carbon Steel and Low-alloy Steel	(E) Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
			(I) Air	None	None Required
Fan/Blower Housings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Filters/Strainers	PB;FLT	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Filters/Strainers	PB;FLT	Bronze	(E) Air	None	None Required
			(I) Gas	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.6-5 Ventilation and Vacuum Systems — Heating And Ventilation

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Filters/Strainers	PB;FLT	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Air	None	None Required
Flexible Ductwork[1]	PB	Rubber	(E) Air	Change in Material Properties	Work Control Process
				Cracking	Work Control Process
			(I) Air	None	None Required
Heaters	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Instrument Valve Assemblies	PB	Bronze	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Air	None	None Required
Instrumentation	PB	Bronze	(E) Air	None	None Required
			(I) Gas	None	None Required
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.6-5 Ventilation and Vacuum Systems — Heating And Ventilation

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Tubing	PB	Copper	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Air	None	None Required
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air	None	None Required
Valve Bodies	PB	Aluminum	(E) Air	None	None Required
			(I) Air	None	None Required
Valve Bodies	PB	Brass	(E) Air	None	None Required
			(I) Air	None	None Required
Valve Bodies	PB	Brass	(E) Air	None	None Required
			(I) Gas	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.6-5 Ventilation and Vacuum Systems — Heating And Ventilation

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Bronze	(E) Air	None	None Required
			(I) Gas	None	None Required

1. These components are stored for use associated with App. R fire scenarios.

Table 3.3.7-1 Drain and Liquid Processing Systems — Boron Recovery

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bellows	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Distillate Coolers and Stripper Trim Cooler	PB	Carbon Steel and Low-alloy Steel (shell)	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubes)	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Loss of Material	Work Control Process
		Stainless Steel (tubesheet)	(E) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
			(I) Treated Water	Loss of Material	Work Control Process
Filters/Strainers	PB;FLT	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.7-1 Drain and Liquid Processing Systems — Boron Recovery

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Heaters	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Overhead Condensers	PB	Stainless Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubes)	(E) Gas	None	None Required
			(E) Steam	Cracking	Work Control Process
				Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubesheet)	(E) Gas	None	None Required
			(E) Steam	Cracking	Work Control Process
				Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.7-1 Drain and Liquid Processing Systems — Boron Recovery

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pump Casings	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Stripper Vent Chillers	PB	Stainless Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubes)	(E) Gas[1]	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubesheet)	(E) Gas[1]	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Stripper Vent Condensers	PB	Stainless Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubes)	(E) Gas[1]	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubesheet)	(E) Gas[1]	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.7-1 Drain and Liquid Processing Systems — Boron Recovery

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

1. Moisture-laden process system vent gases.

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See Section 1.4.2 for function code definitions.

Table 3.3.7-2 Drain and Liquid Processing Systems — Drains-Aerated

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air	None	None Required
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Raw Water	Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Raw Water	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.7-3 Drain and Liquid Processing Systems — Drains-Building Services

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Raw Water	Loss of Material	Work Control Process
Pump Casings	PB	Stainless Steel	(E) Air	None	None Required
			(I) Raw Water	Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Raw Water	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.7-4 Drain and Liquid Processing Systems — Drains-Gaseous

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Work Control Process
Primary Drain Transfer Tank Coolers	PB	Carbon Steel and Low-alloy Steel (shell)	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubes)	(E) Treated Water	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubesheet)	(E) Treated Water	Loss of Material	Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.7-4 Drain and Liquid Processing Systems — Drains-Gaseous

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.3.7-5 Drain and Liquid Processing Systems — Liquid And Solid Waste

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
S/G Blowdown Heat Exchangers	PB	Carbon Steel and Low-alloy Steel (shell-side)	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
		Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tube-side)	(E) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.7-6 Drain and Liquid Processing Systems — Radwaste

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems

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See Section 1.4.2 for function code definitions.

Table 3.3.8-1 Vent and Gaseous Processing Systems — Post-Accident Hydrogen Removal

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Expansion Joints	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Fan/Blower Housings	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Filters/Strainers	FLT	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Flexible Connections	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Flow Elements	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.8-1 Vent and Gaseous Processing Systems — Post-Accident Hydrogen Removal

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Recombiners	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Tanks	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air	None	None Required

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Table 3.3.8-2 Vent and Gaseous Processing Systems — Radiation Monitoring

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.8-3 Vent and Gaseous Processing Systems — Vents-Gaseous

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Gas	None	None Required

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Table 3.3.9-1 Fire Protection and Supporting Systems — Fire Protection

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
CO2 Tank Cooling Coils	PB	Copper	(E) Gas	None	None Required
			(I) Gas	None	None Required
Compressor Casings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Fire Protection Program
Filters/Strainers	FLT;PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Raw Water	Loss of Material	Fire Protection Program
Fire Hydrants	PB	Cast Iron	(E) Air	None	None Required
			(E) Atmosphere / Weather	Loss of Material	Fire Protection Program
			(I) Raw Water	Loss of Material	Fire Protection Program
Flame Arrestors	FB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air	None	None Required
Flexible connections	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Flow Orifices	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Raw Water	Loss of Material	Fire Protection Program
Gas Bottles	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Gas	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.9-1 Fire Protection and Supporting Systems — Fire Protection

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Instrument Valve Assemblies	PB	Brass	(E) Air	None	None Required
			(E) Atmosphere / Weather	Loss of Material	Fire Protection Program
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air[1]	Loss of Material	Fire Protection Program
			(I) Raw Water	Loss of Material	Fire Protection Program
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(E) Atmosphere / Weather	Loss of Material	Fire Protection Program
			(I) Air	None	None Required
			(I) Raw Water	Loss of Material	Fire Protection Program
Instrument Valve Assemblies	PB	Brass	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fire Protection Program
					Fuel Oil Chemistry
Level Indicators	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Fire Protection Program
			(I) Raw Water	Loss of Material	Fire Protection Program

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Table 3.3.9-1 Fire Protection and Supporting Systems — Fire Protection

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Nozzles	SP	Brass	(E) Air	None	None Required
			(E) Atmosphere / Weather	Loss of Material	Fire Protection Program
			(I) Air[1]	Loss of Material	Fire Protection Program
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Atmosphere / Weather	Loss of Material	Fire Protection Program
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air[1]	Loss of Material	Fire Protection Program
			(I) Raw Water	Loss of Material	Fire Protection Program
Pipe	PB	Cast Iron	(E) Atmosphere / Weather	Loss of Material	Fire Protection Program
			(E) Soil	Loss of Material	Fire Protection Program
					Buried Piping and Valve Inspection Activities
			(I) Air[1]	Loss of Material	Fire Protection Program
			(I) Raw Water	Loss of Material	Fire Protection Program
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fire Protection Program
					Fuel Oil Chemistry

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See Section 1.4.2 for function code definitions.

Table 3.3.9-1 Fire Protection and Supporting Systems — Fire Protection

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pump Casings	PB	Cast Iron	(E) Air	None	None Required
			(I) Raw Water	Loss of Material	Fire Protection Program
Pump Casings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fire Protection Program
					Fuel Oil Chemistry
Pump casings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Raw Water	Loss of Material	Fire Protection Program
Diesel Fire Pump Radiator	HT;PB	Cast Iron (shell)	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Fire Protection Program
		Copper (tubes)	(E) Treated Water	Loss of Material	Fire Protection Program
			(I) Raw Water	Heat Transfer Degradation	Fire Protection Program
				Loss of Material	Fire Protection Program
Rupture Disks	PB	Brass	(E) Air	None	None Required
			(I) Air	None	None Required
Sprinkler heads	PB;SP	Bronze	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
			(I) Air[1]	Loss of Material	Fire Protection Program
			(I) Raw Water	Loss of Material	Fire Protection Program

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See Section 1.4.2 for function code definitions.

Table 3.3.9-1 Fire Protection and Supporting Systems — Fire Protection

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Fire Protection Program
			(I) Raw Water	Loss of Material	Fire Protection Program
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Air[1]	Loss of Material	Fire Protection Program
					Tank Inspection Activities
			(I) Fuel Oil	Loss of Material	Fire Protection Program
					Fuel Oil Chemistry
					Tank Inspection Activities
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fire Protection Program
					Fuel Oil Chemistry

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See Section 1.4.2 for function code definitions.

Table 3.3.9-1 Fire Protection and Supporting Systems — Fire Protection

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tubing	PB	Copper	(E) Air	None	None Required
			(E) Atmosphere / Weather	Loss of Material	Fire Protection Program
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air[1]	Loss of Material	Fire Protection Program
			(I) Raw Water	Loss of Material	Fire Protection Program
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(E) Atmosphere / Weather	Loss of Material	Fire Protection Program
			(I) Air	None	None Required
			(I) Raw Water	Loss of Material	Fire Protection Program
Tubing	PB	Copper	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fire Protection Program
					Fuel Oil Chemistry

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See Section 1.4.2 for function code definitions.

Table 3.3.9-1 Fire Protection and Supporting Systems — Fire Protection

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Atmosphere / Weather	Loss of Material	Fire Protection Program
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air[1]	Loss of Material	Fire Protection Program
			(I) Raw Water	Loss of Material	Fire Protection Program
Valve Bodies	PB	Brass	(E) Air	None	None Required
			(E) Atmosphere / Weather	Loss of Material	Fire Protection Program
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air[1]	Loss of Material	Fire Protection Program
			(I) Raw Water	Loss of Material	Fire Protection Program
		Bronze	(E) Air	None	None Required
			(E) Atmosphere / Weather	Loss of Material	Fire Protection Program
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Air[1]	Loss of Material	Fire Protection Program
			(I) Raw Water	Loss of Material	Fire Protection Program

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See Section 1.4.2 for function code definitions.

Table 3.3.9-1 Fire Protection and Supporting Systems — Fire Protection

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Cast Iron	(E) Atmosphere / Weather	Loss of Material	Fire Protection Program
			(E) Soil	Loss of Material	Fire Protection Program
					Buried Piping and Valve Inspection Activities
			(I) Air[1]	Loss of Material	Fire Protection Program
			(I) Raw Water	Loss of Material	Fire Protection Program
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Gas	None	None Required
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fire Protection Program
					Fuel Oil Chemistry
Valve Bodies	PB	Brass	(E) Air	None	None Required
			(I) Gas	None	None Required
		Bronze	(E) Air	None	None Required
			(I) Gas	None	None Required
Valve Bodies	PB	Bronze	(E) Air	None	None Required
			(I) Fuel Oil	Loss of Material	Fire Protection Program
					Fuel Oil Chemistry

1. Moisture-laden air.

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See Section 1.4.2 for function code definitions.

Table 3.3.9-2 Fire Protection and Supporting Systems — Reactor Coolant

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Drip pan enclosures[1]	EN	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
			(I) Lubricating Oil	None	None Required
Drip pans[1]	EN	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
			(I) Lubricating Oil	None	None Required
Flame arrestors[1]	FB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
			(I) Lubricating Oil	None	None Required
Flexible connections[1]	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
			(I) Lubricating Oil	None	None Required
Pipe[1]	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
			(I) Lubricating Oil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.3.9-2 Fire Protection and Supporting Systems — Reactor Coolant

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tanks[1]	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
			(I) Lubricating Oil	None	None Required
Valve Bodies[1]	PB	Stainless Steel	(E) Air	None	None Required
			(I) Air	None	None Required
			(I) Lubricating Oil	None	None Required
Valve Bodies[1]	PB	Brass	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Fire Protection Program

1. Reactor coolant pump motor oil collection system component.

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See Section 1.4.2 for function code definitions.

Steam and Power Conversion Systems AMR Results Tables

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Table 3.4-1 Steam and Power Conversion Systems — Auxiliary Steam

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies[1]	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Steam	Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Work Control Process

1. The piping associated with these components is included in the main steam (MS) system.

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See Section 1.4.2 for function code definitions.

Table 3.4-2 Steam and Power Conversion Systems — Blowdown

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Flow Elements	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
					Work Control Process
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
					Work Control Process
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.4-2 Steam and Power Conversion Systems — Blowdown

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
S/G Blowdown Vent Condensers	PB	Carbon Steel and Low-alloy Steel (shell)	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
		Stainless Steel (tubes)	(E) Treated Water	Cracking	Chemistry Control Program for Primary Systems[1]
				Loss of Material	Chemistry Control Program for Primary Systems[1]
					Work Control Process
			(I) Treated Water/Steam	Cracking	Work Control Process
				Loss of Material	Work Control Process
		Stainless Steel (tubesheet)	(E) Treated Water	Cracking	Chemistry Control Program for Primary Systems[1]
				Loss of Material	Chemistry Control Program for Primary Systems[1]
			(I) Treated Water/Steam	Cracking	Work Control Process
				Loss of Material	Work Control Process
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems

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See Section 1.4.2 for function code definitions.

Table 3.4-2 Steam and Power Conversion Systems — Blowdown

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Work Control Process

1. These BD components are associated with the component cooling system pressure boundary. The Chemistry Control Program for Primary Systems maintains the water chemistry for the component cooling system.

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See Section 1.4.2 for function code definitions.

Table 3.4-3 Steam and Power Conversion Systems — Condensate

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water[1]	Loss of Material	Work Control Process
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water[1]	Loss of Material	Work Control Process
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water[1]	Loss of Material	Tank Inspection Activities[2]
					Work Control Process
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Atmosphere / Weather	Loss of Material	Tank Inspection Activities
			(I) Treated Water[1]	Loss of Material	Tank Inspection Activities
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water[1]	Loss of Material	Work Control Process

1. The treated water environment for these components originates from the emergency condensate storage tank. Dissolved oxygen concentrations are assumed to be higher than limits established for the feedwater cycle by the Chemistry Control Program for Secondary Systems. Therefore, the Work Control Process and/or Tank Inspection Activities are credited for managing the aging effects for these components.
2. The Tank Inspection Activities include inspections of accessible adjoining piping during tank inspections.

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See Section 1.4.2 for function code definitions.

Table 3.4-4 Steam and Power Conversion Systems — Feedwater

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Filters/Strainers	PB;FLT	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Flow Elements	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water[1]	Cracking	Chemistry Control Program for Secondary Systems
					Work Control Process
				Loss of Material	Chemistry Control Program for Secondary Systems
					Work Control Process
Instrument Valve Assemblies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water[1]	Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Work Control Process
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water[1]	Cracking	Chemistry Control Program for Secondary Systems
					Work Control Process
				Loss of Material	Chemistry Control Program for Secondary Systems
					Work Control Process
Instrumentation	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water[1]	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.4-4 Steam and Power Conversion Systems — Feedwater

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Treated Water[1]	Cracking	Augmented Inspection Activities[2]
				Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Work Control Process
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air[3]	Loss of Material	Infrequently Accessed Area Inspection Activities
			(I) Treated Water[1]	Cracking	Augmented Inspection Activities[4]
					ISI Program - Component and Component Support Inspections[4]
				Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Tank Inspection Activities[5]
					Work Control Process
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Cracking	Work Control Process
				Loss of Material	Work Control Process
Pump Casings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water[1]	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.4-4 Steam and Power Conversion Systems — Feedwater

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pump Lube Oil Coolers	PB	Carbon Steel and Low-alloy Steel (channel head)	(E) Air	None	None Required
			(I) Treated Water[1]	Loss of Material	Work Control Process
		Carbon Steel and Low-alloy Steel (shell)	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
		Stainless Steel (tubes)	(E) Lubricating Oil	Cracking	Work Control Process
				Loss of Material	Work Control Process
			(I) Treated Water[1]	Loss of Material	Work Control Process
		Stainless Steel (tubesheet)	(E) Lubricating Oil	Cracking	Work Control Process
				Loss of Material	Work Control Process
			(I) Treated Water[1]	Loss of Material	Work Control Process
Restricting Orifices	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water[1]	Cracking	Work Control Process
				Loss of Material	Chemistry Control Program for Secondary Systems
					Work Control Process
Tanks	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil[6]	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.4-4 Steam and Power Conversion Systems — Feedwater

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water[1]	Cracking	Chemistry Control Program for Secondary Systems
					Work Control Process
				Loss of Material	Chemistry Control Program for Secondary Systems
					Work Control Process
Turbine Casings	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Steam	Loss of Material	Work Control Process
Valve Bodies	PB	Brass	(E) Air	Cracking	Work Control Process
			(I) Treated Water[1]	Loss of Material	Work Control Process
		Bronze	(E) Air	Cracking	Work Control Process
			(I) Treated Water[1]	Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Steam	Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.4-4 Steam and Power Conversion Systems — Feedwater

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Treated Water[1]	Cracking	ISI Program - Component and Component Support Inspections[4]
				Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Work Control Process
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Lubricating Oil	Cracking	Work Control Process
				Loss of Material	Work Control Process
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water[1]	Cracking	Chemistry Control Program for Secondary Systems
					Work Control Process
				Loss of Material	Chemistry Control Program for Secondary Systems
					Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.4-4 Steam and Power Conversion Systems — Feedwater

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Treated Water[1]	Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Work Control Process

1. The treated water environment for some of these components originates from the emergency condensate storage tank. Dissolved oxygen concentrations are assumed to be higher than limits established for the feedwater cycle by the Chemistry Control Program for Secondary Systems. Therefore, the Work Control Process and/or Tank Inspection Activities are credited for managing the aging effects for components exposed to treated water from the emergency condensate storage tank.
2. The Augmented Inspection Activities manage the potential effects of fatigue due to thermal stratification of the FW piping adjacent to the steam generator FW inlet nozzle.
3. These components are subject to intermittent wetting externally.
4. The Augmented Inspection Activities and ISI Program - Component and Component Support Inspections are performed to manage FW piping cracking that is postulated as part of the HELB analysis.
5. The Tank Inspection Activities include inspections of accessible adjoining piping during tank inspections.
6. The potential for water contamination of lubricating oil is considered and collection of water in the oil reservoir (tank) results in a requirement to manage the effect of loss of material for the tank components.

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See Section 1.4.2 for function code definitions.

Table 3.4-5 Steam and Power Conversion Systems — Main Steam

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Flow Elements	PB;RF	Nickel-based Alloy	(E) Air	None	None Required
			(I) Steam	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
					Work Control Process
Flow Elements	PB;RF	Stainless Steel	(E) Air	None	None Required
			(I) Steam	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
					Work Control Process
Instrument Valve Assemblies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Steam	Loss of Material	Chemistry Control Program for Secondary Systems
					Work Control Process
Instrument Valve Assemblies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Steam	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
					Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.4-5 Steam and Power Conversion Systems — Main Steam

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Steam	Cracking	Augmented Inspection Activities[1]
					ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Steam	Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection

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See Section 1.4.2 for function code definitions.

Table 3.4-5 Steam and Power Conversion Systems — Main Steam

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Steam Traps	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Steam	Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Work Control Process
			(I) Treated Water	Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Work Control Process
Tubing	PB	Stainless Steel	(E) Air	None	None Required
			(I) Steam	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Steam	Cracking	ISI Program - Component and Component Support Inspections[1]
				Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.4-5 Steam and Power Conversion Systems — Main Steam

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Steam	Cracking	Chemistry Control Program for Secondary Systems
				Loss of Material	Chemistry Control Program for Secondary Systems
					Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I) Steam	Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Work Control Process

1. The Augmented Inspection Activities and ISI Program - Component and Component Support Inspections are performed to manage MS piping cracking that is postulated as part of the HELB analysis.

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See Section 1.4.2 for function code definitions.

Table 3.4-6 Steam and Power Conversion Systems — Steam Drains

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Pipe	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(I) Steam	Loss of Material	Chemistry Control Program for Secondary Systems
					Secondary Piping and Component Inspection
					Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.4-7 Steam and Power Conversion Systems — Steam Generator Water Treatment

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bolting	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Pipe	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Work Control Process
Valve Bodies	PB	Stainless Steel	(E) Air	None	None Required
			(I) Treated Water	Loss of Material	Work Control Process
Valve Bodies	PB	Carbon Steel and Low-alloy Steel	(E) Air	None	None Required
			(E) Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
			(I) Treated Water	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Structures and Component Supports AMR Results Tables

Table 3.5.1-1 Containment

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Access doors	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	General Condition Monitoring Activities
			Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Columns	SSR; SNS	Concrete	Air	None	None Required
Columns and baseplates	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Atmosphere / Weather[1]	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Concrete beams	SSR; SNS	Concrete	Air	None	None Required
Concrete blocks (shielding)	EN	Concrete	Air	None	None Required
Concrete dikes	SNS; FLB	Concrete	Air	None	None Required
Concrete jet impingement barriers	JIS	Concrete	Air	None	None Required
Containment dome	SSR; EN; FB; MB; SNS; EQB	Concrete	Atmosphere / Weather	None	None Required
Containment dome plug[2]	SNS	Carbon Steel and Low-alloy Steel	Atmosphere / Weather	Loss of Material	Infrequently Accessed Area Inspection Activities
Containment liner	PB; SSR	Carbon Steel and Low-alloy Steel	Air	Loss of Material	ISI Program - Containment Inspection
			Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance

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See Section 1.4.2 for function code definitions.

Table 3.5.1-1 Containment

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Containment sump liner	PB[9]; SSR	Stainless Steel	Air	None	None Required
			Raw Water	Loss of Material	Infrequently Accessed Area Inspection Activities
Containment sump trash racks	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Containment wall (exterior)	PB; SSR; EN; FB; MB; SNS; EQB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
			Soil	None	None Required
Door locking mechanism[3]	PB; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	ISI Program - Containment Inspection
			Atmosphere / Weather	Loss of Material	ISI Program - Containment Inspection
Electrical penetration sleeves	PB; SSR	Carbon Steel and Low-alloy Steel	Air	Loss of Material	ISI Program - Containment Inspection
Embedded steel	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel	Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.1-1 Containment

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Equipment hatch	PB; SSR; EN; MB; EQB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	ISI Program - Containment Inspection
			Atmosphere / Weather	Loss of Material	ISI Program - Containment Inspection
			Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Equipment hatch air lock doors	PB; SSR; EN; MB; EQB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	ISI Program - Containment Inspection
			Atmosphere / Weather[3]	Loss of Material	ISI Program - Containment Inspection
			Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Equipment hatch platform	SSR	Carbon Steel and Low-alloy Steel	Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Expansion joint[4]	PB; SNS	Stainless Steel	Air	None	None Required
			Treated Water[5]	Loss of Material	Chemistry Control Program for Primary Systems
Flood curbs and barriers	SNS; FLB	Concrete	Air	None	None Required
Floor slabs	SSR; EN; MB; SNS	Concrete	Air	None	None Required
Footing and grade beam[1]	SSR	Concrete	Atmosphere / Weather	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.1-1 Containment

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Fuel transfer tube	PB; SSR	Stainless Steel	Air	None	None Required
			Treated Water[5]	Loss of Material	Chemistry Control Program for Primary Systems
Fuel transfer tube enclosure protection shield	EN; SNS	Stainless Steel	Air	None	None Required
Fuel transfer tube gate valve	PB[6]; SNS	Stainless Steel	Air	None	None Required
			Treated Water[5]	Loss of Material	Chemistry Control Program for Primary Systems
Grout	SSR; SNS	Concrete	Air	None	None Required
Hinges and pins[3]	PB; SSR	Carbon Steel and Low-alloy Steel	Air	Loss of Material	ISI Program - Containment Inspection
			Atmosphere / Weather	Loss of Material	ISI Program - Containment Inspection
Mechanical penetrations	PB; SSR	Carbon Steel and Low-alloy Steel	Air	Loss of Material	ISI Program - Containment Inspection
			Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
		Stainless Steel[7]	Air	None	None Required
			Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Missile barriers (internal)	SSR; EN; MB	Concrete	Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.1-1 Containment

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Missile shields	SSR; MB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Missile barrier (external)	SSR; MB	Concrete	Atmosphere / Weather	None	None Required
O-rings	PB; SNS	EPDM	Air	Change in Material Properties	Work Control Process
				Cracking	Work Control Process
		Neoprene	Air	Change in Material Properties	Work Control Process
				Cracking	Work Control Process
		Viton	Air	Change in Material Properties	Work Control Process
				Cracking	Work Control Process
Personnel hatch	PB; SSR EN; FB; EQB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	ISI Program - Containment Inspection
			Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Pipe[8]	PB; SSR	Stainless Steel	Air	None	None Required
Reactor cavity liner	PB[9]; SNS	Stainless Steel	Air[10]	None	None Required
Reactor cavity seal	PB[9]; SNS	Carbon Steel and Low-alloy Steel	Air[10]	Loss of Material	Work Control Process

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See Section 1.4.2 for function code definitions.

Table 3.5.1-1 Containment

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Spare penetrations	PB; SSR	Carbon Steel and Low-alloy Steel	Air	Loss of Material	ISI Program - Containment Inspection
		Stainless Steel	Air	None	None Required
Stairs, platforms, grating, and ladders (including supports)	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Atmosphere / Weather[1]	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Steel beams	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Atmosphere / Weather[1]	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Valve bodies[11]	PB; SSR	Stainless Steel	Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.1-1 Containment

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Walls	SSR; EN; MB; SNS; JIS; EQB	Concrete	Air	None	None Required

1. Equipment hatch platform only.
2. Containment dome plug outer cover plate and pipe sleeve.
3. Equipment hatch escape air lock outer door only.
4. Expansion joint bellows for the fuel transfer tube in the fuel transfer canal.
5. Applies to Fuel Building side of fuel transfer tube.
6. Pressure boundary for spent fuel pool integrity when the spent fuel pool keyway gates are removed during fuel handling.
7. Sleeve for the fuel transfer tube.
8. Piping related to the pressure equalization function of the Containment access hatches.
9. Not for Containment pressure boundary, but for system pressure boundary.
10. Not continuously exposed to a borated water environment.
11. Valves related to the pressure equalization function of the Containment access hatches.

Table 3.5.2-1 Auxiliary Building Structure

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Access doors	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	General Condition Monitoring Activities
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Bracing	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Columns	SSR; SNS	Concrete	Air	None	None Required
Columns and baseplates	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Concrete beams	SSR; SNS	Concrete	Air	None	None Required
Concrete blocks (shielding)	SSR; EN; MB	Concrete	Air	None	None Required
Concrete dikes	SNS; FLB	Concrete	Air	None	None Required
Concrete floor support framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Concrete hatches	EN; MB; SNS	Concrete	Air	None	None Required
Duct banks	EN; MB; SSR	Concrete	Air	None	None Required
Embedded steel	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Equipment pads	SSR; SNS	Concrete	Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.2-1 Auxiliary Building Structure

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Flood barriers	FB; SNS; FLB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Flood curbs and barriers	SNS; FLB	Concrete	Air	None	None Required
Floor slabs	SSR; EN; FB; SNS; EQB	Concrete	Air	None	None Required
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Grout	SSR; SNS	Concrete	Air	None	None Required
Masonry block walls	SSR; EN; FB; SNS; EQB	Concrete	Air	Cracking	Civil Engineering Structural Inspection
Missile barriers (internal)	SSR; MB	Concrete	Air	None	None Required
Missile protection doors	SSR; MB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	General Condition Monitoring Activities
			Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
Missile shields	SSR; EN; MB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Roof framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection

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See Section 1.4.2 for function code definitions.

Table 3.5.2-1 Auxiliary Building Structure

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Roof slabs	SSR; EN; MB; SNS; EQB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Stairs, platforms, grating, and ladders (including supports)	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Steel beams	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Steel hatches	EN; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Walls	SSR; EN; FB; MB; SNS; FLB; EQB	Concrete	Air	None	None Required
Walls (external)	SSR; EN; FB; MB; SNS; EQB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
			Soil	None	None Required

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.5.3-1 Other Class I Structures — Safeguards Building

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bracing	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Columns	SSR; SNS	Concrete	Air	None	None Required
Columns and baseplates	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Concrete beams	SSR; SNS	Concrete	Air	None	None Required
Concrete floor support framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Concrete hatches	SSR; EN; MB; SNS	Concrete	Air	None	None Required
Embedded steel	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Floor slabs	SSR; EN; SNS	Concrete	Air	None	None Required
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Grout	SSR; SNS	Concrete	Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.3-1 Other Class I Structures — Safeguards Building

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Roof framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Roof slabs	SSR; EN; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Stairs, platforms, grating, and ladders (including supports)	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Steel beams	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Walls	SSR; SNS	Concrete	Air	None	None Required
Walls (external)	SSR; FB; MB; SNS; EQB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.3-2 Other Class I Structures — Main Steam Valve House

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Access doors	EN; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Bracing	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Columns	SSR; SNS	Concrete	Air	None	None Required
Columns and baseplates	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Concrete beams	SSR; SNS	Concrete	Air	None	None Required
Concrete floor support framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Concrete hatches	SSR; EN; FB; MB; SNS	Concrete	Air	None	None Required
Embedded steel	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Floor slabs	SSR; FB; SNS; FLB	Concrete	Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.3-2 Other Class I Structures — Main Steam Valve House

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Soil	Cracking[1]	Civil Engineering Structural Inspection
Grout	SSR; SNS	Concrete	Air	None	None Required
Masonry block walls	SSR; EN; SNS	Concrete	Air	Cracking	Civil Engineering Structural Inspection
Missile protection doors	SSR; MB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	General Condition Monitoring Activities
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Roof framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Roof slabs	SSR; EN; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Stairs, platforms, grating, and ladders (including supports)	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Steel beams	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Walls	SSR; FB; SNS	Concrete	Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.3-2 Other Class I Structures — Main Steam Valve House

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Walls (external)	SSR; EN; FB; MB; SNS; FLB; JIS; EQB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
			Soil	Cracking[1]	Civil Engineering Structural Inspection

1. The settlement of the building is monitored to ensure that the piping between the Main Steam Valve House/Quench Spray Pump House and the Service Building for Unit 2 is not overstressed due to differential settlement between the buildings.

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See Section 1.4.2 for function code definitions.

Table 3.5.3-3 Other Class I Structures — Quench Spray Pump House

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Access doors	EN	Carbon Steel and Low-alloy Steel	Air	Loss of Material	General Condition Monitoring Activities
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Bracing	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Columns	SSR; SNS	Concrete	Air	None	None Required
Columns and baseplates	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Concrete beams	SSR; SNS	Concrete	Air	None	None Required
Concrete floor support framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Concrete hatches	EN; SNS	Concrete	Air	None	None Required
Embedded steel	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Floor slabs	SSR; EN; MB; SNS	Concrete	Air	None	None Required
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Soil	Cracking[1]	Civil Engineering Structural Inspection

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See Section 1.4.2 for function code definitions.

Table 3.5.3-3 Other Class I Structures — Quench Spray Pump House

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Grout	SSR; SNS	Concrete	Air	None	None Required
Roof framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Stairs, platforms, grating, and ladders (including supports)	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Steel beams	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Walls	SSR; FB; SNS	Concrete	Air	None	None Required
Walls (external)	SSR; EN; FB; SNS; FLB; EQB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
			Soil	Cracking[1]	Civil Engineering Structural Inspection

1. The settlement of the building is monitored to ensure that the piping between the Main Steam Valve House/Quench Spray Pump House and the Service Building for Unit 2 is not overstressed due to differential settlement between the buildings.

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See Section 1.4.2 for function code definitions.

Table 3.5.3-4 Other Class I Structures — Fuel Oil Pump House

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Grout	SSR; SNS	Concrete	Air	None	None Required
Roof slabs	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Slabs on grade	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Walls	SSR; FB; SNS	Concrete	Air	None	None Required
Walls (external)	SSR; FB; MB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
			Soil	None	None Required

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.5.3-5 Other Class I Structures — Auxiliary Feedwater Pump House

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Columns	SSR; SNS	Concrete	Air	None	None Required
Concrete beams	SSR; SNS	Concrete	Air	None	None Required
Concrete hatches	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Grout	SSR; SNS	Concrete	Air	None	None Required
Roof slabs	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Walls	SSR; FB; SNS	Concrete	Air	None	None Required
Walls (external)	SSR; FB; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.3-6 Other Class I Structures — Auxiliary Feedwater Tunnel

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Grout	SSR; SNS	Concrete	Air	None	None Required
Manway covers	SSR; MB; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Infrequently Accessed Area Inspection Activities
			Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection
Roof slabs	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Steel beams	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Infrequently Accessed Area Inspection Activities
Walls (external)	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.3-7 Other Class I Structures — Casing Cooling Pump House

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Columns	SSR; SNS	Concrete	Air	None	None Required
Columns and baseplates	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Concrete beams	SSR; SNS	Concrete	Air	None	None Required
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Grout	SSR; SNS	Concrete	Air	None	None Required
Roof framing and decking	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Roof slabs	SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Steel beams	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Walls (external)	SSR; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.3-8 Other Class I Structures — Service Water Pump House

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bracing	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Columns	SSR; SNS	Concrete	Air	None	None Required
Columns and baseplates	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Concrete beams	SSR; SNS	Concrete	Air	None	None Required
Concrete floor support framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Concrete hatches	SSR; MB; SNS	Concrete	Air	None	None Required
Embedded steel	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Floor slabs	SSR; SNS	Concrete	Air	None	None Required
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Raw Water	None	None Required
			Soil	Cracking[1]	Civil Engineering Structural Inspection
Grout	SSR; SNS	Concrete	Air	None	None Required
Missile protection doors	SSR; MB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	General Condition Monitoring Activities
			Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities

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See Section 1.4.2 for function code definitions.

Table 3.5.3-8 Other Class I Structures — Service Water Pump House

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Roof framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Roof slabs	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Steel beams	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Walls	SSR; SNS	Concrete	Air	None	None Required
			Raw Water	None	None Required
Walls (external)	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
			Raw Water	None	None Required
			Soil	Cracking[1]	Civil Engineering Structural Inspection

1. The settlement of the building is monitored to ensure that the displacement across the service water piping expansion joint is maintained within allowable limits.

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See Section 1.4.2 for function code definitions.

Table 3.5.3-9 Other Class I Structures — Service Water Pipe Expansion Joint Enclosure

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Manway covers	SSR; MB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Infrequently Accessed Area Inspection Activities
			Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection
Roof slabs	SSR; MB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Slabs on grade	SSR	Concrete	Air	None	None Required
			Soil	None	None Required
Walls (external)	SSR; MB	Concrete	Air	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.3-10 Other Class I Structures — Service Water Valve House

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Columns	SSR; SNS	Concrete	Air	None	None Required
Columns and baseplates	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Concrete beams	SSR; SNS	Concrete	Air	None	None Required
Concrete floor support framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Concrete hatches	SSR; MB; SNS	Concrete	Air	None	None Required
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Floor slabs	SSR; SNS	Concrete	Air	None	None Required
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Soil	Cracking[1]	Civil Engineering Structural Inspection
Grout	SSR; SNS	Concrete	Air	None	None Required
Missile protection doors	SSR; MB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	General Condition Monitoring Activities
			Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
Roof framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Roof slabs	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.3-10 Other Class I Structures — Service Water Valve House

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Stairs, platforms, grating, and ladders (including supports)	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Steel beams	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Walls	SSR; SNS	Concrete	Air	None	None Required
Walls (external)	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
			Soil	Cracking[1]	Civil Engineering Structural Inspection

1. The settlement of the building is monitored to ensure that the service water piping expansion joint in the Service Water Valve House is not overstressed due to settlement of the building.

Text enclosed in a thick border indicates technical information specific to **NORTH ANNA**.

See Section 1.4.2 for function code definitions.

Table 3.5.3-11 Other Class I Structures — Service Water Tie-in Vault

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Columns and baseplates	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Infrequently Accessed Area Inspection Activities
Concrete hatches	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Soil	Cracking[1]	Civil Engineering Structural Inspection
Grout	SSR; SNS	Concrete	Air	None	None Required
Manway covers	SSR; MB; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Infrequently Accessed Area Inspection Activities
			Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection
Roof framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Infrequently Accessed Area Inspection Activities
Roof slabs	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Stairs, platforms, grating, and ladders (including supports)	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Infrequently Accessed Area Inspection Activities
Steel beams	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Infrequently Accessed Area Inspection Activities

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See Section 1.4.2 for function code definitions.

Table 3.5.3-11 Other Class I Structures — Service Water Tie-in Vault

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Walls	SSR; SNS	Concrete	Air	None	None Required
Walls (external)	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
			Soil	Cracking	Civil Engineering Structural Inspection

1. The settlement of the building is monitored to ensure that the service water piping expansion joint in the Service Water Tie-In Vault is not overstressed due to settlement of the structure.

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See Section 1.4.2 for function code definitions.

Table 3.5.4-1 Fuel Building

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Blow-off metal siding	EN	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection
Bracing	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Columns and baseplates	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Concrete beams	SSR; SNS	Concrete	Air	None	None Required
Embedded steel	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
		Stainless Steel	Air	None	None Required
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Floor slabs	SSR; EN; SNS	Concrete	Air	None	None Required
Foundation mat slabs	SSR; EN; SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Grout	SSR; SNS	Concrete	Air	None	None Required
Masonry block walls	EN; SNS	Concrete	Air	Cracking	Civil Engineering Structural Inspection
New fuel racks assembly	SSR; EN	Stainless Steel	Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.4-1 Fuel Building

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Roof framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Roof trusses	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Spent fuel pool liner plates	PB; SSR; EN; SNS	Stainless Steel	Air	None	None Required
			Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Spent fuel storage racks	SSR; EN	Stainless Steel	Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Stairs, platforms, grating, and ladders (including supports)	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Steel beams	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Steel gates or doors	PB; SSR; EN	Stainless Steel	Air	None	None Required
			Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Walls	SSR; EN; SNS	Concrete	Air	None	None Required
Walls (external)	SSR; EN; FB; MB; SNS	Concrete	Air	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.5-1 Miscellaneous Structures — Turbine Building

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Access doors	EN; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	General Condition Monitoring Activities
Bracing	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Columns and baseplates	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Concrete dikes	FB; SNS; FLB	Concrete	Air	None	None Required
Concrete floor support framing and decking	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Embedded steel	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Equipment pads	SNS	Concrete	Air	None	None Required
Expansion joint	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Flood barriers	SNS; FLB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Floor slabs	SNS	Concrete	Air	None	None Required
Footing and grade beam	SNS	Concrete	Soil	None	None Required
Grout	SNS	Concrete	Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.5-1 Miscellaneous Structures — Turbine Building

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Masonry block walls	FB; SNS	Concrete	Air	Cracking	Civil Engineering Structural Inspection
Roof framing and decking	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Roof trusses	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Slabs on grade	SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Stairs, platforms, grating, and ladders (including supports)	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Steel beams	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Walls	FB; SNS	Concrete	Air	None	None Required
Walls (external)	SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.5-2 Miscellaneous Structures — Service Building

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Access doors	SSR; EN; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	General Condition Monitoring Activities
Bracing	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Columns and baseplates	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Concrete dikes	FB; SNS; FLB	Concrete	Air	None	None Required
Concrete floor support framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Control room ceiling	SNS	Aluminum	Air	None	None Required
Control room ceiling supports	SNS	Carbon Steel and Low-alloy Steel	Air[1]	None	None Required
		Stainless Steel	Air[1]	None	None Required
Embedded steel	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Exhaust penthouse roof slabs and walls	SSR; EN; MB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.5-2 Miscellaneous Structures — Service Building

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Expansion joint	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Flood barriers	SNS; FLB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Floor slabs	PB[2]; SSR; FB; SNS; EQB	Concrete	Air	None	None Required
Footing and grade beam	SSR; SNS	Concrete	Soil	None	None Required
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Grout	SSR; SNS	Concrete	Air	None	None Required
Louvers roof	SNS	Aluminum	Atmosphere / Weather	None	None Required
Masonry block walls	SSR; FB; SNS	Concrete	Air	Cracking	Civil Engineering Structural Inspection
Missile protection doors	SSR; MB; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	General Condition Monitoring Activities
Missile shields	SSR; MB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Missile barrier (external)	SSR; MB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.5-2 Miscellaneous Structures — Service Building

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Roof framing and decking	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Roof slabs	SSR; EN; FB; MB; SNS; EQB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Slabs on grade	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Stairs, platforms, grating, and ladders (including supports)	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Steel beams	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Walls	PB[2]; SSR; FB; MB; SNS; FLB; EQB	Concrete	Air	None	None Required
Walls (external)	SSR; EN; FB; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
			Soil	None	None Required

1. Not subject to intermittent wetting in the controlled environment of the control room.
2. Control Room envelope pressure boundary only.

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See Section 1.4.2 for function code definitions.

Table 3.5.5-3 Miscellaneous Structures — SBO Building

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bracing	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Columns and baseplates	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Concrete dikes	FB; SNS; FLB	Concrete	Air	None	None Required
Equipment pads	SNS	Concrete	Air	None	None Required
Footing and grade beam	SNS	Concrete	Soil	None	None Required
Grout	SNS	Concrete	Air	None	None Required
Masonry block walls	SNS	Concrete	Air	Cracking	Civil Engineering Structural Inspection
Roof framing and decking	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Slabs on grade	SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Steel beams	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection

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See Section 1.4.2 for function code definitions.

Table 3.5.5-4 Miscellaneous Structures — Security Diesel Building

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Foundation mat slabs	SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Roof slabs	SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Walls (external)	SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.6-1 Intake Structures — Intake Structure

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bracing	SSR; SNS	Carbon Steel and Low-alloy Steel	Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection
			Raw Water	Loss of Material	Civil Engineering Structural Inspection
Columns	SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Concrete beams	SSR; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Equipment pads	SSR; SNS	Concrete	Air	None	None Required
Floor slabs	SSR; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Footing and grade beam	SSR; SNS	Concrete	Soil	None	None Required
Foundation mat slabs	SSR; SNS	Concrete	Raw Water	None	None Required
			Soil	None	None Required
Grout	SSR; SNS	Concrete	Air	None	None Required
H-piles	SSR; SNS	Carbon Steel	Soil	None[1]	None Required
Intake tunnel headers	SSR; SNS	Concrete	Raw Water	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.6-1 Intake Structures — Intake Structure

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Masonry block walls	SNS	Concrete	Air	Cracking	Civil Engineering Structural Inspection
			Atmosphere / Weather	Cracking	Civil Engineering Structural Inspection
Missile shields	SSR; MB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection
Roof Access Cover	SNS	Aluminum	Air	None	None Required
			Atmosphere / Weather	None	None Required
Roof slabs	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Slabs on grade	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Stairs, platforms, grating, and ladders (including supports)	SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
Steel beams	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection
			Raw Water	Loss of Material	Civil Engineering Structural Inspection
Trash racks	SSR; SNS	Carbon Steel and Low-alloy Steel	Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection
			Raw Water	Loss of Material	Civil Engineering Structural Inspection

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See Section 1.4.2 for function code definitions.

Table 3.5.6-1 Intake Structures — Intake Structure

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Walls	SSR; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather[2]	None	None Required
			Raw Water	None	None Required
Walls (external)	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
			Raw Water	None	None Required
			Soil	None	None Required

1. Steel piles are driven in undisturbed soil that is deficient in oxygen at levels a few feet below the ground surface or below the water table. Therefore, the soil environment is not considered corrosive to steel piles (Reference 2, Section 3.5).
2. Above the waterline the walls are treated as in an atmosphere/weather environment.

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See Section 1.4.2 for function code definitions.

Table 3.5.6-2 Intake Structures — Discharge Tunnels and Seal Pit

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Concrete tunnels and seal pit[1]	PB; SSR; SNS	Concrete	Atmosphere / Weather	None	None Required
			Raw Water	None	None Required
			Soil	None	None Required

1. The discharge tunnels share a common seal pit.

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See Section 1.4.2 for function code definitions.

Table 3.5.7-1 Yard Structures — Tank Foundations and Missile Barriers

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Buried Fuel Oil Tank Missile Barrier					
Slabs on grade	SSR; MB	Concrete	Atmosphere / Weather	None	None Required
			Soil	None	None Required
Chemical Addition Tank Foundation					
Foundation mat slabs	SSR	Concrete	Atmosphere / Weather	None	None Required
			Soil	None	None Required
Grout	SSR	Concrete	Atmosphere / Weather	None	None Required
Emergency Condensate Storage Tank Foundation and Missile Barrier					
Foundation mat slabs	SSR	Concrete	Atmosphere / Weather	None	None Required
			Soil	None	None Required
Missile shields	SSR; MB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection
Roof slabs	SSR; MB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.7-1 Yard Structures — Tank Foundations and Missile Barriers

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Walls (external)	SSR; MB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.7-1 Yard Structures — Tank Foundations and Missile Barriers

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Refueling Water Storage Tank Foundation					
Foundation mat slabs	SSR	Concrete	Atmosphere / Weather	Cracking[1]	Civil Engineering Structural Inspection
				Loss of Material[1]	Civil Engineering Structural Inspection
			Soil	None	None Required
Grout	SSR	Concrete	Atmosphere / Weather	None	None Required
Casing Cooling Tank Foundation					
Foundation mat slabs	SSR	Concrete	Atmosphere / Weather	None	None Required
			Soil	None	None Required
Grout	SSR	Concrete	Atmosphere / Weather	None	None Required

1. Cracking and loss of material due to freeze-thaw is only applicable to the Refueling Water Storage Tank foundation because of the high water-to-cement ratio (0.80) and plant specific operating experience.

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See Section 1.4.2 for function code definitions.

Table 3.5.7-2 Yard Structures — Manholes

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Concrete hatches	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Foundation mat slabs	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required
Grout	SSR; SNS	Concrete	Atmosphere / Weather	None	None Required
Manway covers	SSR; MB; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection
Roof slabs	SSR; MB; SNS	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Walls	SSR; SNS	Concrete	Air	None	None Required
Walls (external)	SSR; SNS	Concrete	Air	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.7-3 Yard Structures — Fuel Oil Storage Tank Dike

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Spread footing	SNS	Concrete	Soil	None	None Required
Walls	FB; FLB	Concrete	Atmosphere / Weather	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.7-4 Yard Structures — Transformer Firewalls/Dikes

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Spread footing	SNS	Concrete	Soil	None	None Required
Walls	FB; FLB	Concrete	Atmosphere / Weather	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.7-5 Yard Structures — Duct Banks

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Duct banks	SSR; SNS	Concrete	Soil	None	None Required

Table 3.5.7-6 Yard Structures — Security Lighting Poles

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Lighting pole foundation	SNS	Concrete	Soil	None	None Required
Grout	SNS	Concrete	Atmosphere / Weather	None	None Required
Lighting poles	SNS	Galvanized Steel	Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection

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See Section 1.4.2 for function code definitions.

Table 3.5.7-7 Yard Structures — Domestic Water Treatment Building

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Foundation mat slabs	SNS	Concrete	Air	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.7-8 Yard Structures — Auxiliary Service Water Expansion Joint Enclosure

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Concrete hatches	SSR; MB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Foundation mat slabs	SSR	Concrete	Air	None	None Required
			Soil	None	None Required
Manway covers	SSR; MB	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Civil Engineering Structural Inspection
			Atmosphere / Weather	Loss of Material	Civil Engineering Structural Inspection
Roof slabs	SSR; MB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Walls (external)	SSR; MB	Concrete	Air	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.7-9 Yard Structures — Yard Valve Pit

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Concrete hatches	SSR; MB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Foundation mat slabs	SSR	Concrete	Air	None	None Required
			Soil	None	None Required
Roof slabs	SSR; MB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
Stairs, platforms, grating, and ladders (including supports)	SSR; SNS	Carbon Steel and Low-alloy Steel	Air	Loss of Material	Infrequently Accessed Area Inspection Activities
Walls (external)	SSR; MB	Concrete	Air	None	None Required
			Atmosphere / Weather	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.8-1 Earthen Structures — Service Water Reservoir

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Clay liner	SSR; SCW; SNS; HS	Soil	Raw Water	None	None Required
Concrete liners	SNS	Concrete	Raw Water	None	None Required
			Soil	None	None Required
Earthen dike and embankment	SSR; SCW; SNS; HS	Soil	Atmosphere / Weather	Loss of Form	Civil Engineering Structural Inspection
				Loss of Material	Civil Engineering Structural Inspection
			Raw Water	None	None Required
Spread footing	SSR; SNS	Concrete	Raw Water	None	None Required
			Soil	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.8-2 Earthen Structures — Floodwall West of the Turbine Building

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Culverts	FLB	Carbon Steel	Soil	Loss of Material	Buried Piping and Valve Inspection Activities
		Concrete	Atmosphere / Weather	None	None Required
Earthen dike and embankment	FLB	Soil	Atmosphere / Weather	Loss of Form	Civil Engineering Structural Inspection
				Loss of Material	Civil Engineering Structural Inspection

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See Section 1.4.2 for function code definitions.

Table 3.5.9-1 NSSS Equipment Supports

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bearing plate	SSR	Bronze[1]	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Carbon Steel and Low-alloy Steel[1]	(E)Air	Loss of Material	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
High strength bolting	SSR	Maraging Steel	(E)Air	Cracking	ISI Program - Component and Component Support Inspections
				Loss of Material	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
High strength hardware	SSR	Maraging Steel	(E)Air	Loss of Material	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Neutron shield tank	SSR	Carbon Steel and Low-alloy Steel	(E)Air	Loss of Material	Infrequently Accessed Area Inspection Activities
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
			(I)Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Neutron shield tank support structure	SSR	Carbon Steel and Low-alloy Steel[2]	(E)Air	Loss of Material	Infrequently Accessed Area Inspection Activities
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance

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See Section 1.4.2 for function code definitions.

Table 3.5.9-1 NSSS Equipment Supports

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
RCP, SG, and PZR, support structure	SSR	Carbon Steel and Low-alloy Steel[2]	(E)Air	Loss of Material	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Sliding foot assembly	SSR	Carbon Steel and Low-alloy Steel	(E)Air	Loss of Material	ISI Program - Component and Component Support Inspections
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Structural hardware	SSR	Stainless Steel	(E)Air	None	None Required

1. The bearing plate base metal is impregnated with Lubrite lubricant. Lubrite has been evaluated for the worst case fluence levels at the reactor vessel sliding supports. There are no aging effects requiring management for Lubrite since it is essentially pure graphite with some trace amounts of metallic oxides to enhance its lubricity. The aging effects requiring management are for the base material only.
2. This material group includes high-strength bolting.

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See Section 1.4.2 for function code definitions.

Table 3.5.10-1 General Structural Supports

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Battery Racks	SNS; SSR	Carbon Steel and Low-alloy Steel	(E)Air	Loss of Material	Battery Rack Inspections
Control Rod Drive Mechanism Restraints	SSR	Carbon Steel and Low-alloy Steel	(E)Air	Loss of Material	General Condition Monitoring Activities
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
		Stainless Steel	(E)Air	None	None Required
Electrical Conduit and Cable trays	SNS; SSR	Aluminum	(E)Air	None	None Required
		Galvanized Steel	(E)Air	None	None Required
			(E)Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
					Infrequently Accessed Area Inspection Activities
Bearing Plate	SNS; SSR	Bronze[1]	(E)Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.10-1 General Structural Supports

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Structural support subcomponents such as plate and structural shapes	EN; SNS; SSR	Carbon Steel and Low-alloy Steel[2]	(E)Air	Loss of Material	Augmented Inspection Activities[3]
					General Condition Monitoring Activities
					Infrequently Accessed Area Inspection Activities
					ISI Program - Component and Component Support Inspections[4]
			(E)Atmosphere / Weather	Loss of Material	Augmented Inspection Activities[3]
					General Condition Monitoring Activities
					ISI Program - Component and Component Support Inspections[4]
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
					Infrequently Accessed Area Inspection Activities
			(E)Raw Water	Loss of Material	Infrequently Accessed Area Inspection Activities
	SNS; SSR	Stainless Steel	(E)Air	None	None Required
			(E)Treated Water	Loss of Material	Chemistry Control Program for Primary Systems[5]

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See Section 1.4.2 for function code definitions.

Table 3.5.10-1 General Structural Supports

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Vendor supplied specialty items such as spring hangers and struts	SNS; SSR	Carbon Steel and Low-alloy Steel	(E)Air	Loss of Material	Augmented Inspection Activities[3]
					General Condition Monitoring Activities
					Infrequently Accessed Area Inspection Activities
					ISI Program - Component and Component Support Inspections[4]
			(E)Atmosphere / Weather	Loss of Material	Augmented Inspection Activities[3]
					General Condition Monitoring Activities
					ISI Program - Component and Component Support Inspections[4]
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
					Infrequently Accessed Area Inspection Activities
		Stainless Steel	(E)Air	None	None Required

1. The bearing plate base metal is impregnated with Lubrite lubricant. There are no aging effects requiring management for Lubrite. The aging effects requiring management are for the base material only.
2. This material group includes high-strength bolting.
3. The Augmented Inspection Activities are applicable to pipe support components that provide structural support to seismically-supported non-safety related piping beyond the safety-related boundary out to the first equivalent anchor point.
4. The ISI Program - Component and Component Support Inspections are applicable to supports within the scope of ASME Section XI, Subsection IWF.
5. The Chemistry Control Program for Primary Systems applies to supports located in the spent fuel pool.

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See Section 1.4.2 for function code definitions.

Table 3.5.11-1 Miscellaneous Structural Commodities

Commodity Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bus duct enclosure	EN	Aluminum	(E)Air	None	None Required
		Carbon Steel and Low-alloy Steel	(E)Air	None[1]	None Required
Cable tray cover	FB; SNS	Aluminum	(E)Air	None	None Required
		Galvanized Steel	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
Electrical Component supports (within panels and cabinets)	SNS; SSR	Carbon Steel and Low-alloy Steel	(E)Air	None[1]	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.11-1 Miscellaneous Structural Commodities

Commodity Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Fire barrier penetration seals	PB[2]; SSR; FB; SNS; FLB	3M Caulk	(E)Air	Change in Material Properties	Fire Protection Program
					Work Control Process
				Separation and Cracking/Delamination	Fire Protection Program
					Work Control Process
		FS 601/605	(E)Air	Change in Material Properties	Fire Protection Program
					Work Control Process
				Separation and Cracking/Delamination	Fire Protection Program
					Work Control Process
		Silicone Foam	(E)Air	Change in Material Properties	Fire Protection Program
					Work Control Process
				Separation and Cracking/Delamination	Fire Protection Program
					Work Control Process
Fire doors and/or EQ barrier doors[3]	PB[2];SSR; FB, SNS; EQB	Carbon Steel and Low-alloy Steel	(E)Air	Loss of Material	Fire Protection Program
					General Condition Monitoring Activities
					Work Control Process
			(E)Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Fire stops	FB; SNS	Maranite	(E)Air	Change in Material Properties	Fire Protection Program
				Separation and Cracking/Delamination	Fire Protection Program

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See Section 1.4.2 for function code definitions.

Table 3.5.11-1 Miscellaneous Structural Commodities

Commodity Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Fire Wraps	FB; SNS	3M E53A Mats	(E)Air	None	None Required
		Mineral-wool Batts	(E)Air	None	None Required
		Monokote-5	(E)Air	Loss of Material	General Condition Monitoring Activities
				Separation and Cracking/Delamination	General Condition Monitoring Activities
		Thermo-lag	(E)Air	Change in Material Properties	General Condition Monitoring Activities
				Loss of Material	General Condition Monitoring Activities
				Separation and Cracking/Delamination	General Condition Monitoring Activities
Fire Wraps bands	SNS	Stainless Steel	(E)Air	None	None Required
Firestops supports	SNS	Galvanized Steel	(E)Air	None	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Gaskets in junction, terminal, and pull boxes	EN	Neoprene	(E)Atmosphere / Weather	Change in Material Properties	Work Control Process
				Cracking	Work Control Process
Gypsum boards	FB; SNS	Gypsum	(E)Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.5.11-1 Miscellaneous Structural Commodities

Commodity Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Junction, terminal, and pull boxes	EN	Galvanized Steel	(E)Air	None	None Required
			(E)Atmosphere / Weather	Loss of Material	General Condition Monitoring Activities
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Panels and Cabinets	EN; SNS; SSR	Carbon Steel and Low-alloy Steel	(E)Air	None[1]	None Required
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities
Radiant energy shield	FB; SNS	Stainless Steel	(E)Air	None	None Required
Seismic gap covers	FB; SNS	Carbon Steel and Low-alloy Steel	(E)Air	Loss of Material	Fire Protection Program
					General Condition Monitoring Activities
			(E)Borated Water Leakage	Loss of Material	General Condition Monitoring Activities
Seismic gap materials	SNS	Polyethylene Foam	(E)Air	None	None Required
		Polystyrene Foam	(E)Air	None	None Required
Switchgear enclosures	EN	Carbon Steel and Low-alloy Steel	(E)Air	None[1]	None Required

1. These components are not subject to intermittent wetting.
2. Control Room pressure boundary only.
3. Includes bullet-proof door in the Control Room.

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See Section 1.4.2 for function code definitions.

Table 3.5.12-1 Load-handling Cranes and Devices

Structural Member	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Fuel elevator structural beams, columns, rails, baseplates and anchors for attachment to structures	SNS	Stainless Steel	(E)Air	None	None Required
			(E)Treated Water	Loss of Material	Chemistry Control Program for Primary Systems
Structural crane components such as structural beams, girders, columns, trolley rails, baseplates and anchors for attachment to structures, and retaining clips	SSR, SNS	Carbon Steel and Low-alloy Steel	(E)Air	Loss of Material	Inspection Activities - Load Handling Cranes and Devices
			(E)Atmosphere / Weather	Loss of Material	Inspection Activities - Load Handling Cranes and Devices
			(E)Borated Water Leakage	Loss of Material	Boric Acid Corrosion Surveillance
					General Condition Monitoring Activities

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See Section 1.4.2 for function code definitions.

Electrical and Instrumentation & Controls AMR Results Tables

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Table 3.6.1-1 Bus Ducts

Component Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Bus Assembly	CE	Metal Conductors	(E) Air	None	None Required
		Organic Compounds	(E)Air	None	None Required
Bus Support Assembly	SS	Organic Compounds	(E) Air	None	None Required

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See Section 1.4.2 for function code definitions.

Table 3.6.2-1 Cables and Connectors

Commodity Group	Passive Function	Material Group	Environment	Aging Effects Requiring Management	Aging Management Activity
Cables and Connectors	CE	Metal Conductors	(E)Air	None	None Required
		Organic Compounds	(E)Air	None	None Required
			(E)Raw Water	None	None Required
			(E)Soil	None	None Required

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See Section 1.4.2 for function code definitions.

WCAP SERs Applicant Action Items Resolution Tables

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Table 3.1.1-W1 WCAP-14575-A FSER Response to Applicant Action Items

Aging Management Evaluation for Class I Piping and Associated Pressure Boundary Components	
Renewal Applicant Action Item	**Dominion Specific Response**
1) The license renewal applicant is to verify that its plant is bounded by the technical report. Further, the renewal applicant is to commit to programs described as necessary in the technical report to manage the effects of aging during the period of extended operation on the functionality of the reactor coolant system piping. Applicants for license renewal will be responsible for describing any such commitments and identify how such commitments will be controlled. Any deviations from the aging management programs with this technical report described as necessary to mange the effects of aging during the period of extended operation and to maintain the functionality of the reactor coolant system piping and associated pressure boundary components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	As discussed in Section 3.0 and associated tables, the ASME Class 1 piping and associated pressure boundary components are bounded by the topical report with regard to design criteria and features, material of construction, fabrication techniques, installed configuration, mode of operation and environments/exposures. The programs necessary to manage the effects of aging are identified in Section 3.0. A detailed discussion of the aging management activities is provided in Appendix B.
2) Summary description of the programs and evaluation of Time-limited Aging Analyses are to be provided in the license renewal FSAR supplement in accordance with 10 CFR 54.21(d).	A summary of the programs identified to manage the results of the effects of aging and the Time-limited Aging Analyses evaluation results for ASME Class 1 piping, valves, and reactor coolant pumps are provided in the UFSAR supplement in Appendix A.

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Table 3.1.1-W1 WCAP-14575-A FSER Response to Applicant Action Items

Aging Management Evaluation for Class I Piping and Associated Pressure Boundary Components	
Renewal Applicant Action Item	**Dominion Specific Response**
3) The renewal applicant should complete the updated review of generic communications and capture any additional items not identified by the original review.	A review of the generic communications related to the reactor coolant system has been completed. The aging management review of the reactor coolant system captures industry issues with no additional aging effects identified.
4) Applications must provide a description of all insulation used on austenitic stainless steel Nuclear Steam Supply System piping to ensure the piping is not susceptible to stress-corrosion cracking from halogens.	Halogens are controlled by insulation specifications to minimize the potential for SCC. The insulation materials for the RC system meets the requirements of Regulatory Guide 1.36, "Nonmetallic Thermal Insulation for Austenitic Stainless Steel." This ensures no adverse material interaction with the external surface of the RC system components.
5) The license renewal applicant should describe how each plant-specific AMP addresses the following 10 elements: (1) scope of the program, (2) preventive actions, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.	Programs necessary to manage the effects of aging for Class 1 piping and reactor coolant pumps address the 10 elements identified. These programs are identified in Table 3.1.1-1, Reactor Coolant System, and described in Appendix B.

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Table 3.1.1-W1 WCAP-14575-A FSER Response to Applicant Action Items

Aging Management Evaluation for Class I Piping and Associated Pressure Boundary Components	
Renewal Applicant Action Item	**Dominion Specific Response**
6) The license renewal applicant should perform additional inspection of small-bore RC system piping, that is, less than 4-inch-size piping, for license renewal to provide assurance that potential cracking of small-bore piping is adequately managed during the period of extended operation.	In general, SCC/PWSCC in the RC system is managed by proper material selection for the system environment, and by controlling the chemical properties of the environment. This latter activity is identified as the Chemistry Control for Primary Systems Program, which is supplemented by the Work Control Process. Dominion is implementing a Risk-Informed Inservice Inspection (RI-ISI) Program at SPS and NAPS as part of the ASME Section XI ISI Program. Volumetric examinations of small-bore piping would be added to the scope of ISI based upon risk significance and probability of failure. At this time, no small-bore butt or socket welds have been designated as high safety significance and no volumetric inspections of Class 1 small-bore pipe are planned. However, volumetric examinations are being performed on Surry Unit 1 on a sample population of welds in several 3-inch lines in the Safety Injection and Chemical and Volume Control systems. These are Class 2 lines, but are used as leading indicators for small-bore piping conditions in Class 1 systems.

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Table 3.1.1-W1 WCAP-14575-A FSER Response to Applicant Action Items

Aging Management Evaluation for Class I Piping and Associated Pressure Boundary Components	
Renewal Applicant Action Item	**Dominion Specific Response**
	Dominion actively participates in the EPRI sponsored Materials Reliability Project Industry Task Group on thermal fatigue. In addition, as indicated in Appendix B, Licensee Follow-up Actions, Dominion has committed to following on-going industry activities related to failure mechanisms for small-bore piping and will evaluate changes to inspection activities based on industry recommendations. The combination of above activities will ensure cracking resulting from SCC/PWSCC or unanticipated cyclic loading is managed during the period of extended operation.
7) Components that have delta ferrite levels below the susceptibility screening criteria have adequate fracture toughness and do not require supplemental inspection. As a result of thermal embrittlement, components that have delta ferrite levels exceeding the screening criterion may not have adequate fracture toughness and do require additional evaluation or examination. The license renewal applicant should address thermal-aging issues in accordance with the staff's comments in Section 3.3.3 of this evaluation.	Reduction in fracture toughness is identified as an aging effect related to thermal aging. ASME Class 1 piping, valves and reactor coolant pumps have been evaluated for reduction in fracture toughness and the results are presented in Section 3.1.1, Reactor Coolant System.

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Table 3.1.1-W1 WCAP-14575-A FSER Response to Applicant Action Items

Aging Management Evaluation for Class I Piping and Associated Pressure Boundary Components	
Renewal Applicant Action Item	**Dominion Specific Response**
8) The license renewal applicant should perform additional fatigue evaluation or propose an AMP to address the components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP-14575.	Dominion has established an Aging Management Activity (AMA), performed a plant-specific fatigue evaluation, or a USAS B31.7 evaluation for the applicable components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP-14575. The B31.1 piping and plant-specific metal fatigue evaluation results are provided in Section 4.0, Time-Limited Aging Analyses.
	A combination of the aging management review results for the Pressurizer (Section 3.1.4), Reactor Pressure Vessel (Section 3.1.2), Steam Generator (Section 3.1.5), Reactor Coolant System (Section 3.1.1), the Primary Process Systems (Section 3.3.1) and the Engineered Safety Features (Section 3.2) addresses the various AMAs used to manage the subject components labeled I-M and I-RA in Tables 3-2 through 3-16 of WCAP-14575.

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Table 3.1.1-W1 WCAP-14575-A FSER Response to Applicant Action Items

Aging Management Evaluation for Class I Piping and Associated Pressure Boundary Components	
Renewal Applicant Action Item	**Dominion Specific Response**
9) The staff recommendation for the closure of GSI-190 "Fatigue Evaluation of Metal Components for 60-Year Plant Life" is contained in a December 26, 1999, memorandum from Ashok Thadani to William Travers. The license renewal applicant should address the effects of the coolant environment on component fatigue life as aging management programs are formulated in support of license renewal. The evaluation of a sample of components with high-fatigue usage factors using the latest available environmental fatigue data is an acceptable method to address the effects of the coolant environment on component fatigue life.	Section 4.3.4, Environmentally Assisted Fatigue, presents the results of the plant-specific evaluation of ASME Class 1 components with regard to environmental effects on fatigue. The surge line nozzle connection at the reactor coolant system's hot leg pipe is the leading indicator for reactor water environmental effects. As indicated in Table 3.1.1-1, Reactor Coolant System, an Augmented Inspection Activity has been specifically developed to inspect for cracking of the pressurizer surge line weld at the RC system hot leg pipe connection. The development of these Augmented Inspection Activities is identified in Appendix B as a Licensee Follow-up Action.

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Table 3.1.1-W1 WCAP-14575-A FSER Response to Applicant Action Items

Aging Management Evaluation for Class I Piping and Associated Pressure Boundary Components	
Renewal Applicant Action Item	**Dominion Specific Response**
10) The license renewal applicant should revise AMP-3.6 to include an assessment of the margin on loads in conformance with the staff guidance provided in Reference 11. In addition, AMP-3.6 should be revised to indicate if the CASS component is repaired or replaced per ASME Code, Section XI IWB-4000 or IWB-7000, a new LBB analysis based on the material properties of the repaired or replaced component (and accounting for its thermal aging through the period of extended operation, as appropriate), is required to confirm the applicability of LBB. The inservice examination/flaw evaluation option is, per the basis on which the NRC staff has approved LBB in the past, insufficient to reestablish LBB approval.	If ASME Class 1 cast austenitic stainless steel components are repaired or replaced, Dominion design control procedures would evaluate the existing LBB analysis based on replacement material properties.

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Table 3.1.3-W1 WCAP-14577, Rev. 1-A, FSER Response to Applicant Action Items

Aging Management Evaluation for Reactor Internals	
Renewal Applicant Action Item	**Dominion Specific Response**
1) The license renewal applicant is to verify that the critical parameters for the plant are bounded by the topical report. Further, the renewal applicant must commit to programs described as necessary in the topical report to manage the effects of aging during the period of extended operation on the functionality of the reactor vessel components. Applicants for license renewal will be responsible for describing any such commitments and proposing the appropriate regulatory controls. Any deviations from the aging management programs described in this topical report as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel internal components or other information presented in the report, such as materials of construction, must be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	As discussed in Section 3.1.3, Reactor Vessel Internals, the Dominion reactor vessel internals are bounded by the topical report with regard to design criteria and features, material of construction, fabrication techniques, installed configuration, mode of operation and environments/exposures. The programs necessary to manage the effects of aging are identified in Table 3.1.3-1, Reactor Vessel Internals, and described in Appendix B.
2) A summary description of the programs and activities for managing the effects of aging and the evaluation of TLAAs must be provided in the license renewal FSAR supplement in accordance with 10 CFR 54.21(d).	A summary of the programs identified to manage the effects of aging and the evaluation of TLAAs for the reactor vessel internals is provided in the UFSAR supplement in Appendix A.

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Table 3.1.3-W1 WCAP-14577, Rev. 1-A, FSER Response to Applicant Action Items

Aging Management Evaluation for Reactor Internals	
Renewal Applicant Action Item	**Dominion Specific Response**
3) For the holddown spring, applicants for license renewal are expected to address intended function, aging management review, and appropriate aging management program(s).	The holddown spring is in-scope for the reactor vessel internals. The results of the aging management review for the reactor vessel internals are provided in Section 3.1.3 and summarized along with the intended function and the programs necessary to manage the effects of aging in Table 3.1.3-1, Reactor Vessel Internals. A description of these programs is provided in Appendix B.
4) The license renewal applicant must address aging management review, and appropriate aging management program(s), for guide tube support pins.	The guide tube support (split) pins are in-scope for the reactor vessel internals. The results of the aging management review for the reactor vessel internals are provided in Section 3.1.3 and summarized along with the intended function and the programs necessary to manage the effects of aging in Table 3.1.3-1, Reactor Vessel Internals. A description of these programs is provided in Appendix B.
5) The license renewal applicant must explicitly identify the materials of fabrication of each of the components within the scope of the topical report. The applicable aging effect should be reviewed for each component based on the materials of fabrication and the environment.	The materials for each in-scope RVI component along with aging effects and environments are identified in Table 3.1.3-1, Reactor Vessel Internals. A description of these programs is provided in Appendix B.

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Table 3.1.3-W1 WCAP-14577, Rev. 1-A, FSER Response to Applicant Action Items

Aging Management Evaluation for Reactor Internals	
Renewal Applicant Action Item	**Dominion Specific Response**
6) The license renewal applicant must describe its aging management plans for loss of fracture toughness in cast austenitic stainless steel reactor vessel internal components, considering the synergistic effects of thermal aging and neutron irradiation embrittlement in reducing the fracture toughness of these components.	The program necessary to manage the loss of fracture toughness in cast austenitic stainless steel reactor vessel internal components is described in Appendix B, Reactor Vessel Internals Inspection.
7) The license renewal applicant must describe its aging management plans for void swelling during the license renewal period.	A license renewal industry position on void swelling is being developed. Dominion will follow this issue and evaluate appropriate changes to the Reactor Vessel Internals Inspection, as identified in Appendix B, once an industry position has been established.
8) Applicants for license renewal must describe how each plant-specific AMP addresses the following 10 elements: (1) scope of the program, (2) preventative actions, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.	The programs necessary to manage the effects of aging for the reactor vessel internals addresses the 10 elements identified. These programs are identified in Table 3.1.3-1, Reactor Vessel Internals, and described in Appendix B.
9) The license renewal applicant must address plant-specific plans for management of cracking (and loss of fracture toughness) of reactor vessel internal components, including any plans for augmented inspection activities.	The programs necessary to manage cracking and loss of fracture toughness are identified in Table 3.1.3-1, Reactor Vessel Internals, and described in Appendix B.

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Table 3.1.3-W1 WCAP-14577, Rev. 1-A, FSER Response to Applicant Action Items

Aging Management Evaluation for Reactor Internals	
Renewal Applicant Action Item	**Dominion Specific Response**
10) The license renewal applicant must address plant-specific plans for management of age-related degradation of baffle/former and barrel/former bolting, including any plans for augmented inspection activities.	The programs necessary to manage age-related degradation of baffle/former and barrel/former bolting are identified in Table 3.1.3-1, Reactor Vessel Internals, and described in Appendix B.

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Table 3.1.3-W1 WCAP-14577, Rev. 1-A, FSER Response to Applicant Action Items

Aging Management Evaluation for Reactor Internals	
Renewal Applicant Action Item	**Dominion Specific Response**
11) The license renewal applicant must address the TLAA of fatigue on a plant-specific basis.	The reactor internals were designed and fabricated before the existence of Subsection NG (Core Structures) of the ASME Code. The criteria utilized by Westinghouse for pre-1974 plants was developed internally within Westinghouse and is similar to the subsection NG requirements since many of the Westinghouse designers were members of the ASME code committee that developed the NG subsection. No ASME code design or stress report was required and therefore does not exist for those reactor internals. There are no fatigue related time-limited aging analyses (TLAAs) for the reactor vessel internals. To assess the acceptability of the reactor internals components relative to fatigue for the extended period of operation, the methodology of WCAP-14577 was followed. The preferred approach is to demonstrate that the fatigue effects anticipated for the license renewal term are bounded by the fatigue effects anticipated for the original service period. It is projected that the number of transients for 60 years, including period of extended operation will be less than the design transients. All the significant transients will be monitored as described in Section B3.2, Transient Cycle Counting. This will assure that the transients for 60 years will be within design values.

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Table 3.1.4-W1 WCAP-14574-A FSER Response to Applicant Action Items

Aging Management Evaluation for Pressurizers	
Renewal Applicant Action Item	**Dominion Specific Response**
1) **3.3.1.1-1** - License renewal applicants should identify the TLAAs for the pressurizer components, define the associated CUF and, in accordance with 10 CFR 54.2(c)(1), demonstrate that the TLAAs meet the CLB fatigue design criterion, CUF < 1.0, for the extended period of operation, including the insurge/outsurge and other transient loads not included in the CLB, which are appropriate to such an extended TLAA, as described in the WOG report "Mitigation and Evaluation of Thermal Transients Caused by Insurges and Outsurges," MUHP-5060/5061/5062, and considering the effects of the coolant environment on critical fatigue locations. The applicant must describe the methodology used for evaluating insurge/outsurge and other off-normal and additional transients in the fatigue TLAAs.	The pressurizer TLAA evaluation is provided in Section 4.3, Metal Fatigue.

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Table 3.1.4-W1 WCAP-14574-A FSER Response to Applicant Action Items

Aging Management Evaluation for Pressurizers	
Renewal Applicant Action Item	**Dominion Specific Response**
2) **3.2.2.1-1** - In the report, WOG concluded that general corrosion is nonsignificant for the internal surfaces of Westinghouse-designed pressurizers and that no further evaluations of general corrosion are necessary. While the staff concurs that hydrogen overpressure can mitigate the aggressive corrosive effect of oxygen in creviced geometries on the internal pressurizer surfaces, applicants for license renewal will have to provide a basis (statement) in their plant-specific applications about how their water chemistry control programs will provide for a sufficient level of hydrogen overpressure to manage general corrosion of the internal surfaces of their pressurizer.	A hydrogen overpressure is maintained in the volume control tanks to minimize general corrosion in the reactor coolant system, as well as the pressurizer. The Chemistry Control Program for Primary Systems is based on EPRI document TR-105714 (PWR Primary Water Chemistry Guidelines). These guidelines establish strict limits on hydrogen concentration, which are verified through periodic sampling. The hydrogen overpressure, in combination with stainless steel cladding of components, ensures that general corrosion is a non-significant aging mechanism. The Chemistry Control Program for Primary Systems is described in Appendix B.
3) **3.2.2.1-2** - The staff finds that the criteria in GL 88-05 and the Section XI requirements for conducting leak tests and VT-2 type visual examinations of the pressurizer pressure boundary are acceptable programs for managing boric acid corrosion of the external, ferritic surfaces and components of the pressurizer. However the report fails to refer to the actual provisions in the ASME Code, Section XI that require mandatory system leak tests of the pressurizer boundary. The applicants must identify the appropriate Code inspection requirements from ASME Code Table IWB-2500-1.	Mandatory leak testing of the pressurizers is required by ASME Section XI, Subsection IWB, Table IWB-2500-1, Category B-P.

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Table 3.1.4-W1 WCAP-14574-A FSER Response to Applicant Action Items

Aging Management Evaluation for Pressurizers	
Renewal Applicant Action Item	**Dominion Specific Response**
4) **3.2.2.3.2-1** - The staff concurs that the potential to develop SCC in the bolting materials will be minimized if the yield strength of the material is held to less than 150 ksi, or the hardness is less than 32 on the Rockwell C hardness scale; however, the staff concludes that conformance with the minimum yield strength criteria in ASME Specification SA-193, Grade B7 does not in itself preclude a quenched and tempered low-alloy steel from developing SCC, especially if the acceptable yield strength is greater than 150 ksi. To take credit for the criteria in EPRI Report NP-5769, the applicant needs to state that the acceptable yield strengths for the quenched and tempered low-alloy steel bolting materials (e.g., SA-193 Grade B7 materials) are in the range of 105 - 150 ksi.	SCC of bolting is addressed in Appendix C.

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Table 3.1.4-W1 WCAP-14574-A FSER Response to Applicant Action Items

Aging Management Evaluation for Pressurizers	
Renewal Applicant Action Item	**Dominion Specific Response**
5) **3.2.5-1** - The staff considers the discussion in Section 3.5.2 to be extremely confusing in that it appears WOG is making three different conclusions that conflict with one another: a. That fluid flow velocity and particulate conditions are not sufficient in the pressurizer to consider that erosion is a plausible degradation mechanism that could affect the integrity of the subcomponents in the pressurizer. b. That seven components in the pressurizer (refer to the list above) are exposed to fluid flows that have the potential to result in erosion of the components. c. That only one component in the pressurizer (the spray head) is exposed to a fluid flow that has the potential to result in erosion of the component. The applicant should state why erosion is not plausible for the surge nozzle thermal sleeve, spray nozzle thermal sleeve, surge nozzle safe-end, and spray nozzle safe-end. If erosion is plausible, then an AMP is required.	The relatively low flow velocity in the spray and surge line thermal sleeves and safe ends, combined with the use of stainless steel materials and limited particulate matter in the system, ensures that loss of material due to erosion is not an aging effect requiring aging management.

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Table 3.1.4-W1 WCAP-14574-A FSER Response to Applicant Action Items

Aging Management Evaluation for Pressurizers	
Renewal Applicant Action Item	**Dominion Specific Response**
6) **3.3-1** - Applicants for license renewal must describe how each plant-specific AMP addresses the following 10 elements: (1) scope of the program, (2) preventive action, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.	The programs necessary to manage the effects of aging for the pressurizer address the 10 elements identified. These programs are identified in Table 3.1.4-1, Pressurizers, and described in Appendix B.
7) **3.3.2.1-1** - Applicants for license renewal must provide sufficient details in their LRAs about how their GL 88-05 programs and ISI programs will be sufficient to manage the corrosive effects of boric acid leakage on their pressurizer components during the proposed extended operating terms for their facilities, including postulated leakage from the pressurizer nozzles, pressurizer nozzle-to-vessel welds, pressurizer nozzle-safe end welds, and pressurizer manway bolting materials.	Boric acid wastage is an aging mechanism requiring management on the external surfaces of the pressurizers. The Boric Acid Corrosion Surveillance activity is credited with managing boric acid wastage. The system pressure test required by ASME Section XI, Subsection IWB, Table IWB-2500-1, Category B-P may also be used to detect pressurizer leakage. The Boric Acid Corrosion Surveillance activity and the ISI Program - Component and Component Support Inspections are described in Appendix B. Included in the description is a demonstration of program effectiveness.

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Table 3.1.4-W1 WCAP-14574-A FSER Response to Applicant Action Items

Aging Management Evaluation for Pressurizers	
Renewal Applicant Action Item	**Dominion Specific Response**
8) **3.3.2.2-1** - The staff concludes that an AMP is necessary to control and manage the potential for SCC to occur in welded pressurizer penetration nozzles and manway bolting materials, and recommends that a licensee could credit the following programs as the basis for managing the phenomena of PWSCC/IGSCC or the pressurizer components: (1) the primary coolant chemistry control program; (2) the ISI program of the pressurizers; and (3) the plant-specific quality assurance program as it pertains to assuring that previous welding activities on welds in the pressurizer have been controlled in accordance with the pertinent requirements of 10 CFR 50, Appendix B, and with the pertinent welding requirements of the ASME Code for Class 1 systems. The staff concludes that applicants need to extend AMP-2-1 to the pressurizer penetration nozzles, to the nozzle-to-vessels welds, and to the manway bolting materials, and to include the appropriate Code requirements among the program attributes listed in Table 4-1 and summarized in the text in Section 4.1 of this report.	SCC of bolting is addressed in Appendix C. The Chemistry Control Program for Primary Systems manages SCC in pressurizer subcomponents, including nozzles and the manway cover insert plate, by limiting total halogen content in the primary coolant. ISI program inspections (Table IWB-2500-1) are used to detect cracking resulting from flaw initiation and growth. These programs are described in Appendix B, which include a demonstration of the effectiveness of the programs. The Quality Assurance Program is applicable to all programs credited for aging management.

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Table 3.1.4-W1 WCAP-14574-A FSER Response to Applicant Action Items

Aging Management Evaluation for Pressurizers	
Renewal Applicant Action Item	**Dominion Specific Response**
Applicants for license renewal must provide sufficient details in their LRAs as to how their primary coolant chemistry control programs, ISI programs, and 10 CFR 50, Appendix B quality assurance programs will be sufficient to manage the potential for SCC to occur in the pressurizer nozzle components and bolted manway covers during the proposed extended operating terms for their facilities.	
9) **3.3.2.2-2** - Applicants must propose an AMP to verify whether or not thermal fatigue-induced cracking has propagated through the clad into the ferritic base metal or weld metal beneath the clad.	There is no industry experience to suggest that cracks initiating at the clad inner surfaces in the pressurizer will propagate into the underlying base metal or weld metal. Observed flaws in other plants were monitored for an extended period of time, and no significant flaw growth was observed. In 1990, several indications were discovered in the pressurizer cladding at the Connecticut Yankee Plant. Ultrasonic inspection confirmed that the indications did not penetrate into the ferritic base metal, and therefore, in accordance with ASME Section XI, the indications were acceptable without repair. A surveillance program was initiated, and after two follow-up inspections that showed no change, the surveillance program was discontinued with NRC approval. In several of the cases of observed cracking, fracture mechanics analyses were performed and demonstrated that the cladding indications would not compromise the integrity of the primary system components.

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Table 3.1.4-W1 WCAP-14574-A FSER Response to Applicant Action Items

Aging Management Evaluation for Pressurizers	
Renewal Applicant Action Item	**Dominion Specific Response**
	At temperatures greater than 180°F, the cladding has virtually no impact on fracture behavior. This is the low end of the plant operating temperature range. ASME Section XI flaw evaluation rules require that the effects of cladding must be considered in any structural integrity evaluation, especially for postulated flaws that penetrate the cladding into the base metal. The actual impact of the cladding on such an evaluation is negligible. The pressurizer shell design considers fatigue usage throughout the operating lifetime and includes adequate margin. This is expected to preclude the formation of fatigue cracks in the cladding material. The fracture mechanics evaluations performed for actual observed cracks in other plants indicate that the cracks do not grow significantly over the plant lifetime. Therefore, a specific aging management program to manage fatigue cracking of the pressurizer cladding is not required.

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Table 3.1.4-W1 WCAP-14574-A FSER Response to Applicant Action Items

Aging Management Evaluation for Pressurizers	
Renewal Applicant Action Item	**Dominion Specific Response**
10) **3.3.2.2-3** - The staff is concerned that IGSCC in the heat-affected zones of 304 stainless steel supports that are welded to the pressurizer cladding could grow as a result of thermal fatigue into the adjacent pressure boundary during the license renewal term. The staff considers that these welds will not require aging management in the extended operating periods if applicants can provide a reasonable justification that sensitization has not occurred in these welds during the fabrication of these components. Therefore, applicants for license renewal must provide a discussion of how the implementation of their plant-specific procedures and quality assurance requirements, if any, for the welding and testing of these austenitic stainless steel components provides reasonable assurance that sensitization has not occurred in these welds and their associated heat-affected zones. In addition, the staff requests that applicants for license renewal identify whether these welds fall into item B8.20 of Section XI Examination Category B-H, Integral Attachments for Vessels, and if applicable, whether the applicants have performed the mandatory volumetric or surface examinations of these welds during the ISI intervals referenced in the examination category.	The pressurizer cladding material and weld metal used to join the pressurizer internal supports and cladding were selected to have sufficiently low carbon content to minimize the possibility of sensitization. However, the existence of sensitized areas in the heat-affected zones of 304 stainless steel support welds cannot be totally excluded. Therefore, cracking due to stress corrosion cracking is an aging effect requiring aging management for internal pressurizer welds. The Chemistry Control Program for Primary Systems, as described in Section B2.2.4 of Appendix B, is credited with management of this aging effect. Control of oxygen, chlorides, and halogens provides an essentially benign environment, which has been shown to be effective in limiting stress corrosion cracking. Pressurizer internal welds do not fall under item B8.20 of ASME Section XI Examination Category B-H.

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Table 3.5.9-W1 WCAP-14422, Rev. 2-A, FSER Response to Applicant Action Items

License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
1) **Definition of "Local" and "Adjacent"** The Westinghouse Owners Group (WOG) did not clearly define the term "local" in its report. However, the aging management programs could be the same for all concrete structures and structural components. Therefore the license renewal applicants must describe the aging management program for adjacent concrete structures and any differences from the aging management program for the local concrete structures.	The aging of concrete structures for the RCS primary supports is addressed in the aging management review of the Containment. The aging management review results for the Containment are summarized in Table 3.5.1-1. In the aging management review of the Containment, there is no difference made between local and adjacent concrete or structural components.
2) **Detailed Description of the RCS Supports** A license renewal applicant will have to justify any differences between its RCS support system and the figures and descriptions of the support systems contained in the WOG report.	Not all the support configurations for the RCS primary supports were depicted in the WOG report. The aging management review for the RCS primary supports addressed all the major RCS primary support configurations. The support configurations for the reactor vessel, steam generator, reactor coolant pump, and pressurizer are shown in UFSAR Figure 5.5-7, Figure 5.5-8, Figure 5.5-9, and Figure 5.5-11. The aging management review for the RCS primary supports addressed all the major RCS primary support configurations. The results of the aging management review of the PZR surge line supports contained in the WOG report are provided in Section 3.5.10, General Structural Supports.

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Table 3.5.9-W1 WCAP-14422, Rev. 2-A, FSER Response to Applicant Action Items

License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
3) **Discrepancies and Omissions (Section 3.1)** **The Westinghouse Owners Group report contains many discrepancies and omissions**	
Wear plates and bearing pads are included as support components and are within the scope of this Westinghouse Owners Group report but are not identified in Table 2-1 as parts and sub-components requiring an aging management review.	As identified in the aging management review results for the RCS supports presented in Section 3.5.9, bearing plates for the RCS primary supports were identified, screened in, and evaluated for aging management.
Sketches of RCP support configuration 4 and PZR support configuration 2 are not provided in the Westinghouse Owners Group report.	The support configurations for the pressurizer supports are shown in the Westinghouse Owners Group report. Plant design drawings were used for the aging management review of all the RCS primary supports.
Section 3.2.9 of the Westinghouse Owners Group report indicates that ASTM A36 steel is used in SG and RCP supports, however, ASTM A36 steel is not included in the list of material for the primary component supports (Table 2-4).	Plant design documentation was utilized in the aging management review of the RCS primary supports, which indicated that ASTM A36 steel was used as a material of construction. The aging management review of the RCS primary supports identified this material in its review of the design documentation and did not rely solely on the Westinghouse Owners Group report.

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Renewal Applicant Action Item	**Dominion Specific Response**
The 1963 AISC manual (Ref 3) states that the following steel materials are commonly used for steel construction but they are not listed in table 2-4 of the WOG report. They are ASTM A7, A36, A242, A373, A440, and A441 structural steel and ASTM A325 bolts.	Not all AISC commonly used steel materials were utilized in the manufacture of the RCS primary supports. Based on a review of the design documentation, the following ASTM and AISI steels were used for the manufacture of the RCS primary supports and have been evaluated for aging management: ASTM A36, A70, A105, A107, A237, A285, A515, A516, A543, A563, A572, A723, AISI C1018, 1030, 1075, 4340, Bolting A193, A307, A354, A490, A574.
There are no specific descriptions and sketches for the pressurizer (PZR) surge line supports.	Plant design drawings were utilized for the aging management review of the PZR surge line. Spring hangers support the line, and whip restraints are also provided. The results of the aging management for these supports and restraints are provided in Section 3.5.10, General Structural Supports.

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License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
4) **Strain Aging Embrittlement (Section 3.3.1.4)** Temper embrittlement and strain age embrittlement are the most common forms of thermal embrittlement that are seen in ferritic materials as stated in Section 3.2.4. of the Westinghouse Owners Group report. The WOG report has determined that temperature embrittlement is not a concern for the ferritic materials of RCS supports. However, the WOG report does not address the aging effects from strain aging embrittlement but states that thermal embrittlement is not applicable. The license renewal applicant will address the applicability of the aging effects due to strain energy embrittlement to their plants.	The RCS primary supports are not operated at temperatures generally considered high enough to cause temper embrittlement. Strain age embrittlement is generally associated with either cold formed, rimmed, or capped steels. The materials used for the RCS primary supports are neither cold formed, rimmed, capped nor any combination of these processes. Therefore, strain age embrittlement is not considered an aging effect requiring management for the RCS primary supports.

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Table 3.5.9-W1 WCAP-14422, Rev. 2-A, FSER Response to Applicant Action Items

License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
5) **Low Fracture Toughness (Section 3.3.1.6)** Appendix C of NUREG-0577 addresses this item and groups many WOG member plants as Group 1 "plants requiring further evaluation." Although Table B9 of NUREG-1577 indicated that "low fracture toughness is not significant for containment internal structures," in general, these two documents only addressed the containment internal structures as a whole and did not specifically address the RCS support components. WOG recognizes this concern and states in Section 3.2.9 of its report that "Utilities with potential problems were required to demonstrate that the suspect structures have adequate fracture toughness to comply with the criteria defined in NUREG-0577." However, it further states that "low fracture toughness does not cause detrimental aging effects that must be addressed by maintenance programs." The staff does not believe that the WOG report provides sufficient information to support this conclusion. A license renewal applicant will address, if its plant is listed as Group 1 in Appendix C of NUREG-0577, that its plant had performed an analysis and the steel components of its RCS supports have adequate fracture toughness that no maintenance program is necessary.	North Anna is not listed as Group 1 in Appendix C of NUREG-0577.

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License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
6) **Fatigue (Section 3.3.1.7)** A license renewal applicant will have to justify any differences between the materials used for its RCS supports and the values listed in Table 2-4 of the WOG report.	The WOG report is a generic document that addresses the domestic nuclear plants that utilize the Westinghouse nuclear supply system. The materials listed in Table 2-4 are not an all-inclusive listing of materials that were utilized in the manufacture of the RCS primary supports for all plants. The Dominion aging management review of the RCS primary supports addresses the materials used in their manufacture based on a review of the design documentation.
7) **Irradiation of Concrete (Section 3.3.2.3)** The Westinghouse Owners Group report states that concrete degradation from irradiation will be addressed by plant-specific evaluation. The staff agrees with this suggestion and the license renewal applicant must develop plant-specific program(s) to evaluate this concern.	Shielding from the reactor vessel, vessel insulation, air gaps, and the neutron shield tank filled with water, reduces the neutron fluence resulting in levels far below the levels necessary to cause concrete degradation. The maximum gamma dose evaluated through the period of extended operation is also below the dose required for radiation degradation of concrete. Based on the above, concrete degradation from irradiation is an aging mechanism that does not require aging management.

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Table 3.5.9-W1 WCAP-14422, Rev. 2-A, FSER Response to Applicant Action Items

License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
8) **Elevated Temperature of Concrete (Section 3.3.2.4)** The Westinghouse Owners Group report states that concrete operating temperature should not exceed 150°F and local area temperature should be kept under 200°F. The WOG report further states that RPV supports could be subjected to high temperature that could potentially result in a local temperature above 200°F, if supplemental cooling is not provided. For those support configurations where local temperature at concrete surfaces could exceed 200°F, special design feature are incorporated based on air or water cooling to keep local temperature below 200°F. These temperatures are specified in the ASME Code. Therefore, elevated temperature is not a concern for concrete. Because the operating temperature of concrete components are kept below the limits specified by code by means of supplemented cooling, the staff considers that the aging effects of elevated temperatures are applicable to the RCS supports and are being managed by supplemented cooling features.	Dominion concurs with the WOG position to provide supplementary cooling to keep operating temperatures of concrete within acceptable limits. The Containment average bulk air temperature varies between 75°F and 125°F. Based on operating experience, the air temperature varies throughout the Containments according to location and elevation. General air temperatures in some specific areas can be found to be higher than 120°F but not greater than 150°F. Additionally, the Containment's hot pipe penetrations may be subject to higher than 150°F but not greater than 200°F. Supplementary cooling for the Containment's concrete is provided by the neutron shield tank (NST) and penetration cooling which are within the scope of license renewal and evaluated for aging management. The driving force for the NST cooling water is natural circulation developed by the temperature difference between the top and the bottom of the tank. This thermal-driving head is a low-flow process that provides sufficient flow to maintain the NST at the 120°F or less operating temperature, which limits heat transfer to the primary shield wall.

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Renewal Applicant Action Item	**Dominion Specific Response**
The license renewal applicants will address the concern that the aging effects associated with elevated temperature are applicable and demonstrate that existing design features in this plants are capable of preventing any unacceptable degradation during the extended period of operation.	Penetration coolers are provided at the Containment wall penetrations and engineered air gaps at the primary shield wall hot pipe penetrations to keep operating temperatures of concrete below acceptable limits.
9) **SRP-LR (Section 3.4)** The attributes of the AMPs provided in the Westinghouse Owners Group report do not address all elements as listed in Table A1-1 of Appendix A of the SRP-LR. The applicants should address the missing review elements and describe the plant-specific experience, if any, related to aging degradation of the RCS supports in their applications	The programs necessary to manage the effects of aging for the RCS supports address the 10 elements listed in Table A.1-1 of the Standard Review Plan (Draft, August 2000). These programs are identified in Table 3.5.9-1, NSSS Equipment Supports, and described in Appendix B.

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License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
10) **Details of Leakage Walkdowns and Leakage Monitoring Program (Section 3.4.2)** A license renewal applicant must provide the necessary details to perform leakage identification walkdowns and the details of the leakage monitoring program(s), especially the frequencies, for AMP 1-1 and AMP 1-2	AMP 1-1 addresses aggressive chemical attack and corrosion of steel. AMP 1-2 addresses aggressive chemical attack and corrosion of concrete embedment. The concrete portion of the RCS supports are evaluated for aging management with the Containment and the results are provided in Section 3.5.1, Containment. As indicated in Section 3.5.1, there are no aging effects that require management for concrete structural members within the Containment. Corrosion of steel due to boric acid wastage for RCS primary supports (AMP 1-1) is managed with the Boric Acid Corrosion Surveillance Activities. A description of this program, including the frequencies, is provided in Appendix B.
11) **Baseline Inspection (Section 3.4.2)** All structures and structural components need a baseline inspection to document the condition of the structures and structural components. Therefore, the renewal applicants will have to have plant-specific baseline inspection results for all structures and structural components, or a planned inspection to obtain such results and validate the aging management programs prior to entering the period of extended operation.	Although not characterized as "Baseline Inspections" at the time they were performed, inspections that serve as baseline inspections have been performed and documented for the RCS primary supports under the inservice inspection program.

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License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
12) **Inspection of Inaccessible Areas (Section 3.4.2)** For RCS supports located in inaccessible areas, a license renewal applicant must provide an inspection program to inspect these RCS supports or provide technical justification for not performing inspection.	For RCS support components located in inaccessible areas, monitoring of adjacent accessible components in similar environments is performed to determine the expected condition in the inaccessible areas.
13) **Surveillance Frequency for AMP-1.2 (Section 3.4.3)** AMP-1.2 specifies inspection frequency in accordance with the requirements of Subsection IWF-2410 (Inspection Program) and Table IWB-2412-1, each 10-year interval following the first interval, 10-year inspection program, with IWB-2412. The staff considers the frequency proposed by WOG not to be adequate. The proposed frequency is in accordance with ASME standards, and the inspections are to the requirements of ACI standards, therefore, the frequency of inspection should also follow the recommendations of the ACI standards. Inspection frequencies recommended by ACI 349.3R-96 is every 10 years for below grade structures and controlled interiors and every 5 years for all other structures. Section 4.2.4.1 of NUREG/CR-6424 has the same recommendation for inspection frequencies. An license renewal applicant must address this concern in its applicant.	The aging management review results for the RCS supports are provided in Table 3.5.9-1. The concrete portion of the RCS supports are evaluated for aging management with the Containment and the results are provided in Section 3.5.1, Containment. As indicated in Section 3.5.1, there are no aging effects that require management for concrete structural members within the Containment.

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License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
14) **Acceptance Criteria for Leakage Walkdowns (Section 3.4.4)** In accordance to the Westinghouse Owners Group report, leakage walkdowns and monitoring are plant-specific. Therefore, a license renewal applicant will have to provide the necessary qualitative or quantitative acceptance criteria for leakage walkdowns and monitoring.	Leakage walkdowns and monitoring are included in the Boric Acid Corrosion Surveillance Activities. A description of this program, including acceptance criteria, is provided in Appendix B.

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License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
15) **Acceptance Criteria for AMP 1-2 (Section 3.4.4)** AMP-1.2 specifies acceptance criteria in accordance with several ACI standards. These ACI standards are ACI 201.2R-77, ACI 224.1R-89, and ACI 224R-89. The staff has reviewed these ACI standards and concluded that, except ACI 224.1R, they are mainly for design and construction rather than aging effects for management because those concrete properties are built-in by design and construction. However, they do contain attributes that can be used to develop inspection acceptance criteria for AMP-1.2. For leakage walkdowns and leakage monitoring, the acceptance criteria are the same as that listed for AMP-1.1. The staff has also reviewed ACI 349.3R-96, which is referenced in the WOG report for surveillance technique, and concluded it has acceptance criteria that can be modified and used as the inspection acceptance criteria for AMP-1.2. These criteria include acceptance without further evaluation, acceptance after review, conditions requiring further evaluation. The license renewal applicants will provide a description of the inspection acceptance criteria in their application for the staff to review.	AMP 1-1 addresses aggressive chemical attack and corrosion of steel. AMP 1-2 addresses aggressive chemical attack and corrosion of concrete embedment. The concrete portion of the RCS supports are evaluated for aging management with the Containment and the results are provided in Section 3.5.1, Containment. As indicated in Section 3.5.1, there are no aging effects that require management for concrete structural members within the Containment. Corrosion of steel due to boric acid wastage for RCS primary supports is managed with the Boric Acid Corrosion Surveillance Activities. A description of this program, including the acceptance criteria, is provided in Appendix B.

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License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
16) **Recommendations from Section 5 of the WOG Report (Section 3.6)**	
Identification and evaluation of any plant-specific TLAAs applicable to their RCS supports.	There are no TLAAs applicable to the RCS primary supports.
Identification and evaluation of current-term programs implemented within the current licensing term to address technical issues from industry practices and United States Nuclear Regulatory Commission (NRC) directives (that) should be continued into the license renewal term. Modifications to or elimination of these programs have to be justified.	Per the Statements of Consideration for the License Renewal Rule, programs that have been instituted to address technical issues from industry practices will continue on through the license renewal period. Dominion must carry current licensing basis activities forward into the period of extended operation.

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License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
Identification and justification of plant-specific programs that deviate from the recommended aging management programs (AMPS).	Westinghouse recommended programs are used to manage the aging effects of aggressive chemical attack and corrosion of steel and concrete embedment, and stress corrosion cracking of bolting. The concrete portion of the RCS supports are evaluated for aging management with the Containment and the results are provided in Section 3.5.1, Containment. As indicated in Section 3.5.1, there are no aging effects that require management for concrete structural members within the Containment. The Dominion specific activities indicated in Table 3.5.9-1 manage the identified aging effects for steel and bolting. In Table 3.5.9-1, aggressive chemical attack and corrosion are identified as loss of material. The Dominion specific activities used to manage these aging effects include Boric Acid Corrosion Surveillance, Infrequently Accessed Area Inspection Activities, ISI Program - Component and Component Support Inspections, and the Chemistry Control Program for Primary Systems.

Text enclosed in border indicates technical information specific to **NORTH ANNA.**

Table 3.5.9-W1 WCAP-14422, Rev. 2-A, FSER Response to Applicant Action Items

License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
Identification of any specific program necessary to ensure that proper pre-load is retained for the component supports within the scope of this report.	The results of the aging management review for the RCS supports has determined that loss of pre-load is an aging effect that does not require management. This was based on a review of the bolting utilized for the RCS primary supports. Stress relaxation is of primary concern for bolting with high pre-load at relatively high service temperatures. The RCS system primary supports are the 'worst case' example for connections with high temperature service conditions. It is considered that a thermal environment exposure of 600°F and under is below the threshold temperature that initiates appreciable stress relaxation. The RCS general temperature is 650°F, and location of bolted connections relative to the service temperature service will reduce the temperature well below 600°F. Therefore, for the service conditions evaluated, RCS primary support bolting is considered not to be subject to stress relaxation.

Text enclosed in border indicates technical information specific to **NORTH ANNA.**

Table 3.5.9-W1 WCAP-14422, Rev. 2-A, FSER Response to Applicant Action Items

License Renewal Evaluation: Aging Management for Reactor Coolant System Supports	
Renewal Applicant Action Item	**Dominion Specific Response**
Identification of any evidence of aging degradation in inaccessible areas during the current licensing term that is considered to potentially affect system intended functions. A plan of action to address any identified potential degradation should be provided.	ASME Section XI inservice inspections currently have shown no evidence of degradation in adjacent accessible areas for RCS primary supports that will affect the system intended function. This is an adequate basis for concluding that there is no aging degradation in the inaccessible areas. The RCS primary supports will continue to be inspected via the ISI Program - Component and Component Support Inspections and the Infrequently Accessed Area Inspection Activities. The corrective action program will correct any evidence of degradation.
Verification that the plant is bounded by this GTR. The actions applicants must take to verify that their plant is bounded will be described in an implementation procedure.	The scope of the RCS primary supports described in the topical report bounds the installed supports with the clarifications indicated in Section 3.5.9, Confirmation of Topical Report Applicability.
Plant-specific evaluation of potential degradation due to irradiation of the components within the scope of this report	The actual plant-specific operating environments including degradation due to irradiation were evaluated for the RCS primary supports.

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4.0 TIME-LIMITED AGING ANALYSES

Two areas of plant technical assessment are required to support an application for a renewed operating license. The first area of technical review is the Integrated Plant Assessment, which is described in Chapters 2 and 3 of the License Renewal Application. The second area of technical review that is required for license renewal is the identification and evaluation of plant-specific time-limited aging analyses and exemptions. The identifications and evaluations included in this chapter meet the requirements contained in 10 CFR 54.21(c) and allow the NRC to make the finding contained in 10 CFR 54.29(a)(2).

Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences.

A listing of the abbreviations used in this section is provided in 1.4.1.

4.1 Identification of Time-Limited Aging Analyses

10 CFR 54.21(c) requires that an evaluation of time-limited aging analyses be provided as part of the application for a renewed license. Time-limited aging analyses are defined in 10 CFR 54.3 as those licensee calculations and analyses that *meet the following criteria*:

1. Involve systems, structures, and components within the scope of license renewal, as delineated in 10 CFR 54.4(a).
2. Consider the effects of aging.
3. Involve time-limited assumptions defined by the current operating term, for example, 40 years.
4. Were determined by the licensee to be relevant 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 10 CFR 54.4(b).
6. Are contained or incorporated by reference in the current licensing basis.

4.1.1 Identification Process of Time-Limited Aging Analyses

The process used to identify the site-specific TLAAs is consistent with the guidance provided in NEI 95-10 (Reference 1). Calculations that meet the six criteria of 10 CFR 54.3 have been identified by searching the current licensing basis, which includes the UFSAR,

engineering calculations, technical reports, engineering work requests, licensing correspondence, and applicable Westinghouse WCAPs.

Once a TLAA was identified, an evaluation was performed, as required by 10 CFR 54.21(c)(1), to demonstrate that at least one of the following criteria is applicable:

i. The analyses remain valid for the period of extended operation.

ii. The analyses have been projected to the end of the period of extended operation.

iii. The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

The results of these evaluations are provided in Table 4.1-1 and are discussed in Sections 4.2 through 4.7.

4.1.2 Identification of Exemptions

The requirements of 10 CFR 54.21(c) also stipulate that the application for a renewed license should include a list of plant-specific exemptions granted pursuant to 10 CFR 50.12, and that are in effect, based on time-limited aging analyses, as defined in 10 CFR 54.3. Each active 10 CFR 50.12 exemption has been reviewed to determine whether the exemption is based on a time-limited aging analysis. No plant-specific exemptions granted pursuant to 10 CFR 50.12 and based on a time-limited aging analysis as defined in 10 CFR 54.3 have been identified.

Table 4.1-1 Time-Limited Aging Analysis Categories

TLAA CATEGORY	ANALYSIS	SECTION	RESOLUTION
REACTOR VESSEL NEUTRON EMBRITTLEMENT	Upper Shelf Energy	4.2.1	(ii)
	Pressurized Thermal Shock	4.2.2	(ii)
	Pressure-Temperature Limits	4.2.3	(ii)
METAL FATIGUE	ASME Section III, Class I, Components Including Reactor Coolant System Pressure Boundary Piping	4.3.1	(i) for all components except RV studs & loop stop valves (ii) for RV studs & loop stop valves
	Reactor Vessel Underclad Cracking	4.3.2	(ii)
	ANSI B31.1 Piping	4.3.3	(i) for all piping except hot & cold leg sample lines (ii) for hot & cold leg sample lines
ENVIRONMENTAL QUALIFICATION of ELECTRIC EQUIPMENT	Electrical Equipment (Qualified to 40 years or greater)	4.4	(iii)
CONCRETE CONTAINMENT TENDON PRESTRESS	Concrete Containment Tendon Prestress	4.5	Not Applicable
CONTAINMENT LINER PLATE & PENETRATIONS	Containment Liner Plate	4.6.1	(ii)
	Containment Penetrations	4.6.2	Not a TLAA
OTHER PLANT-SPECIFIC TLAAs	Crane Load Cycle Limit	4.7.1	(i)
	Reactor Coolant Pump Flywheel	4.7.2	(i)
	Leak-Before-Break	4.7.3	(ii)
	Spent Fuel Pool Liner	4.7.4	(i)
	Piping Subsurface Indications	4.7.5	(i)
	Reactor Coolant Pump Code Case N-481	4.7.6	(ii)

(i) The analyses remain valid for the period of extended operation.
(ii) The analyses have been projected to the end of the period of extended operation.
(iii) The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

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4.2 Reactor Vessel Neutron Embrittlement

Dominion actively participated in a Westinghouse Owners Group (WOG) effort that developed a series of evaluations whose purpose was to demonstrate that the aging effects on reactor coolant system components are adequately managed for the period of extended operation. A series of evaluations describe aging mechanisms and effects associated with reactor vessels, and identify time-limited aging analyses applicable to reactor vessels.

At currently licensed service times and operating conditions, reactor vessel fracture toughness properties provide adequate margins against vessel failure. However, as a vessel accumulates additional service time, neutron irradiation (fluence) reduces material fracture toughness. Prevention of reactor vessel failure depends primarily on maintaining reactor vessel fracture toughness at levels that resist brittle fracture during plant operation.

Reactor vessel beltline neutron fluence values applicable to a postulated 20-year period of extended operation have been calculated using the NRC-approved Virginia Power Reactor Vessel Fluence Methodology Topical Report (Reference 2). The methodology described in that report has been developed in accordance with Draft Regulatory Guide DG-1053 (Reference 3). The vessel fluence calculational methodology has been benchmarked using a combination of Dominion surveillance capsules, pressure vessel simulator measurements, and Surry Unit 1 ex-vessel cavity dosimetry measurements.

The underlying requirement of DG-1053 is that a fluence determination should be made on a plant-specific, best-estimate basis, rather than on a generic conservative basis. The methodology used to determine the best-estimate fluence must be demonstrated to have an associated uncertainty no greater than +/- 20% at the 1σ (standard deviation) level. This level of uncertainty is consistent with the assumptions made in the development of the pressurized thermal shock (PTS) screening criteria for reactor vessel welds and plates.

The following time-limited aging analyses are addressed:

- Upper Shelf Energy (USE) evaluation required by 10 CFR 50, Appendix G
- Pressurized Thermal Shock evaluation required by 10 CFR 50.61
- RCS Pressure-Temperature (P-T) Operating Limits required by 10 CFR 50, Appendix G

4.2.1 Upper Shelf Energy

The low upper shelf Charpy energy concern is associated with the determination of an acceptable reactor vessel toughness during the period of extended operation when the vessel is exposed to additional radiation. The upper shelf energy (USE) requirements are included in 10 CFR 50, Appendix G, "Fracture Toughness Requirements." Appendix G of 10 CFR 50 requires utilities to submit an analysis at least three years prior to the time that the

upper shelf energy of any of the RPV materials is predicted to drop below 50 ft-lb, as measured by the Charpy V-notch specimen testing.

When two or more credible reactor surveillance data sets become available, they may be used to determine the Charpy upper shelf energy (USE) of the surveillance material. The surveillance data are then used in conjunction with Regulatory Guide 1.99 to predict the change in the reactor vessel's USE due to irradiation.

Calculations performed in accordance with Regulatory Guide 1.99 demonstrate that the upper shelf energy values for the limiting reactor vessel beltline materials (welds) at the end of the period of extended operation are greater than the 10 CFR 50 Appendix G requirement of 50 ft-lb.

The analysis associated with USE has been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

4.2.2 Pressurized Thermal Shock

A limiting condition on reactor vessel integrity known as pressurized thermal shock (PTS) may occur during a severe system transient, such as a loss-of-coolant-accident (LOCA) or a steam line break. Such transients may challenge the integrity of the reactor vessel under the following conditions: severe overcooling of the inside surface of the vessel wall followed by high repressurization, significant degradation of vessel material toughness caused by radiation embrittlement, and the presence of a critical-size defect in the vessel wall.

In 1985, the NRC issued a formal PTS ruling (10 CFR 50.61) that established screening criteria for PWR vessel embrittlement, as measured by the maximum reference temperature for PTS in the limiting beltline component (RT_{PTS}). RT_{PTS} screening values were set by the NRC for beltline axial welds, forgings, or plates, and for beltline circumferential weld seams for plant operation to the end of plant license.

Operation of all domestic PWR vessels have been required to evaluate vessel embrittlement in accordance with the criteria through the end of license. The NRC has revised 10 CFR 50.61 in 1991 and 1995 to change the procedure for calculating irradiation embrittlement. These revisions make the procedure for calculating RT_{PTS} values consistent with the methods given in Regulatory Guide 1.99 (Reference 4).

The methods of 10 CFR 50.61 have been used with the surface fluence values obtained using the methodology described in VEP-NAF-3-A (Reference 2), to calculate RT_{PTS} for the reactor vessel limiting materials at the end of the period of extended operation. Based on these screening calculations, additional remedial measures will not be required for the reactor vessel during the period of extended operation. The RT_{PTS} values for the beltline

materials at the end of that period for the beltline materials are lower than the applicable screening criteria values established in 10 CFR 50.61.

The analysis associated with PTS has been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

4.2.3 Pressure-Temperature Limits

Atomic Energy Commission (AEC) General Design Criterion (GDC) 14 of 10 CFR 50, Appendix A, "Reactor Coolant Pressure Boundary," requires that the reactor coolant pressure boundary be designed, fabricated, erected, and tested to have an extremely low probability of abnormal leakage or rapid failure and of gross rupture. Likewise, GDC 31, "Fracture Prevention of Reactor Coolant Pressure Boundary," requires that the reactor coolant pressure boundary be designed with sufficient margin to reasonably assure that when stressed by operation, maintenance, and testing conditions, the boundary behaves in a non-brittle manner and the probability of rapidly propagating fracture is minimized. GDC 32, "Inspection of Reactor Coolant Pressure Boundary," requires an appropriate materials surveillance program for assessing the structural integrity of the reactor vessel's beltline region.

Heatup and cooldown limit curves are calculated using the most limiting value of RT_{NDT} (reference nil ductility transition temperature) corresponding to the limiting material in the beltline region of the reactor vessel. The most limiting RT_{NDT} of the material in the core (beltline) region of the reactor vessel is determined using the unirradiated reactor vessel material's fracture toughness properties and the estimated radiation-induced shift (ΔRT_{NDT}).

RT_{NDT} increases as the material is exposed to fast-neutron irradiation. Therefore, to find the most limiting RT_{NDT} at any time period in the reactor vessel's life, ΔRT_{NDT}, due to the radiation exposure associated with that time period, must be added to the original unirradiated RT_{NDT}. Using the adjusted reference temperature values, pressure-temperature (P-T) limit curves are determined in accordance with the requirements of 10 CFR 50, Appendix G, as augmented by ASME Boiler and Pressure Vessel Code, Section XI Appendix G (Reference 5).

The reactor vessel neutron fluence values corresponding to the end of the period of extended operation and the reactor vessel beltline material properties have been used to determine the limiting value of RT_{NDT} using the methods of Regulatory Guide 1.99. The limiting value of RT_{NDT} was used to calculate reactor coolant system (RCS) pressure-temperature (P-T) operating limits that are valid through the end of the period of extended operation. Maximum allowable low-temperature, overpressure protection system (LTOPS) power-operated relief valve (PORV) lift setpoints have been developed on the basis of the P-T limits applicable to the period of extended operation. Dominion has confirmed that

acceptable P-T limits and associated LTOPS setpoints can be established for the period of extended operation. Thus, TLAA has been projected to the end of the period of extended operation and found to be adequate. Existing Technical Specification (Tech Spec) RCS P-T and associated LTOPS setpoints are valid to cumulative core burnup values (i.e., Effective Full Power Years) corresponding to the end of the current license period. Revised RCS limit curves and LTOPS setpoints applicable to the period of extended operation will be submitted for review and approval prior to the expiration of the existing Tech Spec limits in order to remain in compliance with the governing requirements of 10 CFR 50, Appendix G.

The analysis associated with P-T operating limits has been projected to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

4.3 Metal Fatigue

The thermal fatigue analyses of plant mechanical components have been identified as time-limited aging analyses. Specific components have been designed for thermal fatigue using design transient cycle assumptions. The TLAAs for these components are addressed in Sections 4.3.1 through 4.3.4.

4.3.1 ASME Boiler and Pressure Vessel Code, Section III, Class 1

The following reactor coolant system components have been analyzed using the methodology of the ASME Boiler and Pressure Vessel Code, Section III, Class 1 (Reference 6).

- steam generators
- pressurizers
- reactor vessels
- reactor coolant pumps
- control rod drive mechanisms (CRDM)
- reactor coolant system pressure boundary piping.
- loop stop valves

Design codes for the above components are identified in UFSAR Table 5.2-3.

The ASME Boiler and Pressure Vessel Code, Section III, Class 1, requires a design analysis to address fatigue and establish limits such that the initiation of fatigue cracks is precluded.

Pressurizer surge line thermal stratification was identified in NRC Bulletin 88-11. Pressurizer surge lines have been analyzed in response to Bulletin 88-11. Westinghouse has identified insurge/outsurge events, which imposed thermal loads not considered in the original analyses. Pressurizers have been analyzed for the insurge/outsurge events.

The cumulative usage factor (CUF) for critical locations in the Nuclear Steam Supply System components have been determined using design cycles specified in the plant design process. These design cycles are intended to be conservative and bounding for all foreseeable plant operational conditions. The design cycles have been subsequently utilized in the design stress reports for various Nuclear Steam Supply System components, satisfying ASME CUF design requirements.

Experience has shown that actual plant operation is often very conservatively represented by these design transients. The use of actual operating history data allows the quantification of conservatism in the existing fatigue analyses. To demonstrate that the Class 1 component fatigue analyses remain valid for the period of extended operation, the design transients

applicable to the Class 1 components have been assembled. The actual number of occurrences for the design basis transients has been determined and compared to the assumed number for that transient in the design. The magnitude of the actual plant transients has been compared to the magnitude of the design transients. This comparison demonstrates that on an event-by-event basis, the design transient profiles envelop actual plant operation. In addition, a review of the applicable administrative and operating procedures has been performed to verify the effectiveness of the cycle counting program. A review of the existing transient history was performed counting cycles conservatively. The number of cycles was projected for 60 years using recent operating history as a basis. This review has concluded that the existing design transients and cycle frequencies of occurrence are conservative and bounding for the period of extended operation.

The steam generators, pressurizers, reactor vessels, reactor coolant pumps, CRDMs, and all RCS pressure boundary piping, have been evaluated and determined to remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

The reactor vessel closure studs and loop stop valves have been re-analyzed and projected to be valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

For license renewal, continuation of the cycle counting activity during the period of extended operation will assure that the design cycle limits are not exceeded. The cycle counting activity is described in Appendix B, Section B3.2, Transient Cycle Counting.

4.3.2 Reactor Vessel Underclad Cracking

In early 1971, an anomaly identified as grain boundary separation was identified in the heat-affected zone of a European-manufactured reactor vessel's base metal. A subsequent generic fracture mechanics evaluation of Westinghouse plants demonstrated that the growth of underclad cracks during a 40-year plant life was insignificant.

The evaluation was extended to 60 years, using fracture mechanics evaluation based on a representative set of design transients with the occurrences extrapolated to cover 60 years of service life. The 60-year evaluation showed insignificant growth of the underclad cracks and is documented in WCAP-15338 (Reference 7). The plant-specific design transients are bounded by the representative set used in the evaluation.

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).

4.3.3 ANSI B31.1 Piping

The balance-of-plant piping is analyzed to the requirements of ANSI B31.1, Power Piping (Reference 8), which is equivalent to the requirements of ANSI B31.7, Class 2 and Class 3 rules.

Design requirements in ANSI B31.1 use a stress range reduction factor to provide conservatism in the piping design to account for fatigue due to thermal cyclic operation. This reduction factor is 1.0, provided the number of anticipated cycles is limited to 7,000 equivalent full-temperature cycles. A piping system would have to be thermally cycled approximately once every three days over a plant life of 60 years to reach 7,000 cycles. Considering this limit, a review of the ANSI B31.1 piping within the scope of license renewal has been performed to identify those systems that operate at elevated temperature and to establish their cyclic operation.

Typically, ANSI B31.1 systems are subject to continuous steady-state operation, and operating temperatures vary only during plant heatup and cooldown, during plant transients, or during periodic testing. The limiting case was determined to be the hot and cold leg sample lines.

During the period of extended operation, it is anticipated that the hot and cold leg sample lines will be subjected to more than 7,000 cycles but less than 9,000 cycles. Analyses for these lines show they are qualified for 22,000 cycles, including stress range reduction factors. The common header of the sample lines for the hot leg of the RCS experiences about three full temperature cycles per week during the operation of each unit. The total cycles expected to be experienced by this sampling line will be less than 9,000 cycles for a 60-year period. The same has been found for the cold leg sample line. The analysis associated with sample lines has been projected to be valid to the end of the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

The analyses associated with ANSI B31.1 piping fatigue of the RCS, have been evaluated and determined to remain valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(i).

4.3.4 Environmentally Assisted Fatigue

Generic Safety Issue (GSI)-190 (Reference 9) identifies a concern of the NRC staff about the potential effects of reactor water environments on reactor coolant system component fatigue life during the period of extended operation. GSI-190, which was closed in December 1999, has concluded that environmental effects have a negligible impact on core damage

frequency, and as such, no generic regulatory action is required (Reference 10). However, as part of the closure of GSI-190, the NRC has 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.

While fatigue design has been determined to be a TLAA, even though the design limits are based on cycles rather than an explicit time period, reactor water environmental effects, as described in GSI-190, are not TLAAs since they are not included in the station's current licensing basis (CLB).

Therefore, environmental effects on Class 1 component fatigue have been evaluated to determine if any additional actions are required for the period of extended operation. The approach to address reactor water environmental effects accomplishes two objectives, as illustrated in Figure 4.3-1. First, the TLAA on fatigue design has been resolved by confirming that the original transient design limits remain valid for the 60-year operating period. Confirmation by transient cycle counting will reasonably assure that these transient design limits are not exceeded. Secondly, reactor water environmental effects on fatigue life have been examined using the most recent data from laboratory simulation of the reactor coolant environment. These two aspects of fatigue design have been kept separate, since fatigue design is part of the plant CLB and a TLAA, while the consideration of reactor water environmental effects on fatigue life as described in GSI-190, is not considered part of the CLB. This approach is consistent with the proposed EPRI guidance for addressing environmentally assisted fatigue.

It is important to note that three areas of margin are included in the fatigue evaluation that are worthy of consideration. These areas include margins resulting from actual cycle experience, magnitude of transients, and moderate environmental effects.

Margin Due to Actual Cycles- It has been concluded that the original 40-year design transient set for Class 1 components is valid for the 60-year period of extended operation. Conservative projections conclude that the design transient limits will not be exceeded. Additional margin is available in the current Class 1 component fatigue analyses, since the CUF for all Class 1 components remain below the allowable value of 1.0.

Margin Due to Transient Magnitude- Much of the conservatism in the fatigue calculational methodology is due to design basis transient definitions. It has been concluded that the magnitude of the original design transients bounds actual plant operation. Additional industry fatigue studies conclude that the fatigue impact of conservative design basis transient definitions, by themselves, bound the contributing impact of reactor water environmental effects (References 11 through 15). Additional margin exists due to the sequence of occurrence of transient events. The component design considers the

occurrence of the transient in the most unfavorable sequence to yield the highest CUF. Comparably, the actual events do not necessarily occur in the most unfavorable sequence.

Margin Due to Moderate Environmental Effects- A portion of the safety factors applied to the ASME Code's Section III fatigue design curves accounts for moderate environmental effects. While there is debate over exactly how much margin this represents, it is noteworthy to recognize this safety factor in this qualitative discussion of margin.

Considering the three margins above, the transient cycle counting program is conservative from an overall perspective. Nevertheless, specific assessment of potential environmental effects on fatigue is addressed below.

As a part of the industry effort to address environmental effects on operating nuclear power plants during the current 40-year licensing term, Idaho National Engineering Laboratories (INEL) evaluated fatigue-sensitive component locations at plants designed by all four U.S. nuclear steam supply system vendors. This evaluation is documented in NUREG/CR-6260 (Reference 16). The pressurized water reactor calculations, especially the early-vintage Westinghouse calculations, are directly relevant to the station. In addition, the transient cycles considered in the evaluation of early-vintage Westinghouse plants match or bound the design. The following critical fatigue-sensitive component locations were chosen in NUREG/CR-6260 for the early-vintage Westinghouse plant:

- The reactor vessel shell and lower head
- The reactor vessel inlet and outlet nozzles
- The pressurizer surge line (including the pressurizer and hot leg nozzles)
- The reactor coolant system piping's charging system nozzle
- The reactor coolant system piping's safety injection nozzle
- The residual heat removal system's Class 1 piping

Early-vintage Westinghouse-designed plants, including Surry, utilized ANSI B31.1 methodology for the majority of the currently-defined Class 1 piping, for which no explicit fatigue analysis had been performed. For this reason, INEL performed representative design-basis fatigue calculations for the last three component locations above. NUREG/CR-6260 calculated the CUF for all of the above locations utilizing the interim fatigue curves provided in NUREG/CR-5999 (Reference 17).

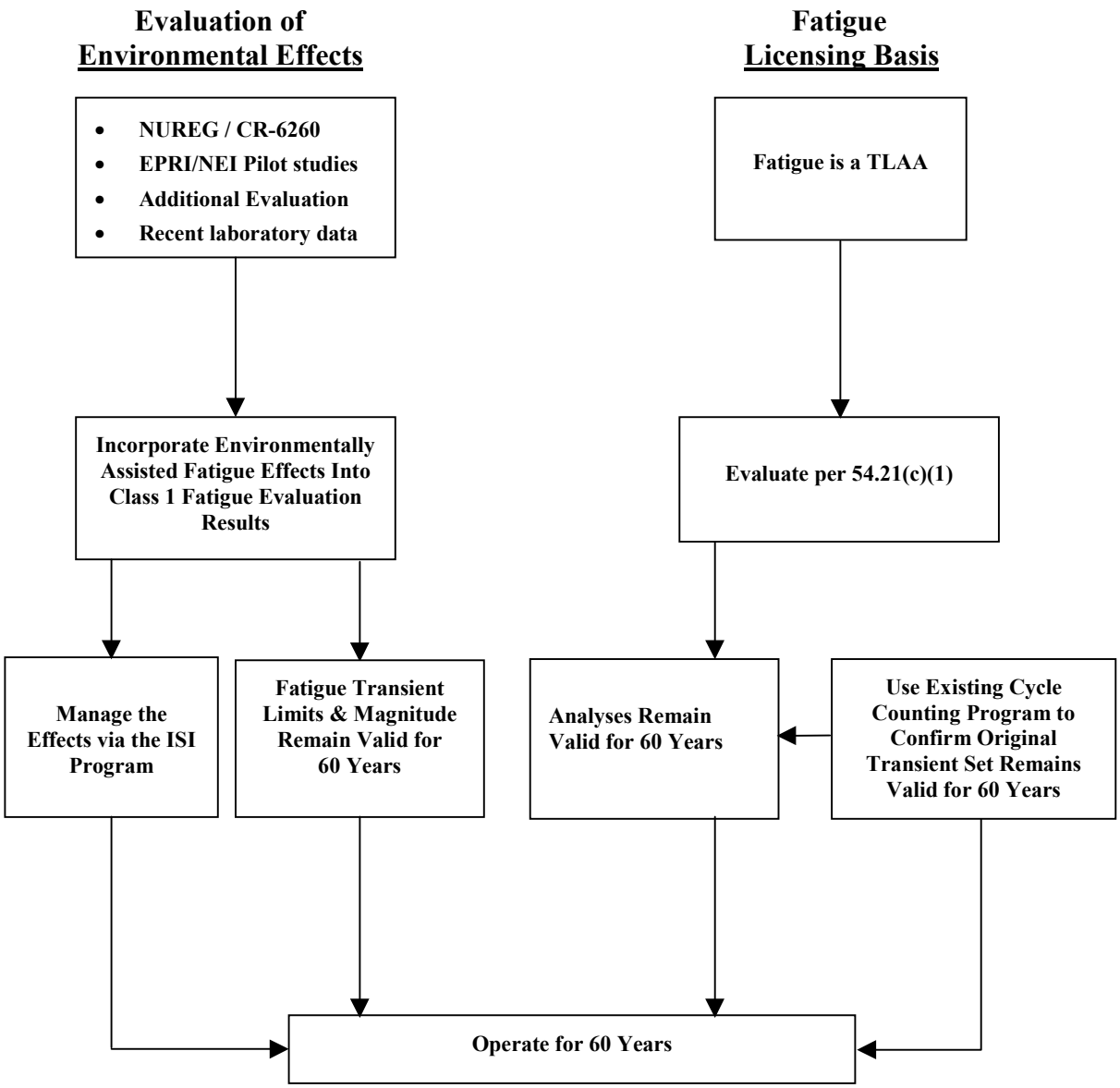
The results of NUREG/CR-6260 analyses, and additional data from NUREG/CR-6583 (Reference 18) and NUREG/CR-5704 (Reference 19), have been used to scale up the plant-specific CUF for fatigue-sensitive locations (including pressurizer locations) to account for environmental effects. Generic industry studies performed by EPRI and NEI have also been considered in this aspect of the evaluation, as well as environmental data that have

been collected and published subsequent to the generic industry studies (References 11 through 15). Based on these adjustments, only the pressurizer surge line piping requires further evaluation for the period of extended operation. In lieu of additional analyses to refine the CUF for the pressurizer surge line, Dominion has selected aging management to address pressurizer surge line fatigue during the period of extended operation.

The surge line connects the pressurizer to the reactor coolant system hot leg piping, and it has been determined that the surge line nozzle connection at the reactor coolant system's hot leg pipe is the leading indicator for reactor water environmental effects. Therefore, the surge line weld at the hot leg pipe connection will be included in an augmented inspection program, so that flaw initiation and growth can be detected and/or monitored. In addition to the results of these inspections, the results of planned research by the EPRI-sponsored Materials Reliability Program will be used to evaluate the need to adjust the technique, frequency and number of locations to be inspected during the period of extended operation, in order to address reactor water environmental effects. This provides reasonable assurance, that, the potential reactor water environment effects will be managed such that components within the scope of license renewal will continue to perform their CLB function during the period of extended operation.

The potential effects of the reactor water environment have been evaluated for the period of extended operation as required by GSI-190.

Figure 4.3-1 TLAA & GSI-190 Environmentally Assisted Fatigue Evaluation Process



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4.4 Environmental Qualification (EQ) of Electric Equipment

10 CFR 50.49 provides the requirements for the Environmental Qualification (EQ) Program. The EQ Program is applicable to safety-related electrical and electronic equipment that is relied upon to remain functional during and following a design-basis event, non-safety-related electric equipment whose failure under postulated environmental conditions could prevent accomplishment of safety functions, and certain post-accident monitoring equipment as described in Regulatory Guide 1.97 (Reference 20). Earlier guidance regarding environmental qualification was given in NRC Information and Enforcement Bulletin (IEB) 79-01B (Reference 21) applicable for Surry Units 1 & 2, and North Anna Unit 1, and in NUREG-0588 (Category II) (Reference 22) applicable for North Anna Unit 2. An evaluation of the EQ Program in terms of the aging management program attributes delineated in the Standard Review Plan for License Renewal is provided in Appendix B, Section B3.1, Environmental Qualification Program.

For purposes of license renewal, EQ components were evaluated in accordance with the EQ Program utilizing Option iii, as identified in 10 CFR 54.21(c)(1)(iii). The EQ Program provides reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification is adequately managed now and for the period of extended operation. To establish the qualified life of the EQ equipment, aging analyses were developed per the requirements delineated above. Aging analyses that are based on or developed for 40 years or greater may be considered to be Time-Limited Aging Analyses (TLAAs), if the equipment ’end-of-life' date falls within the period of extended operation. Components with a qualified lifetime of less than 40 years already are included in a program of periodic replacement and are not considered TLAAs. EQ equipment is identified and tabulated in the Equipment Qualification Master List (EQML). This list also establishes the equipment's 'end-of-life date' and references the Qualification Documentation Review (QDR), which contains pertinent information that establishes qualified life and applicable environmental parameters. Applicable corporate technical standards that implement the EQ Program detail the following:

- Personnel responsibilities
- Program methodologies
- EQ Program maintenance
- Environmental Zone descriptions
- Environmental Qualification Master List
- Qualification Document Reviews

Additional control processes addressed by the EQ Program include: procurement, design changes, upgrades and repairs, plant operating changes, basis calculations, temperature, radiation, ventilation, industry operating experience, and document control.

NRC guidance for addressing GSI-168 for license renewal is contained in the June 2, 1998, NRC letter to NEI (Reference 23). In this letter, the NRC states, "With respect to addressing GSI-168 for license renewal, until completion of an ongoing research program and staff evaluations, the potential issues associated with GSI-168 and their scope have not been defined to the point that a license renewal applicant can reasonably be expected to address them at this time. Therefore, an acceptable approach described in the Statements of Consideration is to provide a technical rationale demonstrating that the current licensing basis for environmental qualification pursuant to 10 CFR 50.49 will be maintained in the period of extended operation. Although the Statements of Consideration also indicates that an applicant should provide a brief description of one or more reasonable options that would be available to adequately manage the effects of aging, the staff does not expect an applicant to provide the options at this time."

Many environmental qualification calculations of electrical equipment are identified as time-limited aging analyses. These calculations are considered the technical rationale that the current licensing basis will be maintained during the period of extended operation. Consistent with the above NRC guidance, no additional information is required to address GSI-168 in a renewal application at this time. When aging analysis cannot justify qualified life into the period of extended operation, then the component and/or parts will be replaced prior to exceeding its qualified life in accordance with the EQ Program.

EQ equipment was re-evaluated for the environmental service conditions that are applicable to the equipment. The environmental service conditions are divided into two basic areas: normal and accident. 10 CFR 50.49 requires that all significant aging effects from normal service conditions be considered. This would include the expected thermal aging effects from normal temperature exposure, any radiation effects during normal plant operation, and mechanical cycle aging as applicable. 10 CFR 50.49 also requires evaluation of the effects from any harsh environments the equipment could be exposed to under accident conditions.

The evaluation of the environmental service conditions for the period of extended operation requires a re-evaluation of the normal aging effects which are discussed below:

Thermal Aging Considerations

The specific analyses for thermal aging were reviewed to determine if the existing calculations would remain valid or could be projected to encompass the period of extended operation. Some components were installed under a plant modification and will not experience 60 years of thermal aging by the end of the period of extended operation. In these cases, the basis for the thermal aging evaluation is provided in the EQ documentation for each component (type).

Radiation Considerations

The specific analyses for radiation aging were reviewed to determine if the existing calculations would remain valid or could be projected to encompass the period of extended operation. An assumption was made that the normal dose for the period of extended operation would be 1.5 times (i.e., 60 years/40 years = 1.5) the established dose for the 40-year period. The total integrated dose (TID), or bounding dose, for the 60-year period, was established by adding the accident dose to the newly determined 60-year normal dose for the device. The TID was then compared to the qualification level to provide reasonable assurance that the required TID would be met or enveloped.

If the required TID calculated by this methodology is higher than the qualification value, the component group or part will require assessment prior to the 'end-of-life' date, in accordance with EQ Program requirements.

Some components have been installed under a plant modification and will not experience 60 years of radiation aging by the end of the period of extended operation. In these cases, the basis for the radiation aging evaluation is provided in the EQ documentation for each component (type).

Mechanical Cycle Considerations

The specific analyses for mechanical cycle-aging were reviewed to determine if the existing calculations would remain valid or could be projected to encompass the period of extended operation. An assumption was made that the normal cycles for the period of extended operation would be 1.5 times (i.e., 60 years/40 years = 1.5) the established cycles for the 40-year period. If the device was previously qualified for this number of cycles, no additional review was required.

If the number of normal cycles by this methodology is higher than the qualification value then the component group or part will require assessment, prior to its 'end-of-life' date, in accordance with EQ Program requirements.

Some components have been installed under a plant modification and will not experience 60 years of cycle aging by the end of the period of extended operation. In these cases, the basis for the cycle-aging evaluation is provided in the EQ documentation for each component (type).

In summary, QDRs determined to be within the EQ TLAA scope were reviewed to determine if the aging requirements for the period of extended operation were enveloped by the qualification levels of each aging category (i.e., thermal, radiation, and mechanical cycle). Results of this review are presented below. The qualification analyses presented in the QDRs will be adequately managed by the EQ program for the period of extended operation,

as required by 10 CFR 54.21(c)(1)(iii). (That is, aging calculations will be updated or equipment will be refurbished, requalified, or replaced.)

4.4.1 Limitorque Motor-Operated Valves Outside Containment

This QDR addresses Limitorque actuators mounted on motor-operated valves (MOV) located outside of Containment. The maximum operating temperature in the zones where EQ MOVs are located outside Containment is 48.9°C. The valve actuators operate intermittently, and based on the amount of time that the actuator is energized, the temperature rise due to self-heating is negligible. Therefore, the operating temperature used to determine qualified life is 48.9°C.

Thermal Analysis

The qualification was based on a conservative 60°C ambient as the base for an aging temperature. It was determined that the weak link material would reach 50% loss of property in 3.07×10^7 hours (3,502 years). Sixty (60) year-life would represent 2.0% of available life. Since degradation would be directly proportional to life, the degradation would be negligible.

Radiation Analysis

The valve actuators are qualified to 2.0×10^7 rads. The bounding 60-year TID is 1.22×10^7 rads. The bounding radiation environment is less than the qualification dose with margin.

Mechanical Cycle Analysis

The valve actuators are qualified for 1,993 mechanical cycles. The cycling during testing envelops the 921 cycles anticipated during 60 years of plant operation.

Conclusion

The Environmental Qualification Program for the Limitorque MOV outside Containment will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.2 Limitorque Motor-Operated Valves Inside Containment

This QDR addresses Limitorque actuators mounted on MOVs located inside of Containment. The maximum operating temperature in the zones where EQ MOVs are located is 51.7°C. The valve actuators operate intermittently, and based on the amount of time that the actuator is energized the temperature rise due to self-heating is negligible. Therefore, the operating temperature used to determine qualified life is 51.7°C.

Thermal Analysis

The maximum ambient temperature used for inside Containment locations is 51.7°C. The QDR determined the qualified life to be in excess of 60 years using the Arrhenius method. The thermal aging analysis envelopes the plant service requirements.

Radiation Analysis

The valve actuators are qualified to 2.04×10^8 rads. The bounding 60-year TID is 1.95×10^8 rads. The bounding TID is less than the qualification dose.

Mechanical Cycle Analysis

The valve actuators are qualified for 1,208 mechanical cycles. The cycling during testing envelops the 929 cycles anticipated during 60 years of plant operation.

Conclusion

The Environmental Qualification Program for the Limitorque MOV inside Containment will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.3 Rockbestos/Cerro XLPE 600v/5Kv Cable

The Rockbestos/Cerro XLPE cable is used for power, control, and instrumentation signal applications for both inside and outside Containment applications.

Thermal Analysis

The cable is qualified for 60 years at 87°C. The bounding cable temperature is 73.4°C.

Radiation Analysis

The cable is qualified to 2×10^8 rads. The bounding 60-year TID is 1.95×10^8 rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this Rockbestos/Cerro cable will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.4 Okonite EPR/Neoprene or CSPE 600v Cable

The Okonite EPR/Neoprene cable has a 40-year qualified life. No plans exist to extend the qualified life until a resolution of NRC GSI-168 is finalized. The Environmental Qualification Program for this Okonite EPR/CSPE cable will provide reasonable assurance through

analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.5 Okonite EPR/CSPE 5Kv Cable

The Okonite EPR/CSPE 5Kv cable has a 40-year qualified life. No plans exist to extend the qualified life until a resolution of NRC GSI-168 is finalized. The Environmental Qualification Program for this Okonite EPR/CSPE cable will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.6 Raychem XLPE 300v Instrument Cable

The Raychem XLPE cable is used for low voltage signal applications for both inside and outside Containment applications.

Thermal Analysis

The cable is qualified for 60 years at 73.6°C. The bounding cable service temperature is 71.1°C. The qualification envelopes the bounding conditions.

Radiation Analysis

The cable is qualified to $2x10^8$ rads. The bounding 60-year TID is $1.95x10^8$ rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this Raychem XLPE cable will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.7 Brand-Rex XLPE 300/600v Cable

The Brand-Rex XLPE cable is used for low voltage applications for both inside and outside Containment applications.

Thermal Analysis

The cable is qualified for 60 years at 89.3°C. The bounding cable temperature is 73.4°C. The bounding cable temperature is less than the qualification temperature.

Radiation Analysis

The cable is qualified to $2x10^8$ rads. The bounding 60-year TID is $1.95x10^8$ rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this Brand-Rex XLPE cable will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.8 GE SIS XLPE 600v Cable

The General Electric (GE) XLPE SIS cable is used for low voltage power applications for both inside and outside Containment applications.

Thermal Analysis

The cable is qualified for 60 years at 86.9°C. The bounding cable temperature is 73.4°C. The bounding cable temperature is less than the qualification temperature.

Radiation Analysis

The cable is qualified to $2x10^8$ rads. The bounding 60-year TID is $4.35x10^7$ rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this GE XLPE cable will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.9 Rockbestos Silicon Rubber 600v Cable

The Rockbestos SR cable can be used for low voltage power applications for both inside and outside Containment applications.

Thermal Analysis

The cable is qualified for 60 years at 124.5°C. The bounding cable temperature is 92.8°C. The bounding cable temperature is less than the qualification temperature.

Radiation Analysis

The cable is qualified to $2x10^8$ rads. The bounding 60-year TID is $1.95x10^8$ rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this Rockbestos SR cable will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.10 Conax RTD

The Conax RTD has a 40-year qualified life. No plans exist to extend the qualified life at this time. The Environmental Qualification Program for the Conax RTD will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.11 Weed RTD

The Weed RTDs are used inside and outside Containment to monitor plant process temperatures.

Thermal Analysis

The RTDs are qualified at each specific application for the period of extended operation, except the North Anna Unit 1 wide-range hot leg, and the Surry Units 1 and 2 narrow-range hot leg and cold leg. These applications are considered short-lived and will be replaced prior to 'end-of-life' qualification.

Radiation Analysis

The RTDs are qualified to 3.03×10^8 rads. The bounding 60-year TID is 1.95×10^8 rads. The bounding TID is less than the qualification dose.

Conclusion

The Environmental Qualification Program for the Weed RTDs will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.12 GEMS Level Transmitter

The GEMS Level Transmitters are used inside Containment for level indication applications.

Thermal Analysis

The transmitters are qualified in excess of 60 years at the maximum plant ambient temperature of 40.6°C.

Radiation Analysis

The transmitters are qualified to $2x10^8$ rads. The bounding 60-year TID is $3.51x10^7$ rads. The bounding TID is less than the qualified dose.

Mechanical Cycle Analysis

The bounding 60-year requirement for mechanical cycling is projected to be 182 cycles. The transmitter is qualified for 220 cycles. The bounding number of required cycles is less than the number of qualification cycles.

Conclusion

The Environmental Qualification Program for the GEMS Level Transmitters will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.13 Victoreen Radiation Monitor

The Victoreen Radiation Monitors are used inside Containment for high-range radiation monitoring.

Thermal Analysis

The monitors are qualified for 60 years at 63.9°C. The bounding maximum ambient temperature is 51.7°C. The bounding rad monitor temperature is less than the qualification temperature.

Radiation Analysis

The monitors are qualified to $2.2x10^8$ rads. The bounding 60-year TID is $6.3x10^7$ rads. The bounding TID is less than the qualification dose.

Conclusion

The Environmental Qualification Program for the Victoreen Radiation Monitors will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.14 ITT/Barton Transmitter

The ITT/Barton Transmitters have a 40-year qualified life. The Environmental Qualification Program for the ITT/Barton Transmitters will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.15 NAMCO Limit Switch

The NAMCO Limit Switches are used inside and outside Containment.

Thermal Analysis

The limit switches are qualified in excess of 60 years of plant applications using the maximum service temperature of 37.8°C. The qualified life exceeds the period of extended operation. Applications greater than the maximum service temperature are considered short-lived, and the limit switches will be replaced prior to the 'end-of-life' qualification.

Radiation Analysis

The limit switches are qualified to 2.04×10^8 rads. The bounding 60-year TID is 1.95×10^8 rads. The bounding TID is less than the qualification dose.

Mechanical Cycle Analysis

The limit switches are qualified for 500,000 cycles. There is no bounding limit for these switches.

Conclusion

The Environmental Qualification Program for the NAMCO Limit Switches will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.16 Conax Electrical Penetrations

The Conax Electrical Penetrations are used for instrument, low voltage power, low voltage control, and medium voltage power Containment penetrations. The medium voltage power applications provide the most ohmic heating and consequently the bounding plant application. For conservatism, an ambient temperature of 51.7°C was used to determine the maximum normal operating temperature.

Thermal Analysis

The penetrations used in medium voltage power applications are qualified for 60 years at 69.0 °C. The bounding plant temperature (maximum ambient + ohmic heating) is 61.2°C. The bounding penetration temperature is less than the qualified temperature.

Radiation Analysis

The penetrations are qualified for 1.0×10^8 rads minimum. The bounding 60-year TID for plant applications is 2.435×10^7 rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for the Conax Electrical Penetrations will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.17 Raychem Splices - WCSF-N (type)

The Raychem cable splices are used for low voltage signal, low voltage power, control, and medium voltage power applications for both inside and outside Containment applications.

Thermal Analysis

The cable splice is qualified for 60 years at 96.8°C. The bounding splice temperature is 73.4°C. The bounding splice service temperature is lower than the qualified temperature.

Radiation Analysis

The cable splice is qualified to 2.9×10^8 rads. The bounding 60-year TID is 2.62×10^8 rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this Raychem cable splice will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.18 Raychem NMCK8-L/V Splices

The Raychem cable splices are used for medium voltage power applications for both inside and outside Containment applications.

Thermal Analysis

The cable splice is qualified for 60 years at 81.4°C. The bounding splice temperature is 73.4°C. The bounding splice service temperature is less than the qualification levels.

Radiation Analysis

The cable splice is qualified to 2.9×10^8 rads. The bounding 60-year TID is 2.62×10^8 rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this Raychem cable splice will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the

equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.19 GE Terminal Blocks

General Electric (GE) Terminal Blocks are installed outside Containment and are utilized in low power and control circuits. The bounding service temperature is 50°C.

Thermal Analysis

The terminal blocks are qualified for 60 years at 77.8°C. The bounding service temperature is 50°C. The bounding temperature is less than the qualification temperature.

Radiation Analysis

The terminal blocks are qualified for 2.2×10^8 rads minimum. The bounding 60-year TID for all plant applications is 1.95×10^8 rads. The bounding TID is less than the qualified dose for this terminal block.

Conclusion

The Environmental Qualification Program for the GE Terminal Blocks will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.20 Conax ECSA Type N

The Conax Electrical Conductor Seal Assembly (ECSA) can be used as both an electrical feedthrough and an environmental seal at the equipment to field cable interface on various equipment both inside and outside Containment. The ECSA is used for low voltage signal, low voltage power, and control signal applications.

Thermal Analysis

The ECSA is qualified for 60 years at 88.8°C. The bounding splice temperature is 73.4°C. The bounding service temperature is less than the qualification temperature.

Radiation Analysis

The ECSA is qualified to 2.25×10^8 rads. The bounding 60-year TID is 1.95×10^8 rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this Conax ECSA will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment

qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.21 Conax PL Conductor Seal Assembly

The Conax PL Conductor Seal Assembly has a 40-year qualified life for specific applications. The Environmental Qualification Program for the Conax PL Conductor Seal Assembly will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.22 Rosemount 353C CSA

The Rosemount 353C Conductor Seal Assembly (CSA) can be used as both an electrical feedthrough and an environmental seal at the equipment to field cable interface on Rosemount Transmitters both inside and outside Containment.

Thermal Analysis

The CSA is qualified for 60 years at 47.2°C. The bounding temperature for Rosemount Transmitter locations is 46.1°C. The qualification temperature envelopes the maximum bounding service temperature.

Radiation Analysis

The CSA is qualified to 1.0×10^8 rads. The bounding 60-year TID is 6.3×10^7 rads. The bounding TID for all applications (except one at Surry) are less than the qualified dose.

Conclusion

The Environmental Qualification Program for the Rosemount CSA will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.23 EGS Quick-Disconnect Connector

The EGS Quick-Disconnect Connectors have a 40-year qualified life. The Environmental Qualification Program for the EGS Quick-Disconnect Connector will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.24 EGS Grayboot Connector

The EGS Grayboot Connectors have a 40-year qualified life. The Environmental Qualification Program for the EGS Grayboot Connector will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.25 ASCO Solenoid-Operated Valves

The ASCO Solenoid-Operated Valves (SOV) are both short-lived or have a 40-year qualified life depending on the specific application. The Environmental Qualification Program for the ASCO SOVs will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.26 Valcor Solenoid-Operated Valves

The Valcor SOVs are used inside and outside Containment areas. The SOVs are normally de-energized, and energized once daily for a brief period; consequently, self-heating is not a factor.

Thermal Analysis

The SOVs are qualified for 60 years at 68.6°C. The bounding service temperature is 51.7°C. The bounding temperature is less than the qualification temperature.

Radiation Analysis

The SOVs are qualified for 2.0×10^8 rads. The bounding 60-year TID for plant applications is 1.95×10^8 rads. The bounding TID is less than the qualified dose for this SOV.

Mechanical Cycle Analysis

The SOVs are qualified for 45,000 cycles. The bounding requirement for 60 years are 42,100 cycles. The bounding cycle requirement is less than the qualification value.

Conclusion

The Environmental Qualification Program for the Valcor SOVs will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.27 Target Rock Solenoid-Operated Valves

The Target Rock SOVs currently have a 40-year qualified life. The Environmental Qualification Program for these Target Rock SOVs will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.28 Comsip-Delphi Hydrogen Analyzer

The Comsip-Delphi Hydrogen Analyzer system is located outside Containment in the Auxiliary Building. Some components will have direct exposure to Containment atmosphere. The system includes pump assemblies and heat tracing.

Thermal Analysis

The analyzer is qualified for 60 years for the applicable service environments. The qualification includes periodic maintenance and replacement of short-lived components prior to the 'end-of-life', in accordance with the EQ Program.

Radiation Analysis

The analyzer control panel and air sample pumps are qualified for 1.0×10^6 rads. The bounding 60-year TID 2.51×10^5 rads. The bounding TID is less than the qualified dose.

The Thermon heat trace system is located in various zones within the Auxiliary Building. Each application has been reviewed and the bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for the Comsip-Delphi Hydrogen Analyzer will provide reasonable assurance through analysis, testing, refurbishment, or replacement that

the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.29 ITE Imperial Switchgear & Transformers

The ITE 480V switchgear and associated transformers are used to supply 480V emergency power to safety-related electrical equipment. The switchgear is located in the Motor Control Center general area (elevation 280') of the Auxiliary Building, where radiation is the only harsh environmental parameter.

Thermal Analysis

The effect of aging due to normal operating temperature without the effect of significant overstress condition is considered negligible. This has been recognized by 10 CFR 50.49.

Radiation Analysis

The switchgear dose due to 60 years' life plus a 6-month LOCA is 6.03×10^4 rads TID. The switchgear is qualified for a minimum of 1.0×10^5 rads. The maximum projected post accident dose plus the normal 60-year operational dose is less than the qualified dose with substantial margin.

Mechanical Cycle Analysis

The circuit breakers in the switchgear are qualified for 28,000 mechanical cycles. The cycling during testing envelops the 1,480 cycles anticipated during 60 years of plant operation.

Conclusion

The Environmental Qualification Program for the ITE switchgear and associated transformers will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.30 Secondary Protection Breaker Panel

The secondary protection breaker panel has a 40-year qualified life. The Environmental Qualification Program for the secondary protection breaker panel will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

Text enclosed in border indicates information specific to **NORTH ANNA.**

4.4.31 Westinghouse HHSI Motor

The Westinghouse High Head Safety Injection/Charging pump motors are located outside Containment in the Auxiliary Building. The motors are rated for continuous duty; however, they are de-energized approximately 33% of the time. For conservatism, the QDR used a constant ambient temperature of 48.9°C.

Thermal Analysis

The pump motors are qualified in excess of 60 years at the operating temperature of 99°C (48.9°C ambient plus 50.1°C heat rise). The standby temperature (non-energized) is 48.9°C.

Radiation Analysis

The pump motors are qualified for 5.12×10^7 rads gamma. The bounding 60-year TID for the Auxiliary Buildings is 1.22×10^7 rads. The bounding condition is less than the qualified level with substantial margin.

Mechanical Cycle Analysis

The total normal operating cycles for one pump motor is 241 cycles. The motor is qualified for 2,000 cycles. The bounding condition for mechanical cycles is enveloped by the qualification.

Conclusion

The Environmental Qualification Program for the Westinghouse HHSI pump motor will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.32 GE OSRS Motor

The General Electric (GE) Outside Recirculation Spray (OSRS) motors are located outside Containment in the Safeguards Area. The motors are rated for continuous duty; however, they are normally de-energized. For conservatism, an ambient temperature of 48.9°C plus 15°C motor heater temp rise for a total temperature of 63.9°C was used to define the maximum normal operating temperature.

Thermal Analysis

The motors are qualified in excess of 60 years at the operating temperature (ambient plus heat rise) of 119 °C and the standby temperature of 63.9°C.

Text enclosed in border indicates information specific to **NORTH ANNA.**

Radiation Analysis

The pump motors are qualified for 2.0×10^8 rads. The bounding 60-year TID is 7.0×10^6 rads gamma. The bounding TID is less than the qualified TID.

Conclusion

The Environmental Qualification Program for the GE OSRS pump motors will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.33 Westinghouse LHSI Motor

The Westinghouse Low Head Safety Injection (LHSI) motors are located outside Containment in the Safeguards Area. The motors are rated for continuous duty; however, they are normally de-energized. For conservatism, an ambient temperature of 48.9°C plus 15°C motor heater temp rise for a total temperature of 63.9°C was used to define the maximum normal ambient temperature.

The motors have an 80°C stator temperature rise while operational for a total operating temperature of 128.9°C.

Thermal Analysis

The motors are qualified in excess of 60 years for the applicable operating time and operating temperature (ambient plus heat rise) of 128.9°C, and for the applicable time and standby temperature of 63.9°C.

Radiation Analysis

The motors are qualified to 2.0×10^8 rads. The bounding 60-year TID is 7.0×10^6 rads. This envelops the required TID of 7.0×10^6 rads.

Conclusion

The Environmental Qualification Program for the Westinghouse LHSI motors will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.34 GE ISRS Motor

The GE Inside Recirculation Spray (ISRS) motors are located inside Containment. The motors are rated for continuous duty; however, they are normally de-energized.

For conservatism, an ambient temperature of 40.6°C plus 15°C motor heater temp rise for a total temperature of 55.6°C was used to define the maximum normal ambient temperature. The motors have an 80°C stator temperature rise for a total operating temperature of 120.6°C (40.6°C ambient plus 80°C heat rise).

Thermal Analysis

The motors are qualified in excess of 60 years at the operating temperature (ambient plus heat rise) of 120.6°C, and the standby (ambient temperatures stated above).

Radiation Analysis

The GE ISRS motors are qualified to $2x10^8$ rads. The bounding 60-year TID for ISRS motors is $3.5x10^7$ rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for the GE ISRS motors will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment

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qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.35 Marathon (Reliance) Electric Motor

The Marathon Electric radiation monitoring pump motors are used outside Containment in the Quench Spray Pump Area and the Safeguards Area. The original Marathon motors were sent to Reliance and all the non-metallic components were replaced. Class H type RH insulation components were utilized in the rework of these motors.

For conservatism, an ambient temperature of 48.9°C was used to determine the maximum normal operating temperature. The maximum temperature rise of the motor is 50°C. The operating temperature used in the thermal aging analysis is 108.9°C (an ambient temperature of 48.9°C and a temperature rise of 60°C).

Thermal Analysis

The pump motors are qualified for 60 years at 168°C. The bounding temperature for plant applications is 109°C. The

Radiation Analysis

The pump motors are qualified to $1x10^7$ rads. The bounding 60-year TID for plant applications is $7x10^6$ rads. The bounding TID is less than the qualified dose for this motor.

Conclusion

The Environmental Qualification Program for the Marathon Electric pump motors will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

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4.4.36 Franklin Electric Motor

The Franklin Electric radiation monitoring pump motors are used outside Containment in the Quench Spray Pump Area and the Main Steam Valve House Area. The motors have Class H insulation systems and are rated for continuous duty.

For conservatism, an ambient temperature of 48.9°C will be used to determine the maximum normal operating temperature. The maximum temperature rise of the motor is 100°C; therefore, the maximum operating temperature is 148.9°C.

Thermal Analysis

The pump motors are qualified in excess of 60 years at the operating temperature of 148.9 °C, and for the standby temperature of 48.9°C.

Radiation Analysis

The pump motors are qualified to $7x10^6$ rads. The bounding 60-year TID for plant applications is $5.4x10^6$ rads. The bounding TID is less than the qualified dose for this motor.

Conclusion

The Environmental Qualification Program for the Franklin Electric pump motors will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

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4.4.37 BIW Cable XLPE 300 Volt

The 300-volt XLPE Boston Insulated Wire (BIW) instrument cable is used to transmit various instrumentation and radiation monitoring signals for control and indication purposes. The cables are expected to operate at no more than 100 volts.

Thermal Analysis

The cable is qualified in excess of 60 years at 55°C. The bounding cable service temperature is 55°C.

Radiation Analysis

The wire is qualified to $1x10^8$ rads. The bounding 60-year TID is $8.53x10^7$ rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this BIW instrument cable will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.38 Rockbestos/Cerro SR 600v Cable

The Rockbestos/Cerro cable is used for power, control, and instrumentation signal applications for both inside and outside Containment applications.

Thermal Analysis

The cable is qualified for 60 years at 126.7°C. The bounding cable temperature is 73.4°C.

Radiation Analysis

The cable is qualified to $2x10^8$ rads. The bounding 60-year TID is $1.95x10^8$ rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this Rockbestos/Cerro cable will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

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4.4.39 General Cable EPR 600v Cable

The General EPR 600v cable is used for low voltage power applications for both inside and outside Containment applications.

Thermal Analysis

The cable is qualified for 60 years at 87°C. The bounding cable temperature is 73.4°C.

Radiation Analysis

The cable is qualified to $2x10^8$ rads. The bounding 60-year TID is $8.53x10^7$ rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this General EPR cable will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.40 General Cable EPR 5Kv Cable

The General EPR 5Kv cable is used for medium voltage power applications for both inside and outside Containment applications.

Thermal Analysis

The cable is qualified for 60 years at 87°C. The bounding cable temperature is 73.4°C. The qualification envelops the bounding conditions.

Radiation Analysis

The cable is qualified to $2x10^8$ rads. The bounding 60-year TID is $7x10^6$ rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this General EPR cable will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

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4.4.41 Okonite FMR-XLPE/CSPE 600v Cable

The Okonite FMR-XLPE cables supply power intermittently to 120/230 volt heat trace systems inside and outside Containment.

Thermal Analysis

The cable is qualified for 60 years at 87.0°C. The bounding cable temperature is 73.4°C. The qualification envelopes the bounding conditions.

Radiation Analysis

The cable is qualified for $2x10^8$ rads. The bounding 60-year TID is $7.1x10^7$ rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this Okonite FMR-XLPE cable will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.42 Anaconda/Ericcson EPR Instrument Cable 600/300 VAC

The Anaconda EPR cable is used for instrumentation circuits for both inside and outside Containment applications.

Thermal Analysis

The cable is qualified for 60 years at 68°C. The bounding cable service temperature is 48.9°C. The qualification envelopes the bounding condition

Radiation Analysis

The cable is qualified to $2x10^8$ rads. The bounding 60-year TID is $6.3x10^7$ rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for this Anaconda EPR cable will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

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4.4.43 Inadequate Core Cooling System

The Inadequate Core Cooling System (ICCS) has components located both inside and outside Containment. The ICCS is not a plant system, but a grouping of components in a QDR. Its components have reactor coolant (RC) and emergency response capability (ERC) mark numbers. Inside Containment equipment includes stainless steel mineral insulated thermocouple cable and connectors. Outside Containment equipment includes Kapton insulated thermocouple wire, terminal blocks, multiplexer unit, and fiber optic cable.

Thermal Analysis

The system is qualified in excess of 60 years for the applicable service environments with the exception of two subcomponents of the multiplexer, a fan assembly and filter assembly, which are short-lived. These items are replaced prior to the end of their respective qualified lives in accordance with the EQ Maintenance Program. The system is considered qualified for thermal aging beyond the period of extended operation.

Radiation Analysis

The system located inside Containment is qualified to 2.2×10^8 rads. The bounding 60-year TID is 6.3×10^7 rads. The bounding TID is less than the qualified dose.

The system located outside Containment is qualified to a minimum of 2×10^5 rads. The bounding 60-year TID is 3.9×10^4 rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for the ICCS will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.44 Westinghouse (Minco) RTD

The Westinghouse Resistance Temperature Detectors (RTDs) are used inside Containment to monitor reactor coolant temperature in the capillary tube reference legs and are part of the RVLIS system. The age sensitive organic materials are found in the lead wires and cable interface, which are located 24 feet away from the process temperatures. This distance insulates and protects the organics from the elevated temperatures.

Thermal Analysis

The RTDs are qualified in excess of 60 years for all plant applications using the maximum service temperature of 43.3°C.

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Radiation Analysis

The RTDs are qualified to 1.6×10^8 rads. The bounding 60-year TID is 3.38×10^7 rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for the Westinghouse RTDs will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.45 Reliance Fan Motor

The Reliance fan motors are located outside Containment areas in the Safeguards Area. The motors have Class H insulation systems and are rated for continuous duty; however, the motors are normally de-energized. For conservatism, an ambient temperature of 48.9°C was used to determine the maximum normal temperature.

Thermal Analysis

The Reliance fan motors are qualified in excess of 60 years at 50°C. The bounding de-energized temperature is 48.9°C. The thermal qualification envelopes the requirements for the period of extended operation.

Radiation Analysis

The Reliance fan is qualified for 2.04×10^8 rads. The bounding 60-year TID for plant applications is 7×10^6 rads. The bounding TID is less than the qualified dose for this motor.

Conclusion

The Environmental Qualification Program for the Reliance fan motors will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

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4.4.46 Conax Thermocouple Penetrations ICCM

The Conax Thermocouple Penetrations are used for the Inadequate Core Cooling Monitor system to allow Containment penetrations of metal sheathed thermocouples. The maximum normal operating temperature is 40.6°C.

Thermal Analysis

The Penetrations are qualified in excess of 60 years at the worse case operating temperature of 40.6 °C. The qualified thermal life envelopes the requirements for the period of extended operation.

Radiation Analysis

The Penetrations are qualified for 1.9×10^8 rads. The bounding 60-year TID for plant applications is 6.84×10^6 rads. The bounding TID is less than the qualified dose for this equipment.

Conclusion

The Environmental Qualification Program for the Conax ICCM system will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.47 Okonite Splice (Tape)

The Okonite (tape) cable splices are used for low voltage signal, low voltage power, control, and medium voltage power applications for both inside and outside Containment applications.

Thermal Analysis

The splice tape is qualified for 60 years at 87.0°C. The bounding splice temperature is 73.4°C. The bounding plant service temperature is less than the qualification level.

Radiation Analysis

The splice tape is qualified to 2.0×10^8 rads. The bounding 60-year TID is 1.745×10^8 rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for the Okonite (tape) cable splice will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

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4.4.48 Connectron Terminal Blocks

The Connectron terminal blocks are used as termination interfaces with penetrations both inside and outside Containment. The Connectron terminal blocks inside Containment are used in control circuits but are not used on instrumentation circuits covered by 10CFR50.49. Instead of Connectron terminal blocks, Raychem splices terminate instrumentation circuits inside Containment. Connectron terminal blocks terminate both instrumentation and control circuits outside Containment.

Thermal Analysis

The terminal blocks are qualified for 60 years at 77.8°C. The bounding service temperature is 50°C. The bounding temperature is less than the qualification temperature.

Radiation Analysis

The terminal block is qualified for 2.5×10^7 rads. The bounding 60-year TID is 4×10^4 rads. The bounding TID is less than the qualified dose for this terminal block.

Conclusion

The Environmental Qualification Program for the Connectron terminal blocks will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

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4.4.49 Marathon Terminal Blocks

Marathon terminal blocks are installed outside Containment and are utilized in low power and control circuits. The bounding service temperature is 50°C.

Thermal Analysis

The terminal blocks are qualified for 60 years at 50°C using the Arrhenius methodology. The bounding service temperature is 50°C. The qualification equals the bounding service requirements.

Radiation Analysis

The terminal blocks are qualified for 2.04×10^8 rads minimum. The bounding 60-year TID for all plant applications is 1.95×10^8 rads. The bounding TID is less than the qualified dose for this terminal block.

Conclusion

The Environmental Qualification Program for the Marathon terminal blocks will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

4.4.50 Rockwell Hydrogen Recombiner

The Rockwell Hydrogen Recombiner system is located outside Containment in isolated cubicles; some components have direct exposure to Containment atmosphere.

Thermal Analysis

The system is qualified for greater than 60 years for the applicable service environments of 150°C energized, and 49°C de-energized. The bounding required thermal life is less than the qualified life.

Radiation Analysis

The system is qualified to a minimum of 1.8×10^6 rads. The bounding 60-year TID is 1×10^6 rads. The bounding TID is less than the qualified dose.

Conclusion

The Environmental Qualification Program for the Rockwell Hydrogen Recombiner system will provide reasonable assurance through analysis, testing, refurbishment, or replacement that the equipment qualification will be adequately managed for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(iii).

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4.5 Concrete Containment Tendon Prestress

The Containments utilize a reinforced concrete design without the use of prestressed tendons. Therefore, loss of prestress is not applicable for the Containments.

4.6 Containment Liner Plate, Metal Containments, and Penetrations Fatigue Analysis

4.6.1 Containment Liner Plate

The accumulated fatigue effects of all applicable liner loading conditions are evaluated in accordance with Paragraph N-415 of the ASME Boiler and Pressure Vessel Code, Section III, 1968. The evaluation was based on 1,000 cycles of operating pressure variations, 4,000 cycles of operating temperature variations, and 20 design earthquake cycles.

The operating pressure variations are anticipated to be less than 100 and temperature variations are anticipated to be 400 for forty years of operation. Extrapolating these values for sixty years of operation results in 150 pressure variations and 600 temperature variations.

The number of design cycles was conservatively increased to 1,500 cycles of operating pressure variations, 6,000 cycles of operating temperature variation, and 30 design earthquake cycles by using a multiplication factor of 1.5, to account for the period of extended operation. Effects of the Containment Type A pressure tests on fatigue of the Containment liner plate have been included in the evaluation. A review has determined that the increase in the expected number of cycles due to the period of extended operation is acceptable. Therefore, the Containment liner is adequate for a 60-year operating period as currently designed. The analyses associated with the Containment liner plate have been revised and projected to remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(ii).

4.6.2 Containment Penetrations

There are no TLAAs for Containment penetrations. The penetrations are designed for a one-time load due to the collapse of the connecting pipe. The normal operating loads are much smaller than the collapse loads of the pipe, including both restrained piping system thermal expansion loads, as well as local thermal expansion loads. The stresses due to the normal operating conditions are within the endurance limit. Therefore, the penetrations will not fail for a large number of operating cycles. No time-limited aging analysis has been performed for the penetrations.

4.6.3 Metal Containments

Each unit has a concrete containment with a metal liner. Therefore, the topic of metal containment fatigue analysis is not applicable to the station.

4.7 Other Plant-Specific Time-Limited Aging Analyses

4.7.1 Crane Load Cycle Limit

The following are cranes included in license renewal scope and in NUREG-0612 (Reference 24):

- Containment polar cranes
- Containment annulus monorails
- Fuel handling bridge crane
- Spent fuel crane
- Auxiliary Building monorails

NUREG-0612 requires that the design of heavy load overhead handling systems meet the intent of Crane Manufacturers Association of America, Inc. (CMAA) Specification #70. The crane load cycle provided in CMAA-70 has been identified as a TLAA, with the most limiting number of loading cycles being 100,000.

The most frequently used cranes are spent fuel cranes. Each of these cranes will experience approximately 25,000 cycles of half-load lifts to support the refueling of both units over a 60-year period. In addition, the crane is used to load new fuel into the fuel pool, to perform the various rearrangements required by operations support, to accommodate inspections by fuel vendors, and to load spent fuel casks. In such service, the crane is conservatively expected to make a total of 50,000 half-load lifts in a 60-year period.

Since the number of operating load cycles for the cranes will be fewer than the design cycles, the crane design will remain valid for the period of extended operation, in accordance with the requirements of 10 CFR 54.21(c)(1)(i).

4.7.2 Reactor Coolant Pump Flywheel

During normal operation, the reactor coolant pump flywheel possesses sufficient kinetic energy to potentially produce high-energy missiles in the unlikely event of failure. Conditions that may result in overspeed of the reactor coolant pump increase both the potential for failure and the increased kinetic energy. The aging effect of concern is fatigue crack initiation in the flywheel bore keyway. An evaluation of a failure over the period of extended operation has been performed. It demonstrates that the flywheel design has a high structural reliability with a very high flaw tolerance and negligible flaw crack growth over a 60-year service life (Reference 25).

The analysis associated with the structural integrity of the reactor coolant pump flywheel has been evaluated and determined to remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.7.3 Leak-Before-Break

Westinghouse (via the Westinghouse Owners Group) tested and analyzed crack growth with the goal of eliminating reactor coolant system primary loop pipe breaks from plant design bases. The objective of the investigation has been to examine mechanistically, under realistic, yet conservative assumptions - whether a postulated crack causing a leak, will grow to become unstable and lead to a full circumferential break when subjected to the worst possible combinations of plant loading.

The detailed evaluation showed that double-ended breaks of reactor coolant pipes are not credible and, as a result, large LOCA loads on primary system components will not occur. The overall conclusion of the evaluation was, that, with the worst combination of plant loading, including the effects of safe shutdown earthquake, the crack will not propagate around the circumference and cause a guillotine break. The plant has leakage detection systems that can identify a crack with margin, and provide adequate warning before the crack can grow.

This concept of eliminating piping breaks in reactor coolant system primary loop piping has been termed “leak-before-break” (LBB). There are two issues associated with LBB – crack growth and thermal aging affecting the material property.

Westinghouse performed the LBB analysis in 1986 for the primary loop piping. TLAAs related to the LBB were identified: thermal aging of cast austenitic stainless steel (CASS) and its consequence on fatigue crack growth.

Fatigue crack growth for LBB is identified as a TLAA. The original fatigue crack growth analysis has been performed for the design transient cycles and with consideration of thermal aging effect for 40 years. To maintain the LBB design basis for the plant, the thermal aging effect for 60 years has been recalculated. The change in the material property was found to be insignificant. Since the design transients and cycles are applicable to 60 years of operation, the LBB analysis is projected to be valid for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii).

4.7.4 Spent Fuel Pool Liner

The spent fuel pool liner located in the Fuel Building is needed to prevent a leak to the environment. A design calculation has been identified which documents that the spent fuel

pool design meets the general industry criteria. The calculation includes a fatigue analysis to add a further degree of confidence.

The normal thermal cycles occur at each refueling, resulting in 80 cycles for both units in 60 years. Total number of thermal cycles is expected to be 90, which includes normal, upset, emergency, and faulted conditions.

The calculations show that the allowable thermal cycles for spent fuel pool liner for the most severe thermal condition, which includes a loss of cooling, is 100.

Therefore, the existing calculations remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.7.5 Piping Subsurface Indications

Calculations have been identified that addressed piping subsurface indications detected by inspections, performed in accordance with ASME Section XI. Section XI provides the acceptance criteria for various flaw orientations, locations, and sizes. The calculations determined the number of thermal cycles required for the flaws to reach an unacceptable size.

Required cycles for the flaws to reach an unacceptable size are 20,700 or higher.

Since it is expected that the number of the cycles experienced by the piping will not exceed these values for sixty years of operation, the analyses have been determined to remain valid for the period of extended operation, in accordance with 10 CFR 54.21(c)(1)(i).

4.7.6 Reactor Coolant Pump - Code Case N-481

Periodic volumetric inspections of the welds of the primary loop pump casings of commercial nuclear power plants are required by Section XI of the ASME Boiler and Pressure Vessel Code. These inspections require a large amount of time and resources to complete. They also result in large radiation exposure (man-rem). Since the pump casings are inspected prior to being placed in service, and no significant mechanisms exist for crack initiation and propagation, it has been concluded that the inservice volumetric inspection can be replaced with an acceptable alternate inspection. In recognition of this, ASME Code Case N-481, Alternative Examination Requirements for Cast Austenitic Pump Casings, provides an alternative to the volumetric inspection requirement. The code case allows the replacement of volumetric examinations of primary loop pump casings with fracture mechanics-based integrity evaluations (Item (d) of the code case) supplemented by specific visual examinations.

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Westinghouse performed the primary loop piping pump casings integrity analyses to the ASME Code Case N-481 requirements. It was concluded that the primary loop pump casings are in compliance with Item (d) of ASME Code Case N-481.

TLAAs related to Code Case N-481 have been identified: thermal aging of cast austenitic stainless steel (CASS) and its consequence on fatigue crack growth. Comparisons of pump casing loads with the screening loads have been made. The stability of the flaws postulated in the primary loop pump casings has been established by evaluating the necessary material properties against the saturated (fully aged) fracture toughness values. Thus, Code Case N-481 is satisfied for the period of extended operation in accordance with the requirements of 10 CFR 54.21(c)(1)(ii).

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APPENDIX A

UFSAR SUPPLEMENT

APPENDIX A
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Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences.

A listing of the abbreviations used in this appendix is provided in Section 1.4.1.

A1.0 INTRODUCTION

The application for a renewed operating license is required by 10 CFR 54.21(d) to include a UFSAR Supplement. This appendix provides that supplement. Section 2.0 of this appendix contains a summarized description of the programs and activities for managing the effects of aging. The evaluation of time-limited aging analyses (TLAAs) for the period of extended operation is summarized in Section 3.0 of this appendix. Section 4.0 of this appendix contains a summarized description of the programs and activities that support the TLAAs.

A2.0 PROGRAMS AND ACTIVITIES THAT MANAGE THE EFFECTS OF AGING

This section provides summaries of the programs and activities credited for managing the effects of aging. Each aging management program or activity accomplishes one or more of the four functions, as listed in the Standard Review Plan for License Renewal (Reference 1): Prevention, Mitigation, Condition Monitoring, and Performance Monitoring.

The Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Section A.2 of the Standard Review Plan for License Renewal. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls; and is applicable to the safety-related and non-safety-related structures, systems, and components that are within the scope of license renewal.

A2.1 New Aging Management Activities

A2.1.1 Buried Piping and Valve Inspection Activities

Prior to the period of extended operation, the integrity of buried piping and valves will be confirmed due to the existence of aging effects. The Buried Piping and Valve Inspection Activities will include a one-time inspection of representative samples of piping and valves for different combinations of buried material and burial condition. Visual inspections will be used to detect cracking of protective coatings and loss of material from protective coatings or the substrate material.

The inspection will be completed prior to the expiration of the original 40-year operating license and will include a representative valves and sample length (i.e., several feet) of piping for each combination of material and burial condition.

An engineering evaluation for the results of the buried piping and valves inspections will be performed to determine future actions. Corrective actions for conditions that are adverse to quality are performed in accordance with the corrective action system. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.1.2 Infrequently Accessed Area Inspection Activities

The purpose of the Infrequently Accessed Area Inspection Activities is to provide reasonable assurance that equipment and components within the scope of License Renewal, which are not readily accessible, will continue to fulfill their intended functions during the period of extended operation. A one-time inspection will be performed prior to the end of the current license period to assess the aging of components and structures located in areas not routinely accessed due to high-radiation, high-temperature, confined spaces, location behind security or missile barriers, or normally flooded. The external condition of structures, supports, piping, and equipment will be determined by visual inspection. These inspections would detect the aging effect of loss of material. Inspection results will be documented for evaluation and retention. Engineering evaluation assesses the severity of the visual inspection results and determines the extent of required actions or future inspections. Corrective actions for conditions that are adverse to quality are performed in accordance with the corrective action system. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.1.3 Tank Inspection Activities

The purpose of the Tank Inspection Activities is to perform inspections of above ground and underground tanks to provide reasonable assurance that the tanks will perform their intended function through the period of extended operation.

A one-time inspection will be performed for specified tanks that are within the scope of license renewal and could experience aging effects. The aging effect of concern for tanks is loss of material. A representative sample of tanks will be designated for the one-time inspections in order to assess the condition of tanks that require aging management. The choice of representative tanks to be inspected is dependent on the material of construction for the tank, its contents, the foundation upon which the tank is based, and the type of coating.

Visual inspections of internal and external surfaces will be performed. Volumetric examinations will be performed to determine the extent of wall thinning on tanks that are founded on soil or buried. Indications of degradation will be referred for evaluation by a materials engineer. The engineering evaluation may determine that the observed condition is acceptable or requires repair; or, in the case of degraded coatings, may direct removal of the coating, non-destructive examination of the substrate material, and replacement of the coating. Re-inspections will be dependent upon the observed surface condition, and the results of this engineering evaluation. Corrective actions for conditions that are adverse to quality are performed in accordance with the corrective action system. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2 Existing Aging Management Activities

A2.2.1 Augmented Inspection Activities

The purpose of the Augmented Inspection Activities is to perform examinations of selected components and supports in accordance with requirements identified in the Technical Specifications, UFSAR, license commitments, industry operating experience, and good practices for the station. Augmented inspections are outside the required scope of ASME Section XI. The scope of Augmented Inspection Activities to be performed during each refueling outage is identified by Engineering in accordance with controlled procedures.

Component conditions are monitored to detect degradation due to loss of material and cracking. Inspections include visual testing, surface examinations, and volumetric examinations. The extent of each component inspection is defined within the Augmented Inspection Activities program description. The acceptance standards for non-destructive examinations for the Augmented Inspection Activities are consistent with guidance provided in ASME Section XI or are provided within applicable examination procedures. Evidence of loss of material or cracking requires engineering evaluation for determination of corrective action. Occurrence of significant degradation that is adverse to quality will be entered into the Corrective Action System. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.2 Battery Rack Inspections

The purpose of the Battery Rack Inspections is to provide reasonable assurance of the integrity of the supports for various station batteries. Loss of material due to corrosion is the aging effect. Periodic checks of the rack integrity are performed, coincident with periodic battery inspections, to determine the physical condition of the battery support racks. The condition and mechanical integrity of the battery support racks are visually inspected to provide reasonable assurance that their function to adequately support the batteries is maintained. Visual inspections are adequate to identify degradation of the physical condition of the support racks. These inspections check for corrosion of the support rack structural members.

Any observed deterioration of the material condition of the racks will be addressed by prompt repair or an evaluation to determine the appropriate corrective action. If any material condition deterioration is sufficiently extensive to interfere with integrity of the racks, the Corrective Action System will determine the cause and appropriate action to repair and prevent recurrence of the degradation. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.3 Boric Acid Corrosion Surveillance

Leakage from borated systems inside Containment creates the potential for degradation of components. Inspections are performed to provide reasonable assurance that borated water leakage does not lead to undetected loss of material from the reactor coolant pressure boundary and surrounding components. Carbon steel is particularly susceptible, but copper also can be damaged.

In Generic Letter 88-05 (Reference 2), the NRC identified concerns with boric acid corrosion of carbon-steel reactor pressure boundary components inside Containment. In response to this generic letter, activities were developed to examine primary coolant components for evidence of borated water leakage that could degrade the external surfaces of nearby structures or components, and to implement corrective actions to address coolant leakage.

Primary coolant systems inside Containment are examined for evidence of borated water leakage. An overall visual inspection of coolant system piping is performed, with particular interest in potential leakage locations. Insulated portions of the coolant systems are examined for signs of borated water leakage through the insulation by examining accessible joints and exposed surfaces of piping and equipment. Vertical components are examined at the lowest elevation. Components and connections that are not accessible are examined by looking for borated water leakage on the surrounding area of the floor or adjacent equipment and insulation. The inspection scope includes connections to the reactor coolant system from the normal coolant letdown and makeup piping, and from the emergency core cooling systems. Components that are in the vicinity of borated water leakage are also examined for damage resulting from the leakage.

The acceptance criterion for visual inspections is the absence of detectable leakage or boric acid residue. Whenever evidence exists of borated water leakage, a visual examination is required, and an engineering evaluation is performed to determine whether degradation of the leaking component or nearby affected components has occurred; and whether the observed condition is acceptable without repair. Occurrence of significant degradation that is adverse to quality is entered into the Corrective Action System. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.4 Chemistry Control Program for Primary Systems

The purpose of the Chemistry Control Program for Primary Systems is to provide reasonable assurance that water quality is compatible with the materials of construction in the plant systems and equipment in order to minimize the loss of material and cracking. The Chemistry Control Program for Primary Systems creates an environment in which material degradation is minimized, therefore, maintaining material integrity and reducing the amount of corrosion product that could accumulate and interfere with equipment operation or heat transfer.

Chemistry sampling is performed and the results are monitored and trended by maintaining logs of all measured parameters. Acceptability of the measurements is determined by comparison with the limits established in the Chemistry Control Program for Primary Systems. Acceptance criteria for the measured primary chemistry parameters are listed in the Chemistry Control Program for Primary Systems. The acceptance criteria reflect EPRI guidelines for parameters that have been shown to contribute to component degradation. Adherence to the guidelines minimizes the aging effects of loss of material and cracking.

Action levels are established to initiate corrective action when the established limits are approached or exceeded. Depending on the magnitude of the out-of-limit condition, plant shutdown may be performed to minimize aging effects while plant actions are being taken. Corrective actions for conditions that are adverse to quality are performed in accordance with the corrective action system. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.5 Chemistry Control Program for Secondary Systems

The purpose of the Chemistry Control Program for Secondary Systems is to provide reasonable assurance that water quality is compatible with the materials of construction in the plant systems and equipment in order to minimize the loss of material and cracking. The Chemistry Control Program for Secondary Systems creates an environment in which material degradation is minimized, therefore, maintaining material integrity and reducing the amount of corrosion product that could accumulate and interfere with equipment operation or heat transfer.

Chemistry results are monitored and trended by maintaining logs of all measured parameters. Acceptability of the measurements is determined by comparison with limits established by the Chemistry Control Program for Secondary Systems. Acceptance criteria for the measured secondary chemistry parameters are listed in the Chemistry Control Program for Secondary Systems. The acceptance criteria reflect EPRI guidelines for parameters that have been shown to contribute to component degradation. Adherence to the guidelines minimizes the aging effects of loss of material and cracking.

Action levels are established to initiate corrective action when the established limits are exceeded. Depending on the magnitude of the out-of-limit condition, power is reduced or the plant is shut down to minimize aging effects while plant actions are being taken. Corrective actions for conditions that are adverse to quality are performed in accordance with the corrective action system. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.6 Civil Engineering Structural Inspection

The maintenance rule, 10 CFR 50.65, requires licensees to monitor the condition of structures against established goals. During the period of extended operation, the provisions of the Maintenance Rule Program will be utilized to provide reasonable assurance the continuing capability of civil engineering structures to fulfill their intended functions. Structural monitoring inspections are visual inspections that are performed to assess the overall physical condition of the structure. Inspections are performed by trained inspectors and include representative samples of both the interior and exterior surfaces of structures. Documentation of inspection results includes a general description of observed conditions, location and size of anomalies, and the noted effects of environmental conditions.

A visual indication of: 1) loss of material for concrete and structural steel, 2) significant cracking for concrete and masonry walls, and 3) loss of material or loss of form for soil each requires an engineering evaluation.

Inspections of masonry walls are included in this program. The inspections check for cracks of joints and missing or broken blocks.

The engineering evaluation of inspection results determines whether analysis, repair, or additional inspections or testing is required to provide reasonable assurance that structures will continue to fulfill their intended functions. Corrective actions for conditions that are adverse to quality are performed in accordance with the corrective action system. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.7 Fire Protection Program

Regulatory requirements associated with fire protection systems and implementation plans are provided in 10 CFR 50.48 and 10 CFR 50, Appendix R. The Fire Protection Plan includes applicable National Fire Protection Association commitments and maintains compliance with NRC Branch Technical Position (BTP) 9.5-1 from the Standard Review Plan (Reference 3). Aging management concerns related to fire protection involve visual inspections of fire protection equipment and barriers, including doors, walls, floors, ceilings, penetration seals, fire-retardant coatings, fire dampers, cable-tray covers, and fire stops.

Applicable aging effects that are found by visual examination include loss of material, separation and cracking/delamination, heat transfer degradation, and change in material properties. Aging effects on piping systems (including valve bodies and pump casings) that are dry or that carry water are evaluated in the same manner as for any other mechanical system. Testing of the fire protection pumps provides indication of heat transfer degradation, and inspections of the pumps provide indication of loss of material. Verification of piping integrity to maintain a pressure boundary for the fire protection system, and the availability of water are addressed by routine plant walkdowns and by pressure/flow tests that are conducted periodically. Visual inspections are performed periodically for hose stations, fire wrap, hydrants, and sprinklers.

Fire protection equipment is examined for indications of visible damage. Acceptable sizes for breaks, holes, cracks, gaps, or clearances in fire barriers, and acceptable amounts of sealant in penetrations are established in the inspection procedures. Any questions regarding the ability of the barrier to fulfill its fire protection function are addressed by engineering evaluation. Acceptance criteria for fire protection equipment performance tests (i.e., flow and pressure tests) are provided in the appropriate test procedures. Occurrence of significant degradation that is adverse to quality is entered into the Corrective Action System. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.8 Fuel Oil Chemistry

The Fuel Oil Chemistry program manages the loss of material by requiring that oil quality is compatible with the materials of construction in plant systems and equipment. Poor fuel oil quality could lead either to degradation of storage tanks or accumulations of particulates or biological growth in the tanks. The purpose of the Fuel Oil Chemistry program is to minimize the existence of contaminants such as water, sediment, and bacteria which could degrade fuel oil quality and damage the fuel oil system and interfere with the operation of safety-related equipment.

The Fuel Oil Chemistry program is an aging effects mitigation activity which does not directly detect aging effects. The Fuel Oil Chemistry guidelines address the parameters to be monitored and the acceptance limit for each parameter. The acceptance criteria reflect ASTM guidelines for parameters that have been shown to contribute to component degradation. Adherence to the guidelines mitigates the aging effect of loss of material. Parameters analyzed and found to be outside established limits will be reported to Engineering, an evaluation will be performed, and appropriate corrective actions will be taken. Occurrence of significant deviations that are adverse to quality is entered into the Corrective Action System. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.9 General Condition Monitoring Activities

General Condition Monitoring Activities are performed for the assessment and management of aging for components that are located in normally accessible areas. The results of this monitoring are the basis for initiating required corrective action in a timely manner. This monitoring is based on the observations that are made during focused inspections that are performed on a periodic basis. The external condition of supports, piping, doors, and equipment will be determined by visual inspection. General Condition Monitoring Activities are performed in three different ways:

- Inspections of radiologically controlled areas for borated water leakage
- Periodic focused inspections such as system walkdowns
- Area inspections for condition of structural supports and doors.

These inspections provide information to manage the aging effects of loss of material, change in material properties, separation and cracking/delamination, and cracking.

The acceptance criteria for visual inspections are identified in procedures that direct the monitoring activities. Responsibility for the evaluation of identified visual indications of aging effects is assigned to Engineering personnel. Evaluations of anomalies found during General Condition Monitoring Activities determine whether analysis, repair, or further inspection is required. Occurrence of significant degradation that is adverse to quality is entered into the Corrective Action System. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.10 Inspection Activities - Load Handling Cranes and Devices

The load handling cranes within the scope of license renewal are listed below:

- Containment polar cranes
- Containment jib cranes
- Containment annulus monorails
- Refueling manipulator cranes
- Fuel handling bridge crane
- New fuel transfer elevator
- Spent fuel crane
- Auxiliary Building monorails

The long-lived passive components of these cranes that are subject to aging management review include rails, towers, load trolley steel, fasteners, base plates, and anchorage.

The Inspection Activities - Load Handling Cranes and Devices has been developed in accordance with ASME B30.2 (Reference 13) and the inspection activities for monorails are developed in accordance with ASME B30.11 (Reference 14).

The Work Control Process directs structural integrity inspections of applicable cranes which include specific steps to check (visually inspect) the condition of structural members and fasteners on the cranes, the runways along which the cranes move, and the baseplates and anchorages for the runways. The applicable aging effect is identified as loss of material. If the nature of any identified discrepancies is such that corrective action can be completed within the scope of the procedure performing the inspection, no additional corrective action may be necessary. Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.11 ISI Program - Component and Component Support Inspections

The ISI Program - Component and Component Support Inspections are performed in accordance with the requirements of Subsection IWB, IWC, and IWF of ASME XI, Rules for Inservice Inspection of Nuclear Power Plant Components. License renewal concerns with respect to Subsection IWC include only the carbon steel piping that is susceptible to high energy line breaks in the feedwater and main steam systems. Inservice Inspections requirements may be modified by applicable Relief Requests and Code Cases, which are approved by the NRC specifically for each unit. The scope and details of the inspections to be performed are contained in the individualized Inservice Inspection Plan for each unit. Each Inservice Inspection Plan is developed and approved by the NRC for a 120-month inspection interval. The examinations required by ASME Section XI utilize visual, surface, and volumetric inspections to detect loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness (which presents itself as cracking of cast-austenitic stainless steel valve bodies due to thermal embrittlement).

Acceptance standards for inservice inspections are identified in Subsection IWB for Class 1 components, Subsection IWC for included Class 2 components, and in Subsection IWF for component supports. Table IWB 2500-1 refers to acceptance standards listed in paragraph IWB 3500. Anomalous indications beyond the criteria set forth in the Code acceptance standards that are revealed by the inservice inspections of Class 1 components may require additional inspections of similar components in accordance with Section XI. Evidence of loss of material, cracking, gross indications of either loss of pre-load or reduction of fracture toughness requires engineering evaluation for determination of corrective action. Occurrence of significant degradation that is adverse to quality will be entered into the Corrective Action System. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.12 ISI Program - Containment Inspection

The station has developed an ISI Program - Containment Inspection for concrete containments and containment steel liners that implements the requirements in 10 CFR 50.55a and Subsections IWE and IWL of ASME Section XI, 1992 edition through 1992 addenda. The program incorporates applicable code cases and approved relief requests. The provisions of 10 CFR 50.55a are invoked for inaccessible areas within the Containment structure. Within the scope of license renewal, only Subsection IWE is credited for managing aging effects for the Containment structure.

Loss of material is the aging effect for the containment steel liner. Surface degradation and wall thinning are determined by visual and volumetric examinations. The frequency and scope of examination requirements specified in 10 CFR 50.55a and Subsection IWE provide reasonable assurance that aging effect is detected prior to compromising design basis requirements. The evaluations of accessible areas provide the basis for extrapolation to the expected condition of inaccessible areas, and an assessment of degradation in such areas.

During the course of IWE inspections, anomalous indications are recorded on inspection reports that are kept in Station Records. Acceptance standards for the IWE inspection are identified in ASME Section XI Table IWE 2500-1 and refer to 10 CFR 50, Appendix J. Engineering evaluations are performed for inspection results that do not meet established acceptance standards. Occurrence of significant degradation that is adverse to quality will be entered into the Corrective Action System. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.13 ISI Program - Reactor Vessel

The ISI Program - Reactor Vessel is performed in accordance with the requirements of Subsection IWB of ASME XI, Rules for Inservice Inspection of Nuclear Power Plant Components. Inservice Inspections requirements may be modified by applicable Relief Requests and Code Cases, which are approved by the NRC specifically for each unit. The scope and details of the inspections to be performed are contained in the individualized Inservice Inspection Plan for each unit. Each Inservice Inspection Plan is developed and approved by the NRC for a 120-month inspection interval.

In accordance with ASME Section XI, reactor vessel components are inspected using a combination of surface examinations, volumetric examinations, and visual examinations to detect the aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness. Acceptance standards for inservice inspections are identified in Subsection IWB for Class 1 components. Table IWB 2500-1 refers to acceptance standards listed in paragraph IWB 3500. Anomalous indications that are revealed by the inservice inspections may require additional inspections of similar components, in accordance with Section XI. Evidence of aging effects requires engineering evaluation for determination of corrective action. Occurrence of significant degradation that is adverse to quality is entered into the Corrective Action System. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.14 Reactor Vessel Integrity Management

The scope of the Reactor Vessel Integrity Management activities is focused on ensuring adequate fracture toughness of the reactor vessel beltline plate and weld materials. Neutron dosimetry and material properties data derived from the reactor vessel materials irradiation surveillance program are used in calculations and evaluations that demonstrate compliance with applicable regulations. The Reactor Vessel Integrity Management activities includes the following aspects:

- Irradiated sample (capsule) surveillance.
- Vessel fast neutron fluence calculations.
- Measurements and calculations of nil-ductility transition temperature (RT_{NDT}) for vessel beltline materials.
- Measurements and calculations of Charpy Upper Shelf Energy (CvUSE).
- Calculation of reactor coolant system pressure-/temperature (P-T operating limits, and Low Temperature Overpressure Protection System setpoints.
- Pressurized Thermal Shock screening calculations.

Specimen capsules were placed in each of the reactors prior to initial irradiation and contain reactor vessel plate and weld material samples. The baseline mechanical properties of reactor vessel steels are determined from pre-irradiation testing of Charpy V-notch and tensile specimens. Post-irradiation testing of similar specimens provides a measure of radiation damage.

Fast neutron irradiation is the cause of radiation damage to the reactor vessel beltline. The results of surveillance capsule dosimetry analyses are used as benchmarks for calculations of neutron fluence to the surveillance capsules and to the reactor vessel beltline.

Measured values of Charpy transition temperature and CvUSE are obtained from mechanical testing of irradiation surveillance program specimens. Measured values of transition temperature are used to determine the reference temperature for nil-ductility transition (RT_{NDT}) for the limiting reactor vessel beltline material. RT_{NDT} is a key analysis input for the determination of reactor coolant system pressure-temperature operating limits and LTOPS setpoints. Measured values of transition temperature shift are similarly utilized in PTS screening calculations required by 10 CFR 50.61. Measured values of CvUSE are used to verify compliance with the upper shelf energy requirements of 10 CFR 50 Appendix G.

Acceptable values are established for the following parameters:

- Heatup and cooldown limits, as implemented by Technical Specifications, to ensure reactor vessel integrity.
- A pressurized thermal shock reference temperature that is within the screening criteria of 10 CFR 50.61.
- A fast fluence value for the surveillance capsule that bounds the expected fluence at the affected vessel beltline material through the period of extended operation.
- Charpy Upper Shelf Energy (CvUSE) greater than limits set forth in 10 CFR 50, Appendix G.

Based on established parameters, calculations are performed to ensure that the units will remain within the acceptable values.

A2.2.15 Reactor Vessel Internals Inspection

Visual inservice inspections are implemented in accordance with Category B-N-3 (Removable Core Support Structures) of ASME Section XI, Subsection IWB, to determine the possible occurrence of age-related degradation. These inspections are performed at 10-year intervals in accordance with the inspection plans approved by the NRC. The scope of components that comprise the reactor internals includes the upper and lower core internals assemblies. This includes core support and hold-down components. Additionally, a one-time focused inspection of the reactor vessel internals will be performed prior to the period of extended operation. The one-time inspection will determine the presence of aging effects identified in the aging management review for the reactor vessel internals. The inspection will be performed on one reactor (at either Surry or North Anna) and an engineering evaluation of results will determine the need for inspections of the other units.

Visual inspections are utilized to detect loss of material and cracking; as well as, gross indications of loss of pre-load and/or reduced fracture toughness. The acceptance standards for the visual examinations are summarized in ASME Subsection IWB-3520.2, Visual Examination, VT-3. These inspections are directed to be performed with the internals assemblies removed from the reactor vessel.

Acceptance standards for Reactor Vessel Internals Inspection activities are identified in ASME Section XI, Subsection IWB. Table IWB 2500-1 identifies references to the acceptance standards listed in Paragraph IWB 3500. Anomalous indications, that are revealed to be beyond the criteria in the acceptance standards by the inservice inspections, may require additional inspections. Evidence of any component degradation requires engineering evaluation for determination of corrective action. Occurrence of significant degradation that is adverse to quality is entered into the Corrective Action System. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.16 Secondary Piping and Component Inspection

The purpose of the Secondary Piping and Component Inspection program is to identify, inspect, and trend components that are susceptible to the aging effect of loss of material as a result of Flow Accelerated Corrosion (FAC) in either single or two-phase flow conditions. This program has been implemented in accordance with NRC Generic Letter 89-08, Erosion/Corrosion-Induced Pipe Wall Thinning (Reference 15), and NUREG-1344, Erosion/Corrosion-Induced Pipe Wall Thinning in U.S. Nuclear Power Plants (Reference 16), and EPRI Guideline NSAC-202L, Recommendations for an Effective Flow Accelerated Corrosion Program (Reference 17).

The scope of the Secondary Piping and Component Inspection program includes portions of the feedwater systems, the main and auxiliary steam systems, and the steam generator blowdown lines.

The Secondary Piping and Component Inspection program also includes susceptible vent and drain lines.

The identification of components and piping segments to be included in each Secondary Piping and Component Inspection effort that is performed by Engineering using plant chemistry data, past inspection data, predictions from FAC-monitoring computer codes, and industry experience. Determination of whether a piping component has experienced FAC degradation is made by measuring the current wall thickness using the UT method and comparing against previous baseline thickness measurement, if available. Visual inspections of the internals of non-piping components, such as pumps and valves, are performed as the equipment is opened for other repairs and/or maintenance, to determine whether flow-accelerated degradation is occurring.

The decision to repair or replace a component is made by Engineering. For the internal surface examinations, engineering evaluations are utilized to determine whether the results of visual inspections indicate conditions that require corrective action. Occurrence of significant degradation that is adverse to quality are entered into the Corrective Action System. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.17 Service Water System Inspections

Compliance with Generic Letter 89-13 (Reference 18) requires a variety of inspections, non-destructive examinations, and heat transfer testing for components cooled by service water. Generic Letter 89-13 directed utilities to assess the following aspects of operational problems with service water cooling systems:

- Biofouling
- Heat Transfer Testing
- Routine Inspection and Maintenance
- Single-failure Walkdown
- Procedure Review

The Service Water System Inspections program provides reasonable assurance that corrosion (including microbiologically-influenced corrosion, MIC), erosion, protective coating failure, silting, and biofouling of service water piping and components will not cause a loss of intended functions. The primary objectives of this program are to (1) remove excessive accumulations of biofouling agents, corrosion products, and silt; and (2) repair defective protective coatings and degraded service water system piping and components that could adversely affect performance. Preventive maintenance, inspection, and repair procedures have been developed to provide reasonable assurance that any adverse effects of exposure to service water are adequately addressed. The addition of biocide to the service water system reduces biological growth (including MIC) that could lead to degradation of components exposed to the service water.

Service Water System Inspections are performed to check for biofouling, damaged coatings, and degraded material condition. Heat transfer parameters for components cooled by service water are monitored. Visual inspections are performed to check for loss of material and changes in material properties. Heat transfer testing is performed to identify the aging effects of loss of material and heat transfer degradation.

Volumetric inspections are also performed to check for loss of material due to MIC.

The acceptance criteria for visual inspections are identified in the procedures that perform the individual inspections. The procedures identify the type and degree of anomalous conditions that are signs of degradation. In the case of service water, degradation includes biofouling as well as material degradation. Engineering evaluations determine whether observed deterioration of material condition is sufficiently extensive to lead to loss of intended function for components exposed to the service water. The degraded condition of material or of heat transfer capability may require prompt remediation.

Occurrence of significant degradation that is adverse to quality is entered into the Corrective Action System. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.18 Steam Generator Inspections

Steam Generator Inspections are performed in accordance with Technical Specifications and Inservice Inspection requirements of ASME Section XI. Steam Generator Inspections plans are based upon the guidelines established by Nuclear Energy Institute document, NEI 97-06 (Reference 4) and the Electric Power Research Institute steam generator inspection guidelines (Reference 5). Steam generator tubing inspections are performed on a sampling basis. The sample population inspected meets or exceeds the requirements of Technical Specifications. Qualified techniques, equipment and personnel are used for inspections in accordance with site-specific eddy current analysis guidelines.

Examination of steam generator sub-components other than tubes are performed as required by the governing edition and addenda of ASME Section XI, as imposed by 10 CFR 50.55a. In some cases the specific inspection requirements of ASME Section XI are modified by regulatory commitments and approved Relief Requests. Inspections of the steam generators to check for loss of material, cracking, and gross indications of loss of pre-load include a combination of visual inspections, surface examinations, and volumetric examinations. Tubing inspections are performed in accordance with ASME Section XI, Subsection IWB.

Acceptance standards for steam generator inspections are provided in ASME Section XI, Subsections IWB-3500 and IWC-3500. Evidence of component degradation requires engineering evaluation for determination of corrective action. Occurrence of significant degradation that is adverse to quality will be entered into the Corrective Action System. Corrective action provides reasonable assurance that conditions adverse to quality are promptly corrected.

A2.2.19 Work Control Process

Performance testing and maintenance activities, both preventive and corrective, are planned and conducted in accordance with the station's Work Control Process. The Work Control Process integrates and coordinates the combined efforts of Maintenance, Engineering, Operations, and other support organizations to manage maintenance and testing activities. Performance testing on heat exchangers evaluates the heat transfer capability of the components to determine if heat transfer degradation is occurring. Maintenance activities provide opportunities to visually inspect the surfaces (internal and external) of plant components and adjacent piping. Adjacent piping is primarily the internal piping surfaces immediately adjacent to a system component that is accessible through the component for visual inspection. Visual inspections performed through the Work Control Process provide data that can be used to determine the effectiveness of the Chemistry Control Program for Primary Systems and Chemistry Control Program for Secondary Systems to mitigate the aging effects of cracking, loss of material, and change of material properties.

The Work Control Process also provides opportunities through preventive maintenance sampling (predictive analysis) to collect lubricating oil and engine coolant samples for subsequent analysis of contaminants that would provide early indication of an adverse environment that can lead to material degradation.

The inspections, testing, and sampling performed under the Work Control Process provide reasonable assurance that the following aging effects will be detected:

- loss of material
- cracking
- heat transfer degradation
- separation and cracking/delamination
- change in material properties
- water treeing in energized medium voltage cables

The acceptance criteria for visual inspections, testing, or sampling are currently identified in the procedures that perform the individual maintenance, testing, or sampling activity. The procedures identify the type and degree of anomalous conditions that are signs of degradation.

The acceptance criterion for visual inspections of the energized medium voltage cabling at North Anna is the absence of the environmental conditions (excessive moisture/water) necessary to support water treeing.

Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Whenever evidence of aging effects exists, an engineering evaluation is performed to determine whether the observed condition is acceptable without repair. Occurrence of significant aging effects that is adverse to quality is entered into the Corrective Action System.

A3.0 TIME-LIMITED AGING ANALYSIS

As part of the application for a renewed license, 10 CFR 54.21(c) requires that an evaluation of time-limited aging analyses (TLAAs) for the period of extended operation be provided. The following TLAAs have been identified and evaluated to meet this requirement.

A3.1 Reactor Vessel Neutron Embrittlement

The reactor vessel is subjected to neutron irradiation from the core. This irradiation results in the embrittlement of the reactor vessel materials. Analyses have been performed that address the following:

- Upper shelf energy
- Pressurized thermal shock
- RCS pressure-temperature operating limits

A3.1.1 Upper Shelf Energy

The Charpy V-notch test provides information about the fracture toughness of reactor vessel materials. 10 CFR 50 requires the Charpy upper shelf energy (USE) of reactor vessel beltline materials to meet Appendix G requirements. If the USE of a reactor vessel beltline material is predicted to not meet Appendix G requirements, then licensees must submit an analysis that demonstrates an equivalent margin of safety at least three years prior to the time the material is predicted to not meet those requirements.

Reactor vessel calculations have been performed which demonstrated that the upper shelf energy values of limiting reactor vessel beltline materials at the end of the period of extended operation meet Appendix G requirements. Thus, the TLAA has been projected to the end of the period of extended operation and is found to be adequate.

A3.1.2 Pressurized Thermal Shock

A limiting condition on reactor vessel integrity, known as pressurized thermal shock (PTS), may occur during postulated system transients, such as a loss-of-coolant accident (LOCA) or a steam line break. Such transients may challenge the integrity of the reactor vessel under the following conditions: severe overcooling of the inside surface of the vessel wall followed by high re-pressurization, significant degradation of vessel material toughness caused by radiation embrittlement, and the presence of a critical-size defect in the vessel wall.

The reference temperature for pressurized thermal shock (RT_{PTS}) is defined in 10 CFR 50.61. RT_{PTS} values for the limiting reactor vessel materials at the end of the period of extended operation have been recalculated by Dominion. At the end of the period of extended operation, the calculated RT_{PTS} values for the beltline materials are less than the applicable screening criteria established in 10 CFR 50.61. Thus, the TLAA has been projected to the end of the period of extended operation and is found to be adequate.

A3.1.3 Pressure-Temperature Limits

Atomic Energy Commission (AEC) General Design Criterion (GDC) 14 of Appendix A of 10 CFR 50, “Reactor Coolant Pressure Boundary," requires that the reactor coolant pressure boundary be designed, fabricated, erected, and tested to have an extremely low probability of abnormal leakage (or rapid failure) and of gross rupture. AEC GDC 31, "Fracture Prevention of Reactor Coolant Pressure Boundary," requires that the reactor coolant pressure boundary be designed with sufficient margin to ensure that when stressed under operating, maintenance, and testing conditions the boundary behaves in a non-brittle manner and the probability of rapidly propagating fracture is minimized.

Reactor vessel neutron fluence values corresponding to the end of the period of extended operation and reactor vessel beltline material properties were used to determine the limiting value of reference nil ductility reference temperature (RT_{NDT}), and to calculate RCS pressure-temperature (P-T) operating limits valid through the end of a period of extended operation. Maximum allowable low temperature overpressure protection system (LTOPS) power operated relief valve (PORV) lift setpoints have been developed on the basis of the P-T limits applicable to the period of extended operation. Revised RCS P-T limit curves and LTOPS setpoints will be submitted for review and approval prior to the expiration of the existing technical specification limits in order to maintain compliance with the governing requirements of 10 CFR 50 Appendix G.

The TLAA has been projected to the end of the period of extended operation and is found to be adequate.

A3.2 Metal Fatigue

The thermal fatigue analyses of the station's mechanical components have been identified as time-limited aging analyses.

A3.2.1 ASME Boiler and Pressure Vessel Code, Section III, Class 1

The steam generators, pressurizers, reactor vessels, loop stop valves, reactor coolant pumps, control rod drive mechanisms (CRDMs), and all reactor coolant system pressure boundary piping have been analyzed using the methodology of the ASME Boiler and Pressure Vessel Code, Section III, Class 1.

The ASME Boiler and Pressure Vessel Code, Section III, Class 1, requires a design analysis to address fatigue and establish limits such that the initiation of fatigue cracks is precluded.

Experience has shown that the transients used to analyze the ASME III requirements are often very conservative. Design transient magnitude and frequency are more severe than those occurring during plant operation. The magnitude and number of the actual transients are monitored. This monitoring assures that the existing frequency and magnitude of transients are conservative and bounding for the period of extended operation, and that the existing ASME III equipment will perform its intended functions for the period of extended operation. A cycle counting program (Section A4.2) is in place to provide reasonable assurance that the actual transients are smaller in magnitude and within number of the transients used in the design.

Fatigue analyses for the steam generators, pressurizers, reactor vessels, reactor coolant pumps, CRDMs, and all RCS pressure boundary piping have been evaluated and determined to remain valid for the period of extended operation.

Fatigue analyses for the reactor vessel closure studs and the loop stop valves have been re-analyzed. The analyses for these components have been projected to be valid for the period of extended operation.

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A3.2.2 Reactor Vessel Underclad Cracking

In early 1971, an anomaly was identified in the heat-affected zone of the base metal in a European-manufactured reactor vessel. A generic fracture mechanics evaluation, based on this situation, demonstrated that the growth of underclad cracks during a 40-year plant life would be insignificant.

The evaluation was extended to 60 years using fracture mechanics evaluation based on a representative set of design transients. The occurrences were extrapolated to cover 60 years of service life. This 60-year evaluation shows insignificant growth of the underclad cracks. The plant-specific design transients are bounded by the representative set used in the evaluation.

The analysis associated with reactor vessel underclad crack growth has been projected to the end of the period of extended operation and has been found to be acceptable.

A3.2.3 ANSI B31.1 Piping

The balance-of-plant piping is designed to the requirements of ANSI B31.1, “Power Piping.”

ANSI B31.1 design requirements assume a stress range reduction factor in order to provide conservatism in the piping design while accounting for fatigue due to thermal cyclic operation. This reduction factor is 1.0, provided the number of anticipated cycles is limited to 7,000 equivalent full-temperature cycles. A piping system would have to be thermally cycled approximately once every three days over a plant life of 60 years to reach 7,000 cycles. Considering this limitation, a review of the ANSI B31.1 piping within the scope of license renewal has been performed to identify those systems that operate at elevated temperature and to establish their cyclic operating practices. Under current plant operating practices, piping systems within the scope of license renewal are only occasionally subject to cyclic operation. Typically, these systems are subjected to continuous steady-state operation. Significant variation in operating temperatures occur only during plant heatup and cooldown, during plant transients, or during periodic testing.

The analyses associated with ANSI B31.1 piping fatigue have been evaluated and determined to remain valid for the period of extended operation except for sample lines for the hot and cold legs. The analyses associated with sample lines for the hot and cold legs has been projected to be valid to the end of the period of extended operation.

A3.2.4 Environmentally Assisted Fatigue

Generic Safety Issue (GSI)-190 (Reference 6) identifies a NRC staff concern about the effects of reactor water environments on reactor coolant system component fatigue life during the period of extended operation. The reactor water's environmental effects as described in GSI-190, are not included in the current licensing basis. As a result, the criterion specified in 10 CFR 54.3(a)(6) is not satisfied. Hence, environmental effects are not TLAAs. GSI-190, which was closed in December 1999, has concluded that environmental effects have a negligible impact on core damage frequency, and as such, no generic regulatory action is required (Reference 7). However, as part of the closure of GSI-190, the NRC has 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. As demonstrated in the preceding sections, fatigue evaluation in the original transient design limits remain valid for the period of extended operation. Confirmation by transient cycle counting will ensure that these transient design limits are not exceeded. Secondly, the reactor water's environmental effects on fatigue life were evaluated using the most recent data from laboratory simulation of the reactor coolant environment.

As a part of the industry effort to address environmental effects for operating nuclear power plants during the current 40-year licensing term, Idaho National Engineering Laboratories evaluated, in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components" (Reference 8), fatigue-sensitive component locations at plants designed by all four U. S. Nuclear Steam Supply System vendors. The pressurized water reactor calculations, especially the early-vintage Westinghouse PWR calculations, are directly relevant to the Dominion stations. The description of the "Older Vintage Westinghouse Plant" evaluated in NUREG/CR-6260 matches the Dominion stations. In addition, the transient cycles considered in the evaluation match or bound the design. The results of NUREG/CR-6260 analyses, and additional data from NUREG/CR-6583 (Reference 9) and NUREG/CR-5704 (Reference 10), were then utilized to scale up the plant-specific cumulative usage factors (CUF) for the fatigue-sensitive locations to account for environmental effects. Generic industry studies performed by EPRI were also considered in this aspect of the evaluation, as well as environmental data that have been collected and published subsequent to the generic industry studies.

Based on these adjusted CUFs, it has been determined that the surge line connection at the reactor coolant system's hot leg pipe is the leading indicator for reactor water environmental effects. Therefore, the surge line weld at the hot leg pipe connection will be included in an augmented inspection program.

The potential effects of the reactor water environment have been evaluated for the period of extended operation as required by GSI-190.

A3.3 Environmental Qualification of Electric Equipment

10 CFR 54.49 requires that each holder of a nuclear power plant operating license establish a program for qualifying safety-related electric equipment. Such a program has been implemented at the station and is invoked by Administrative Procedure. Analyses and tests that qualify safety-related equipment for the period of extended operation are considered TLAAs.

The Environmental Qualification Program (Section A4.1) requires that all electrical equipment important to safety located in a harsh environment shall be managed through the period of extended operation.

A3.4 Containment Liner Plate

The accumulated fatigue effects of applicable liner loading conditions were evaluated in accordance with Paragraph N-415 of the ASME Boiler and Pressure Vessel Code, Section III, 1968. The evaluation was based on 1,000 cycles of operating pressure variations, 4,000 cycles of operating temperature variations, and 20 design earthquake cycles.

Calculations have been identified that address the fatigue of Containment liners. A review of the identified calculations has determined that the increase in the number of cycles due to the period of extended operation is acceptable. Effects of the Containment Type A pressure tests on fatigue of the Containment liner plate have been included in the evaluation. Therefore, the Containment liner is adequate for a 60-year operating period as currently designed. The analyses associated with the Containment liner plate have been revised and projected to be valid for the period of extended operation.

A3.5 Plant-Specific Time-Limited Aging Analyses

A3.5.1 Crane Load Cycle Limit

The following are cranes included in license renewal scope and in NUREG-0612 (Reference 11):

- Containment polar cranes
- Containment annulus monorails
- Fuel handling bridge crane
- Spent fuel crane
- Auxiliary Building monorails

NUREG-0612 requires that the design of heavy load overhead handling systems meet the intent of Crane Manufacturers Association of America, Inc. (CMAA) Specification #70. The crane load cycle provided in CMAA-70 has been identified as a TLAA, with the most limiting number of loading cycles being 100,000.

The most frequently used cranes are spent fuel cranes. Each of these cranes will experience approximately 25,000 cycles of half-load lifts to support the refueling of both units over a 60-year period. In addition, the crane is used to load new fuel into the fuel pool, to perform the various rearrangements required by operations support, to accommodate inspections by fuel vendors, and to load spent fuel casks. In such service, the crane is conservatively expected to make a total of 50,000 half-load lifts in a 60-year period.

Therefore, the analyses associated with crane design, including fatigue, are valid for the period of extended operation.

A3.5.2 Reactor Coolant Pump Flywheel

During normal operation, the reactor coolant pump flywheel possesses sufficient kinetic energy to produce high-energy missiles in the unlikely event of failure.

The aging effect of concern is fatigue crack initiation in the flywheel bore keyway. An evaluation of a failure over the period of extended operation has been performed. It demonstrates that the flywheel design has a high structural reliability with a very high flaw tolerance and negligible flaw crack growth over a 60-year service life (Reference 12).

The analysis associated with the structural integrity of the reactor coolant pump flywheel has been evaluated and determined to be valid for the period of extended operation.

A3.5.3 Leak-Before-Break

Westinghouse (Westinghouse Owners Group) tested and analyzed crack growth with the goal of eliminating reactor coolant system primary loop pipe breaks from plant design bases. The objective of the investigation was to examine mechanistically, under realistic yet conservative assumptions - whether a postulated crack causing a leak, will grow to become unstable and lead to a full circumferential break when subjected to the worst possible combinations of plant loading.

The detailed evaluation has shown that double-ended breaks of reactor coolant pipes are not credible, and as a result, large LOCA loads on primary system components will not occur. The overall conclusion of the evaluation was, that, under the worst combination of loading, including the effects of safe shutdown earthquake, the crack will not propagate around the circumference and cause a guillotine break. The plant has leakage detection systems that can identify a leak with margin, and provide adequate warning before the crack can grow.

The concept of eliminating piping breaks in reactor coolant system primary loop piping has been termed "leak-before-break" (LBB).

In 1986, Westinghouse performed an LBB analysis of the primary loop piping. Two TLAAs related to LBB have been identified: fatigue crack growth and thermal aging of cast austenitic stainless steel (CASS). The original fatigue crack growth analysis has been performed for the design transient cycles and with consideration of thermal aging effect for forty years.

To maintain the plant's LBB design basis, the thermal aging effect for 60 years has been revalidated. The change in the material property has been found to be insignificant. Since the number of design transient cycles will not be exceeded during 60 years of operation, the LBB analysis is projected to be valid for the period of extended operation.

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A3.5.4 Spent Fuel Pool Liner

The spent fuel pool liner located in the Fuel Building is needed to prevent a leak to the environment. A design calculation has been identified which documents that the spent fuel pool design meets the general industry criteria. The calculation includes a fatigue analysis to add a further degree of confidence.

The normal thermal cycles occur at each refueling, resulting in 80 cycles for both units in 60 years. Total number of thermal cycles is expected to be 90, which includes normal, upset, emergency, and faulted conditions.

The calculations show that the allowable thermal cycles for spent fuel pool liner for the most severe thermal condition, which includes a loss of cooling, is 100.

Therefore, the existing calculations remain valid for the period of extended operation.

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A3.5.5 Piping Subsurface Indications

Calculations have been identified that addressed piping subsurface indications detected by inspections, performed in accordance with ASME Section XI. Section XI provides the acceptance criteria for various flaw orientations, locations and sizes. The calculations determined the number of thermal cycles required for the flaws to reach unacceptable size.

Required cycles for the flaws to reach an unacceptable size are 20,700 or higher.

Since it is expected that the number of the cycles experienced by the piping will not exceed these values for sixty years of operation, the analyses have been determined to remain valid for the period of extended operation.

A3.5.6 Reactor Coolant Pump and ASME Code Case N-481

Periodic volumetric inspections of the welds in the primary loop pump casings in commercial nuclear power plants are required by Section XI of the ASME Boiler and Pressure Vessel Code. Since the reactor coolant pump casings are inspected prior to being placed in service, and no significant mechanisms exist for crack initiation and propagation; it has been concluded that the inservice volumetric inspection could be replaced with an acceptable alternate inspection. In recognition of this conclusion, ASME Code Case N-481, “Alternative Examination Requirements for Cast Austenitic Pump Casings,” provides an alternative to the volumetric inspection requirement. The code case allows the replacement of volumetric examinations of primary loop pump casings with fracture mechanics based integrity evaluations - Item (d) of the code case - supplemented by specific visual examinations. The analysis has been performed on the reactor coolant pump casing integrity in accordance with the ASME Code Case N-481 requirements. The analysis has been projected to be valid for 60 years.

A3.6 Exemptions

The requirements of 10 CFR 54.21(c) stipulate that the application for a renewed license should include a list of plant-specific exemptions granted pursuant to 10 CFR 50.12 and that are based on time-limited aging analyses, as defined in 10 CFR 54.3. Each active 10 CFR 50.12 exemption has been reviewed to determine whether the exemption is based on a time-limited aging analysis. No plant-specific exemptions granted pursuant to 10 CFR 50.12 and based on a time-limited aging analysis as defined in 10 CFR 54.3 have been identified.

A4.0 TLAA SUPPORTING ACTIVITIES

A4.1 Environmental Qualification Program

The Environmental Qualification (EQ) Program activities are in compliance with the requirements of 10 CFR 50.49. The EQ Program will be continued throughout the period of extended operation. Electrical equipment located in a harsh environment are evaluated for environmental qualification if they are required to function in the conditions that will exist post-accident after being subjected to the normal effects of aging. A harsh environment results from a loss-of-coolant accident (LOCA) or main steam line break inside Containment, high radiation levels due to the post-LOCA effects outside Containment, or high energy line breaks outside Containment.

The EQ Program is applicable to the following groups of components:

- Safety-related electrical equipment that is relied upon to remain functional during and following a design-basis event (DBE)
- Non-safety-related electrical equipment whose failure, under postulated environmental conditions, could prevent accomplishment of safety functions
- Certain post-accident monitoring equipment as described in Regulatory Guide 1.97 (Reference 19).

Guidance regarding environmental qualification was given in NRC Bulletin 79-01B (Reference 20) for Unit 1 and in NUREG-0588 (Category II) (Reference 22) for Unit 2.

The Equipment Qualification Master List (EQML) provides a listing of electrical equipment that is important to safety and is located in a potentially harsh environment.

Based on the definitions of 10 CFR 54, certain EQ calculations are considered to be Time-Limited Aging Analyses (TLAA). As stated in 10 CFR 54.21(c) and in NEI 95-10 (Reference 21), analyses for TLAAs utilize one of the following three options:

i) The analyses remain valid for the period of extended operation,

ii) The analyses have been projected to the end of extended operation, or

iii) The effects of aging will be adequately managed during the period of extended operation.

For purposes of license renewal, EQ components will be evaluated utilizing Option iii in accordance with the EQ Program. EQ concerns for license renewal will consider only those in-scope components that have a qualified lifetime greater than 40 years. Components with a qualified lifetime of less than 40 years already are included in a program of periodic replacement and are not considered TLAAs.

10 CFR 50.49(j) requires that a qualification record be maintained for all equipment covered by the EQ Rule. The qualification process verifies that the equipment is capable of performing its safety function when subjected to various postulated environmental conditions. These conditions include expected ranges of temperature, pressure, humidity, radiation, and accident conditions such as chemical spray and submergence.

The process of qualifying EQ equipment includes analysis, data collection, and data reduction with appropriate assumptions, acceptance criteria and corrective actions.

Qualification Document Reviews (QDRs) provide the basis for qualifying EQ components. The QDRs provide the following information for each piece of equipment that is qualified:

- The performance characteristics required under normal, design-basis event (DBE), and post-DBE conditions.
- The voltage, frequency, load, and other electrical characteristics for which equipment performance can be provided with reasonable assurance.
- The environmental conditions, including temperature, pressure, humidity, radiation, chemical spray, and submergence, at the location where the equipment must function.

A4.2 Transient Cycle Counting

During normal, upset, and test conditions; reactor coolant system pressure boundary components are subjected to transient temperatures, pressures, and flows, resulting in cyclic changes in internal stresses in the equipment. The cyclic changes in internal stresses cause metal fatigue. Class 1 reactor coolant system components have been designed to withstand a number of design transients without experiencing fatigue failures during their operating life. The purpose of the Transient Cycle Counting is to record the number of normal, upset, and test events, and their sequence that the station experiences during operation. Design transients are counted to provide reasonable assurance that plant operation does not occur outside the design assumptions.

The Transient Cycle Counting activities are applicable to the reactor coolant system pressure boundary components for which the design analysis assumes a specific number of design transients. A summary of reactor coolant system design transients for which transient cycle counting is performed is listed below:

- Heatups/Cooldowns $\leq 100^{o}$F/Hr.
- Step load increase/decrease of 10%
- Large load reduction of 50%
- Loss of load >15%
- Loss of AC power
- Loss of flow in one loop
- Full power reactor trip
- Inadvertent auxiliary pressurizer spray
- Inadvertent safety injection
- Normal charging and letdown return to service
- Charging trip with delayed return to service

The aging effect that is managed by counting transient cycles is cracking due to metal fatigue. The Transient Cycle Counting activities monitor transient cycles that have been experienced by each unit and compare the actual number of cycles to a design assumption. Any concerns related to fatigue are mitigated, as long as the number and magnitude of transient cycles are less than the design assumptions. Approaching a design limit may indicate a situation that is adverse to quality, and would initiate the Corrective Action System. Subsequently, an engineering analysis will determine the design margin remaining, taking credit for the actual magnitude of transients and their sequence to confirm that the

allowable factor has not been exceeded. If warranted, component repair or replacement would be initiated.

APPENDIX A REFERENCES

1. Working Draft of the NRC Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants.

2. Generic Letter 88-05, *Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants*, March 17, 1988.

3. NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants - LWR Edition*, US Nuclear Regulatory Commission. (Formerly NUREG-75/087)

4. NEI 97-06, Steam Generator Program Guidelines, Revision 1, Nuclear Energy Institute.

5. Power Steam Generator Examination Guidelines, TR-107569, Electric Power Research Institute.

6. Generic Safety Issue (GSI)-190, *Fatigue Evaluation for Metal Components for 60-year Plant Life*, U.S. Nuclear Regulatory Commission, August 1996.

7. Memorandum from Ashok C. Thadani, to William D. Travers, U.S. Nuclear Regulatory Commission, *Closeout of Generic Safety Issue 190*, December 26, 1999.

8. NUREG/CR-6260, *Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components*, U.S. Nuclear Regulatory Commission, March 1995.

9. NUREG/CR-6583, *Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels*, U.S. Nuclear Regulatory Commission, March 1998.

10. NUREG/CR-5704, *Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels*, U.S. Nuclear Regulatory Commission, April 1999.

11. NUREG-0612, *Control of Heavy Loads at Nuclear Power Plants*, U.S. Nuclear Regulatory Commission, July 1980.

12. WCAP-14535A, *Topical Report On Reactor Coolant Pump Flywheel Inspection Elimination*, Westinghouse Electric Corporation, November 1996.

13. American National Standards Institute: ANSI B30.2-1976, *Overhead and Gantry Cranes.*

14. American National Standards Institute: ANSI B30.11-1973, *Monorail Systems and Underhung Cranes.*

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15. Generic Letter 89-08, *Erosion/Corrosion-Induced Pipe Wall Thinning*, May 2, 1989.

16. NUREG-1344, *Erosion/Corrosion-Induced Pipe Wall Thinning in US Nuclear Power Plants*, April 1, 1989.

17. NSAC-202L, *Recommendation for an Effective Flow Accelerated Corrosion Program*, Electric power Research Institute, April 8, 1999.

18. Generic Letter 89-13, *Service Water System Problems Affecting Safety-Related Equipment*, July 18, 1989 (Supplement 1 dated 4/4/90).

19. U.S. Nuclear Regulatory Commission, *Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident*, Regulatory Guide 1.97, December 1980.

20. IE Bulletin 79-01B, *Environmental Qualification of Class 1E Equipment*, Office of Inspection and Enforcement, January 14, 1980 (Supplement 1 dated 2/29/80; Supplement 2 dated 9/30/80; and Supplement 3 dated 10/24/80).

21. NEI 95-10, *Industry Guidance for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule*, Revision 2, August 2000.

22. NUREG-0588 (Category II), *Interim Staff Position on Environmental Qualification of Safety-related Electrical Equipment*, August 1, 1979 Revision 1 11/1/79).

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APPENDIX B

AGING MANAGEMENT ACTIVITIES

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Most of the information in this section is common to both North Anna and Surry. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences with the following exception. No attempt has been made to identify the plant-specific cross references to the AMR results sections.

A listing of the abbreviations used in this appendix is provided in Section 1.4.1.

B1.0 INTRODUCTION

B1.1 Overview

Appendix B summarizes the activities that manage the effects of aging for systems, structures, components, and commodities that have been identified in the License Renewal Application (LRA) as being subject to aging management review. Each Aging Management Activity (AMA) summary includes a list of systems, structures, commodities, and major components that rely on the AMA for management of aging effects, an overview and a summary section, and an evaluation of the AMA in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1). Each AMA is characterized as one or more of the four AMA types, as listed in the Standard Review Plan for License Renewal, which are *Prevention, Mitigation, Condition Monitoring,* and *Performance Monitoring*.

The AMA summaries in Section B2.0 of this appendix are divided into categories of new and existing AMAs. Appendix Section B3.0 summarizes the activities in place to support the bases of the Time-Limited Aging Analyses (TLAA) which are discussed in Section 4.0 of the LRA. Appendix Section B4.0 provides an outline listing of Licensee Follow-up Actions that have been identified as necessary enhancements to existing AMAs or the development of new AMA's.

The Aging Management Reviews (AMRs) in Section 3.0 of the LRA provide tables that summarize the results of the AMRs. These tables identify the AMA or combinations of AMAs that are credited for managing the aging effects for each structure or component listed in the AMR. The identified AMA or combination of AMAs manages the aging effects applicable to the structure or component, and provides reasonable assurance that the integrity of the structure or component will be maintained during the period of extended operation.

B1.2 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 in-house operating experience was performed to identify aging effects

experienced. The review of in-house operating experience involved electronic database searches of Deviation Report (DR) information from Surry and North Anna Power Stations. The database included the time period from 1990 to mid 1999 and included approximately 50,000 DRs. In addition, discussions with system engineers and long time company employees were conducted, and identified some additional aging concerns.

A critical review and evaluation of operating experience leads to enhancements of tasks that accomplish aging management. For example, the flow accelerated corrosion incident that occurred in condensate piping at Surry in 1986 resulted in the development of the Secondary Piping and Component Inspection program. Fouling in the component cooling heat exchangers at Surry and North Anna has led to increased frequency for cleaning, inspection, and eventually to tubing replacements. Experiences with steam generator tubing degradation have resulted in improved methods for performing eddy-current inspections.

Dominion reviews and dispositions industry operating experiences reported in NRC Information Notices, INPO reports, and manufacturing bulletins on an ongoing basis as these documents are published. Corrective actions resulting from these documents have been incorporated into programs and processes such as those contained in AMAs.

B1.3 Management of Aging Effects

In accordance with 10 CFR 54.21(a)(3), aging effects will be adequately managed so that intended functions will be maintained consistent with the current licensing basis for the period of extended operation. The following summary describes the adequacy of aging management inspection techniques for the various aging effects of structures and components that require aging management for license renewal.

Visual examinations manage the aging effects of loss of material and cracking. It is noted that the aging due to loss of form, change in material properties, embrittlement, and reduced insulation resistance manifests itself as either loss of material or cracking, and are detected by visual examinations. The types of visual examinations include VT-1, VT-2, and VT-3, as well as general inspections. Extensive industry experience performing and evaluating the results of VT-1, VT-2, and VT-3 examinations confirms the statements from ASME Section XI which describe the ability of VT examinations to detect loss of material and cracking. Therefore, the aging effects of loss of material and cracking will be adequately managed so that intended functions will be maintained consistent with the current licensing basis for the period of extended operation.

VT-3 examinations and general visual inspections are used to detect gross loss of pre-load for bolting. This capability is consistent with ASME section XI, which states that VT-3 examinations verify clearances, physical displacements, loose or missing parts, and loss of integrity at bolted connections. The performance of bolting inspections, in accordance with

ASME Section XI, Subsections IWB and IWF, will manage the aging effect of gross loss of pre-load so that the intended function will be maintained consistent with the current licensing basis for the period of extended operation.

Surface examinations detect the aging effect of cracking that appears as surface discontinuities. The magnetic particle and liquid penetrant techniques are used to find these surface discontinuities. Extensive industry experience performing and evaluating the results of surface examinations confirms the statements from ASME Section XI which describe the ability of these examinations to detect discontinuities. Therefore, the aging effect of cracking will be adequately managed so that the intended function will be maintained consistent with the current licensing basis for the period of extended operation.

Volumetric examinations detect loss of material and cracking that are indicated by discontinuities throughout the volume of a material. Volumetric techniques include radiographic, ultrasonic, and eddy current examinations. Extensive industry experience performing and evaluating the results of volumetric examinations confirms the statements from ASME Section XI which describe the ability of these examinations to detect discontinuities. Therefore, the aging effects of loss of material and cracking will be adequately managed so that the intended function will be maintained consistent with the current licensing basis for the period of extended operation.

Heat exchanger performance testing detects the aging effect of heat transfer degradation. Heat transfer testing involves the acquisition of temperature, flow rate, or pressure data for the evaluation of heat transfer capability. Much of this testing was developed in response to NRC Generic Letter 89-13 regarding the effectiveness of the service water cooling system. Extensive Dominion experience with maintaining proper heat exchanger performance confirms that the aging effect of heat transfer degradation will be adequately managed so that the intended function will be maintained consistent with the current licensing basis for the period of extended operation.

Reactor vessel capsule surveillance activities address the aging effect of reduction in fracture toughness. The calculations that are based on these activities include neutron fluence, nil-ductility transition temperature (for pressure/temperature limit curves), pressurized thermal shock reference temperature, and Charpy upper shelf energy. Evaluation of these parameters confirms compliance with the criteria of 10 CFR 50, Appendices G and H, and with 10 CFR 50.61. Compliance with these regulations confirms that the aging effect of reduction in fracture toughness for vessel material will be adequately managed so that the intended function will be maintained consistent with the current licensing basis for the period of extended operation.

The management of aging effects for the reactor vessel internals is separate from aging management for the reactor vessel. With respect to the internals, change in dimension (void swelling) and reduction in fracture toughness (neutron embrittlement and the synergistic effect of thermal and neutron embrittlement) are aging effects for which Dominion is active in industry groups, such as the EPRI-sponsored Materials Reliability Project Industry Task Group, to determine the necessity and extent of examinations. Presently, a one-time inspection is planned for the single Surry or North Anna reactor that is evaluated to be most susceptible to these aging effects. If future industry developments suggest the need for an alternate inspection plan during the period of extended operation, or negate the need for a one-time inspection, then Dominion will modify the proposed inspection plan. Compliance with industry developments will adequately manage these aging effects for the reactor vessel internals so that the intended function will be maintained consistent with the current licensing basis for the period of extended operation.

B1.4 Designation of Plant Areas

With regard to monitoring the condition of plant equipment, the approach and hence the activities that will be credited depends on how accessible the equipment is for performing visual inspections. Three different types of areas are described below along with the approach to be used to inspect for aging effects.

Normally Accessed Areas

There are areas of the plant for which access is not restricted by physical barriers or radiological conditions and which are routinely occupied by plant personnel while performing regular duties during normal operation and refuelings. With regard to these normally accessed areas, credit is taken for Civil Engineering Structural Inspection and the General Condition Monitoring Activities for assessing the external condition of plant equipment and structures. Included as part of these activities are: (1) structural monitoring performed for the Maintenance Rule, (2) periodic walkdowns of plant areas to assess the condition of supports, (3) System Engineering walkdowns of mechanical and electrical components, and (4) Health Physics surveys outside the containment intended to identify possible sources of contamination originating from leaking components. Degraded conditions that are discovered as part of any of these activities are evaluated and dispositioned via the Corrective Actions System.

Infrequently Accessed Areas

Some areas are classified as infrequently accessed because they are separated from normally accessed areas by physical boundaries and there is no need for plant personnel to regularly survey, operate/test equipment, or perform maintenance in them during the course of a complete operating cycle (typically consisting of 18 months of power operation and

30-40 days for a refueling outage). For these areas, the establishment of specific conditions and/or special preparations, which are not part of routine activities performed sometime during each operating cycle, are required in order to gain access to the area. Examples of infrequently accessed areas are sump areas in the containment, cable or pipe tunnels, vaults, pits, and intake bays. Support and coordination from other groups is often required in order to gain access to these areas. For example, it may be necessary to de-water or drain portions of structures or systems using capabilities that are part of the equipment design (such as stop logs), install scaffolding, secure confined space permits, request special Health Physics Department coverage, station security guards, and/or remove grating, hatches or plugs.

In addition, there are areas where, although entries may be made regularly, because of the need to limit stay times, the entries made are restricted to perform very specific tasks. In these situations, there is no opportunity to adequately assess the general condition of the equipment and structural components within the area. An example of such an area is the volume control tank cubicle. These areas are also considered infrequently accessed since the structural members and equipment in the area are not regularly inspected for signs of aging.

For infrequently accessed areas, one-time inspections conducted between years 30 and 40 are proposed as the means to assess aging. This approach is discussed in the Infrequently Accessed Area Inspection Activities.

Inaccessible Areas

Inaccessible areas are those that cannot be accessed without physically removing or destroying material that was not envisioned (as part of the design) as being periodically disturbed once initial plant construction was completed. The act of preparing to examine an inaccessible area of the plant involves work activities that are not prescribed by normal maintenance and/or operations procedures and do not rely on utilizing features incorporated in the equipment's design. Examples of such activities are the chipping away of concrete to expose a liner and the removing of pavement and/or soil to get to the exterior surface of pipes or below grade concrete.

To actually monitor the condition of hardware in inaccessible areas will typically involve construction activities, some of which may be very costly to perform. As a result, the approach that will normally be used, in accordance with 10 CFR 50.55a, is to monitor conditions of adjacent accessible areas in order to infer something about the conditions that exist in the inaccessible areas. The specific parameters to be monitored will require a case-by-case evaluation of the equipment configuration and the relationship of the environments between the inaccessible area and the adjacent accessible areas.

An exception to this approach will be the treatment of buried piping and valves. In this case, as described in the Buried Piping and Valve Inspection Activities, a one-time inspection of representative types of valves and piping is proposed prior to the end of year forty.

In the event other inaccessible areas are made available for inspection as a result of work unrelated to license renewal activities, the opportunity will be taken to observe the condition of all exposed hardware located in the area. A record of the findings will be made in order to obtain additional insight into the aging effects that may be applicable for inaccessible areas. The results of these inspections will be used to supplement the information gained from monitoring accessible areas when making future decisions on the need to inspect inaccessible areas.

B2.0 AGING MANAGEMENT ACTIVITIES

The Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Section A.2 of the Standard Review Plan for License Renewal. The Quality Assurance Program includes the elements of corrective action, confirmation process, and administrative controls. These elements are applicable to the safety-related and non-safety-related structures, systems, and components that are within the scope of license renewal. Since the non-safety-related items are considered in accordance with these three elements, no additional consideration of the option provided in the Standard Review Plan is required for the non-safety-related items.

B2.1 New Aging Management Activities

B2.1.1 Buried Piping and Valve Inspection Activities

Prior to the period of extended operation, the integrity of buried piping and valves must be confirmed due to the existence of aging effects requiring management. This will be accomplished by examining representative samples of buried piping and valves consisting of various materials, with various protective measures, in different soil conditions. These are one-time inspections and will include representative valves and a sample length (i.e., several feet) of piping for each combination of material and burial condition. An engineering evaluation of inspected piping and valves will be performed to determine the need for future actions, if any. The inspections and evaluations will be completed prior to the expiration of the original 40-year operating license. Development of the inspection activities will be a Licensee Follow-up Action.

An evaluation of the Buried Piping and Valve Inspection Activities in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following systems and structures credit the Buried Piping and Valve Inspection Activities for managing the aging effects of loss of material on external surfaces.

System	AMR Results Section
Quench Spray	Section 3.2, Engineered Safety Features
Emergency Diesel Generator System	Section 3.3.4, Diesel Generator Support Systems
Fire Protection	Section 3.3.9, Fire Protection and Supporting Systems
Recirculation Spray	Section 3.2, Engineered Safety Features
Residual Heat Removal	Section 3.2, Engineered Safety Features
Safety Injection	Section 3.2, Engineered Safety Features
Service Water	Section 3.3.2, Open Water Systems
Structure	**AMR Results Section**
Flood Wall West of Turbine Building	Section 3.5.8, Earthen Structures

Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review).

The inspection of buried piping and valves in systems that are within the scope of license renewal will be performed on representative samples for the following material/burial condition combinations:

- Carbon Steel, coated (Includes Cast Iron)
- Carbon steel, coated, wrapped
- Stainless steel, coated, wrapped
- Carbon steel, coated, wrapped, with cathodic protection

Preventive Actions

External surfaces of buried piping and valves typically are covered with a protective coating during installation to prevent the components from coming in contact with a potentially aggressive soil environment.

Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Buried Piping and Valve Inspection Activities will be designated *Condition Monitoring*. No preventive actions exist for these inspection activities.

Parameters Monitored or Inspected

The external surface of buried component samples will be inspected for evidence of degradation such as damaged wraps and coatings or corrosion products.

Detection of Aging Effects

The external condition of buried components will be examined using a one-time inspection performed in accordance with the Work Control Process. Visual inspections will be used to detect cracking of protective coatings and loss of material from protective coatings or the substrate material.

Monitoring and Trending

Inspections performed by Engineering will be documented in accordance with the Work Control Process. If additional non-destructive examinations (NDE) are performed, anomalous indications that are signs of degradation will be documented on NDE reports that are kept as Station Records. One time inspections will be performed between year 30 and the end or the current operating license.

Acceptance Criteria

The acceptance criterion for visual inspections is the absence of anomalous indications that are signs of degradation. A trained coatings/materials engineer will perform the external inspection of buried components and determine, through evaluation, whether the observed condition is acceptable. If an additional non-destructive examination is performed as a result of the engineering evaluation, its acceptance criterion will be to have no anomalous indications that are signs of degradation. Occurrence of degradation that is adverse to quality will be entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be

significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

If degradation is determined by engineering evaluation to be a recurrent concern, additional confirmation will be provided that buried piping and valves are being adequately protected.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

Experience has been gained through the Work Control Process with respect to buried fire protection and service water system piping.

Significant external degradation of buried piping due to the evaluated aging effects requiring management has not been found.

Summary

Maintenance activities for buried components in the fire protection and service water system have not indicated deterioration of the external surfaces that would adversely impact the intended function.

However, as indicated in the preceding description, a Licensee Follow-up Action will be initiated to perform a one-time inspection for a representative sample of additional material/burial condition combinations. This activity is outlined in Section B4.0, Licensee Follow-up Actions of this appendix. With the addition of these activities, the effects of aging associated with buried piping and valves will be adequately managed so that there is reasonable assurance that the intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.1.2 Infrequently Accessed Area Inspection Activities

The purpose of the Infrequently Accessed Area Inspection Activities will be to provide reasonable assurance that the equipment and components subject to aging management, that are not subject to monitoring for aging effects during activities performed each operating cycle, will continue to fulfill their intended functions consistent with the current licensing basis during the period of extended operation. A one-time inspection will be performed prior to the end of the current license period to assess the aging of components and structures located in areas not routinely accessed due to high-radiation, high-temperature, confined spaces, location behind security or missile barriers, or normally flooded. An engineering evaluation of the inspection results will determine the need for subsequent inspections. Development of the inspection activities will be a Licensee Follow-up Action.

An evaluation of the Infrequently Accessed Area Inspection Activities in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following systems, structures, and commodities credit the Infrequently Accessed Area Inspection Activities for managing the aging effect of loss of material.

System	AMR Results Section
Feedwater	Section 3.4, Steam and Power Conversion Systems
Recirculation Spray	Section 3.2, Engineered Safety Features
Safety Injection	Section 3.2, Engineered Safety Features
Service Water	Section 3.3.2, Open Water Systems
Neutron Shield Tank Cooling	Section 3.3.3, Closed Water Systems

Structure	AMR Results Section
Auxiliary Feedwater Tunnel	Section 3.5.3, Other Class I Structures
Containment	Section 3.5.1, Containment
Service Water Expansion Joint Enclosure	Section 3.5.3, Other Class I Structures

Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Service Water Tie-in Vault	Section 3.5.3, Other Class I Structures
Yard Valve Pit	Section 3.5.7, Yard Structures
NSSS Equipment Supports	Section 3.5.9, NSSS Equipment Supports

Commodity	**AMR Results Section**
General Structural Supports	Section 3.5.10, General Structural Supports

Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review).

The scope of the Infrequently Accessed Area Inspection Activities includes representative regions and equipment in the following areas:

- Reactor Containment sump
- Reactor Containment keyway (including the integrity of the neutron shield tank)
- Cover for Containment dome plug
- Volume control tank cubicle
- Emergency diesel generator exhaust bunkers
- Cable spreading rooms, Cable tunnels, Upper areas of emergency switchgear rooms
- New fuel storage area
- Auxiliary Building filter and ion exchanger cubicles

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- Tunnel from Turbine Building to Auxiliary Building
- Service Water (SW) expansion joint vault
- SW tie-in vault
- Auxiliary SW valve pit
- Turbine building SW valve pit
- SW valve house lower level
- SW pump house lower level
- Spray array structure in SW reservoir
- Auxiliary SW expansion joint vault
- Charging pump pipe chase
- Auxiliary feedwater piping tunnel

Preventive Actions

The Infrequently Accessed Area Inspection Activities will be designated *Condition Monitoring*. *Condition Monitoring* includes no preventive actions.

Parameters Monitored or Inspected

The following types of degradation or adverse conditions can be detected by visual inspections:

- Component leakage.
- Rust or corrosion products.
- Peeling, bubbling, or flaking coatings.
- Indications of chemical attack.
- Corroded fasteners.
- Cracking (of concrete, supports, equipment, sealants).
- Bubbled, discolored, or cracked electrical insulation.
- Damaged or missing thermal insulation (focus on material integrity, not thermal performance).
- Deformed or mispositioned piping and cable supports.
- Wastage due to boric acid leakage.

Detection of Aging Effects

The external condition of structures, supports, piping, and equipment will be determined by visual inspection. These inspections will detect the aging effect of loss of material.

Monitoring and Trending

Monitoring of the structures, supports, piping, and equipment in infrequently accessed areas will be accomplished using the Work Control Process to perform one-time inspections. The inspections will be conducted between year 30 and the end of the current operating license. Inspection results will be documented for evaluation and retention.

Acceptance Criteria

The acceptance criterion for visual inspections is the absence of anomalous indications that are signs of degradation. Responsibility for the evaluation of visual indications will be assigned to Engineering. Evaluations of indication of degradation found during Infrequently Accessed Area Inspection Activities determine whether analysis, repair, or further inspection will be required. Occurrence of degradation that is adverse to quality will be entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

If degradation is determined by engineering evaluation to be a recurrent concern, additional confirmation will be provided to reasonably assure that the system, structures, and components in the infrequently accessed areas are being adequately protected.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

In 1999, a visual inspection at North Anna found degraded supports in the auxiliary feedwater piping tunnel. The resultant corrective actions for the supports and establishment of a surveillance activity for the auxiliary feedwater pipe tunnel provided appropriate resolution of the observed degraded condition.

Summary

As indicated in the preceding description, a Licensee Follow-up Action will be initiated to perform one-time inspections of infrequently accessed areas. This activity is outlined in Section B4.0, Licensee Follow-up Actions, of this appendix. With the addition of these activities, the effects of aging associated with structures, supports, piping, and equipment located in infrequently accessed areas will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.1.3 Tank Inspection Activities

The purpose of the Tank Inspection Activities will be to perform inspections of above-ground and underground tanks to provide reasonable assurance that the tanks perform their intended functions consistent with the current licensing basis throughout the period of extended operation. One-time inspections will be performed on tanks that are within the scope of license renewal and could experience aging effects requiring management. A representative sampling of each type of tank that requires aging management will be designated for the one-time inspections. The inspections, to be performed between year 30 and the end of the current operating license, will assess the condition of these tanks. Development of the inspection activities will be a Licensee Follow-up Action.

An evaluation of the Tank Inspection Activities in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following systems credit the Tank Inspection Activities for managing the aging effect of loss of material.

System	AMR Results Section
Alternate AC Diesel Generator System	Section 3.3.4, Diesel Generator Support Systems
Condensate	Section 3.4, Steam and Power Conversion Systems
Quench Spray	Section 3.2, Engineered Safety Features
Emergency Diesel Generator System	Section 3.3.4, Diesel Generator Support Systems
Feedwater	Section 3.4, Steam and Power Conversion Systems
Fire Protection	Section 3.3.9, Fire Protection and Supporting Systems
Recirculation Spray	Section 3.2, Engineered Safety Features
Security	Section 3.3.4, Diesel Generator Support Systems

Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review).

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The choice of representative tanks to be inspected will be dependent on the tank's material of construction, its contents, the foundation upon which the tank is based, and the type of coating. Acceptable, substitute tanks may be inspected that have the same construction, contents, and foundation/coatings as the in-scope tanks, but which are more easily accessed. If this situation exists, an engineering evaluation will determine the appropriateness of inspecting the substitutes. The tanks to be inspected will be representative of those on the following listing:

- Emergency Diesel Generator (EDG) Fuel Oil Tanks
- Alternate AC Diesel Generator (AAC) Fuel Oil Tanks
- Security Diesel Generator Fuel Oil Tanks
- EDG and AAC Diesel Starting Air Tanks
- EDG and AAC Diesel Coolant Tanks
- Underground fuel oil storage tanks
- Diesel-driven fire pump fuel oil storage tank
- Refueling Water Storage Tanks
- Chemical Addition Tanks
- Emergency Condensate Storage Tanks
- Casing cooling tanks
- Service Water Pump House air receiver

Preventive Actions

The Tank Inspection Activities will be designated *Condition Monitoring*. No preventive actions are performed.

Parameters Monitored or Inspected

Uncoated surfaces and surface coatings inside the selected tanks will be inspected. External observations of tank conditions occur during routine plant walkdowns, but only for tanks that are not insulated, protected by a missile barrier, founded on soil, or buried. The external surfaces that are not readily accessible will be included in the Tank Inspection Activities, and inspections of representative samples will be performed.

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Detection of Aging Effects

The internal and/or external surface conditions will be evaluated by visual examination to identify loss of material. Volumetric examinations will be performed to determine the extent of wall thinning on tanks that are founded on soil or buried.

Monitoring and Trending

Inspection of tank surfaces will be accomplished using the Work Control Process. The extent of surface degradation will be determined by visual inspection, and wall thinning can be characterized by non-destructive examination. Indications of degradation identified during visual inspections will be documented, and any anomalous indications that are signs of degradation, based on non-destructive examination (NDE), will be recorded on NDE Reports and kept in Station Records. One-time inspections will be conducted between year 30 and the end of the current operating license.

Acceptance Criteria

The acceptance criterion for visual tank inspections is the absence of anomalous indications that are signs of degradation. The acceptance criteria for volumetric inspections, when necessary, will relate to minimum wall thickness requirements. Evidence of loss of material requires engineering evaluation for determination of corrective action. Occurrence of degradation that is adverse to quality will be entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

If degradation is determined by engineering evaluation to be a recurrent concern, additional confirmation will be provided to reasonably assure that the tanks will be adequately protected.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

Indications of degradation that have been found during previous tank inspections have been evaluated by Engineering to determine the acceptability of the observed condition or to develop a corrective action plan. Operating experience from prior inspections and corrective action activities that have been performed, although limited in scope, indicates that there has been no significant loss of material from the base metal.

Summary

A Licensee Follow-up Action will be initiated to perform one-time inspections of tanks that are within the scope of license renewal and experience aging effects requiring management. This activity is outlined in Section B4.0, Licensee Follow-up Actions of this appendix. Operating experience indicates that the existing inspections and corrective action activities, though limited in scope, that have been performed have indicated that there has been no significant loss of material from the base metal. The same expectation exists for the additional inspections of representative samples of tanks requiring aging management for license renewal.

The effects of aging associated with tanks will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2 Existing Aging Management Activities

B2.2.1 Augmented Inspection Activities

The purpose of the Augmented Inspection Activities is to perform examinations of selected components and supports in accordance with requirements identified in the Technical Specifications, UFSAR, license commitments, industry operating experience, and good practices for the station. Augmented Inspection Activities are outside the required scope of ASME Section XI. The scope of Augmented Inspection Activities to be performed during each refueling outage is identified by Engineering in accordance with controlled procedures.

An evaluation of the Augmented Inspection Activities in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following systems and commodities credit the Augmented Inspection Activities for managing the aging effects of loss of material and cracking.

System	AMR Results Section
Feedwater	Section 3.4, Steam and Power Conversion Systems
Main Steam	Section 3.4, Steam and Power Conversion Systems
Reactor Coolant System	Section 3.1.1, Reactor Coolant System

Commodity	AMR Results Section
General Structural Supports	Section 3.5.10, General Structural Supports

Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review).

The following table summarizes the Augmented Inspection Activities that are within the scope of license renewal, the test methods used, and the frequency of the examinations.

Inspection Description	Method	Frequency
Turbine throttle valves; the valves are in the scope for license renewal due to Appendix R	VT, MT, or PT	Every 40 months
Steam generator supports	VT-1	Every 40 months
Reactor vessel incore flux thimble tubes	ET	100% every refueling outage
Component supports	VT-3	Every ISI inspection period
Reactor vessel head	Modified VT-2 non-pressurized	Every refueling outage
Steam generator feedwater nozzles	UT or Supplemental RT	Every refueling outage
Main Steam Postulated Break Locations	MT and/or PT. and UT or RT	25% of all selected welds, during each 40-month period, with 75% completed by the end of each 120-month interval.
Feedwater Postulated Break Locations	MT and/or PT. and UT or RT	25% of all selected welds, during each 40-month period, with 75% completed by the end of each 120-month interval.

As a Licensee Follow-up Action, the station will implement an augmented examination of the pressurizer surge line connection to the reactor coolant system's hot-leg loop piping prior to the end of the current operating license. These examinations will address the issue of thermal fatigue failure of welds due to environmental effects, GSI-190 (Reference 19). Additionally, a Licensee Follow-up Action will be implemented to include inspection of

the core barrel hold-down spring as one of the Augmented Inspection Activities. The initial inspection of the core barrel hold-down spring will be performed prior to the end of the current operating license.

Preventive Actions

The Augmented Inspection Activities are designated *Condition Monitoring*. No preventive actions are performed.

Parameters Monitored or Inspected

Component conditions are monitored to detect degradation due to loss of material and cracking. Inspections include visual testing, surface examinations, and volumetric examinations. The extent of each component inspection is defined within the plant program documents. Inspection requirements for the pressurizer surge line connection and the core barrel hold-down springs are not yet defined but will be included in the inspection procedures when they are developed.

Detection of Aging Effects

Augmented Inspection Activities that check for loss of material and cracking include a combination of visual inspections, surface examinations, and volumetric examinations. These examinations are consistent with those endorsed by the NRC for ASME Section XI inspections.

Monitoring and Trending

Non-destructive examinations provide indication of loss of material and cracking. Anomalous indications that are signs of degradation are documented on non-destructive examination reports, which are kept in Station Records. Engineering evaluations are performed for inspection results that do not meet established acceptance standards. The engineering evaluations consider the extent of degradation so that timely corrective or mitigative actions are taken to provide reasonable assurance that intended functions of inspected components are maintained. The inspection frequencies are established within the Augmented Inspection Activities.

Acceptance Criteria

The acceptance criterion for non-destructive examinations is the absence of anomalous indications that are signs of degradation. Acceptance standards for the Augmented Inspection Activities are consistent with guidance provided in ASME Section XI. Evidence

of loss of material or cracking requires engineering evaluation for determination of corrective action. Occurrence of degradation that is adverse to quality is entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Since the implementation of corrective actions for augmented inspections is consistent with the requirements of ASME Section XI, post-maintenance inspections and testing are performed. These inspections and tests provide reasonable assurance that required repairs or replacements have been satisfactorily implemented.

The infrequent degradation or failure of in-scope license renewal components examined by the Augmented Inspection Activities confirms the effectiveness of the activities, the appropriateness of the inspection frequencies, and the completeness of corrective actions that are taken if degradation occurs.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

As new industry concerns and commitments related to component integrity have arisen, examinations have been added to the Augmented Inspection Activities. Degradation of components that is found through these inspections is recorded and corrected, as directed by engineering evaluation, in order to maintain the integrity and intended function

of the component. Component integrity, resulting from successful corrective and preventive maintenance activities, confirm the adequacy of the inspection activities and the effectiveness of the Corrective Action System.

Summary

Operating experience indicates that the inspection and corrective action activities have successfully maintained the integrity of the components within the scope of the Augmented Inspection Activities.

As a Licensee Follow-up Action, an activity to implement an augmented examination of the pressurizer surge line connection to the reactor coolant system's hot-leg loop piping during the period of extended operation is required. These examinations will address the issue of thermal fatigue failure of welds due to environmental effects associated with GSI-190 (Reference 19). Additionally, a Licensee Follow-up Action is required to include inspection of the core barrel hold-down spring as one of the Augmented Inspection Activities. These activities are outlined in Section B4.0, Licensee Follow-up Actions of this appendix.

The effects of aging associated with components and structures within the scope of the Augmented Inspection Activities will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.2 Battery Rack Inspections

The purpose of the Battery Rack Inspections activities is to reasonably assure the integrity of the supports for various batteries. Loss of material due to corrosion is the aging effect. A seismic event would be the limiting condition for battery support rack integrity. Inspections are performed for the support racks of numerous batteries, including:

- Main station batteries
- Emergency diesel generator batteries
- Diesel-driven fire pump battery
- Security diesel generator battery
- Station blackout (AAC) diesel generator battery

An evaluation of the activities for Battery Rack Inspections in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following commodities credit the Battery Rack Inspections for managing the aging effect of loss of material.

Commodity	AMR Results Section
General Structural Supports	Section 3.5.10, General Structural Supports

Periodic checks of rack integrity, coincident with periodic battery inspections, are performed to determine the physical condition of support racks for batteries that are important for the proper functioning of components within the scope of license renewal.

Preventive Actions

The Battery Rack Inspections are designated *Condition Monitoring*. No preventive actions are performed.

Parameters Monitored or Inspected

The condition of the battery support racks are visually inspected on a periodic basis to reasonably assure that their function to adequately support the batteries is not compromised. The aging effect that is monitored by these inspections is loss of material.

Detection of Aging Effects

Visual inspections identify degradation of the physical condition of the support racks. These inspections check for loss of material (corrosion) of the support racks. Inspections provide reasonable assurance that the integrity of the racks is maintained during a seismic event.

Monitoring and Trending

Periodic visual inspections determine the existence of loss of material. The inspection frequency is typically quarterly, but is monthly or weekly on a few battery systems. Engineering evaluations assess whether the extent of corrosion could result in a loss of intended function. All observations regarding the material condition of the battery racks are recorded in completed inspection procedures.

Acceptance Criteria

The acceptance criterion for visual inspections is the absence of anomalous indications that are signs of degradation. Engineering evaluations determine whether observed degradation of material condition is significant enough to compromise the ability of the support to perform its intended function during a seismic event. Occurrence of degradation that is adverse to quality is entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

Periodic inspections of the battery support racks provide confirmation that corrective actions have been completed and are effective. The absence of recurring structural deterioration confirms that periodic inspections are effective in maintaining the integrity of battery racks.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

Incidents of battery rack corrosion have occurred and corrective action has been taken to repair or replace storage rack components as necessary. Periodic inspections of the support racks provide reasonable assurance of their continued integrity and proper functioning during routine operation, as well as during the limiting condition of a seismic event. The inspections and corrective actions have been successful in maintaining support rack integrity, and will continue into the period of extended operation.

Summary

Operating experience indicates that while degradation of battery storage racks has occurred, there have been no cases of loss of intended function due to problems with battery racks. Corrective actions have been effectively implemented when inspection results indicate degradation.

The effects of aging associated with components within the scope of the Battery Rack Inspections will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.3 Boric Acid Corrosion Surveillance

Leakage from borated systems inside Containment creates the potential for degradation of components. Inspections are performed to provide reasonable assurance that borated water leakage does not lead to undetected loss of material from the reactor coolant pressure boundary and surrounding components. Carbon (and low-alloy) steel is particularly susceptible, but copper also can be damaged.

In Generic Letter 88-05 (Reference 2), the NRC identified concerns with boric acid corrosion of carbon-steel reactor pressure boundary components. In response to this generic letter, activities were developed to examine primary coolant components for evidence of borated water leakage that could degrade the external surfaces of nearby structures or components, and to implement corrective actions to address coolant leakage. At a minimum, these activities are performed inside containment at the beginning and end of each refueling outage.

An evaluation of the activities for Boric Acid Corrosion Surveillance in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following systems, structures, commodities, and major components credit the Boric Acid Corrosion Surveillance for managing the aging effect of loss of material.

System	AMR Results Section
Blowdown	Section 3.4, Steam and Power Conversion Systems
Chemical and Volume Control	Section 3.3.1, Primary Process Systems
Chilled Water	Section 3.3.3, Closed Water Systems
Component Cooling Water	Section 3.3.3, Closed Water Systems
Containment Vacuum	Section 3.3.6, Ventilation and Vacuum Systems
Quench Spray	Section 3.2, Engineered Safety Features
Drains - Aerated	Section 3.3.7, Drain and Liquid Processing Systems
Drains - Gaseous	Section 3.3.7, Drain and Liquid Processing Systems

Feedwater	Section 3.4, Steam and Power Conversion Systems
Fire Protection	Section 3.3.9, Fire Protection and Supporting Systems
Fuel Pit Cooling	Section 3.2, Engineered Safety Features
Instrument Air	Section 3.3.5, Air and Gas Systems
Main Steam	Section 3.4, Steam and Power Conversion Systems
Neutron Shield Tank Cooling	Section 3.3.3, Closed Water Systems
Post-Accident Hydrogen Removal	Section 3.3.8, Vent and Gaseous Processing Systems
Primary and Secondary Plant Gas Supply	Section 3.3.5, Air and Gas Systems
Radiation Monitoring	Section 3.3.8, Vent and Gaseous Processing Systems
Refueling Purification	Section 3.3.1, Primary Process Systems
Reactor Coolant System	Section 3.1.1, Reactor Coolant System
	Section 3.3.5, Air and Gas Systems
	Section 3.3.3, Closed Water Systems
	Section 3.3.9, Fire Protection and Supporting Systems
Recirculation Spray	Section 3.2, Engineered Safety Features
Residual Heat Removal	Section 3.2, Engineered Safety Features
Safety Injection	Section 3.2, Engineered Safety Features
Sampling System	Section 3.3.1, Primary Process Systems
Service Air	Section 3.3.5, Air and Gas Systems
Service Water	Section 3.3.2, Open Water Systems
Steam Generator Water Treatment	Section 3.4, Steam and Power Conversion Systems
Vacuum Priming	Section 3.3.6, Ventilation and Vacuum Systems

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Ventilation	Section 3.3.6, Ventilation and Vacuum Systems
	Section 3.3.3, Closed Water Systems

Structure	**AMR Results Section**
Containment	Section 3.5.1, Containment
Load Handling Cranes and Devices	Section 3.5.12, Load-handling Cranes and Devices
NSSS Equipment Supports	Section 3.5.9, NSSS Equipment Supports

Commodity	**AMR Results Section**
General Structural Supports	Section 3.5.10, General Structural Supports
Miscellaneous Structural Commodities	Section 3.5.11, Miscellaneous Structural Commodities

Major Component	**AMR Results Section**
Pressurizer	Section 3.1.4, Pressurizer
Reactor Vessel	Section 3.1.2, Reactor Vessel
Steam Generator	Section 3.1.5, Steam Generator

Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review).

The scope of the Boric Acid Corrosion Surveillance activities includes the effects on the leaking borated systems and susceptible equipment and structures in the vicinity of leakage. Similar inspections for the effects of boric acid leakage on components outside Containment are performed in accordance with General Condition Monitoring Activities.

Preventive Actions

The Boric Acid Corrosion Surveillance activities are designated *condition monitoring*. No preventive actions are performed.

Parameters Monitored or Inspected

External surface, visual inspections are performed inside the Containment to determine the presence of borated water leakage, which could lead to deterioration of susceptible components. Equipment surfaces, insulated surfaces, and surrounding areas are

examined for discoloration, staining, boric acid residue, and other evidence of leakage. Components that have come in contact with leaked borated water are visually examined to determine whether degradation has occurred.

Detection of Aging Effects

The aging effect to be detected is loss of material from susceptible components due to leakage from borated systems. Inspections of these systems are performed to comply with the requirements of NRC Generic Letter 88-05 and ASME Section XI.

Inspections of carbon-steel components are performed in accordance with Generic Letter 88-05 to determine borated water leakage locations and pathways. These examinations do not need to be performed with the reactor coolant system pressurized. Any detrimental effects of the leakage are evaluated and resolved.

Additional visual inspections are performed inside Containment with the reactor coolant system at normal pressure to determine the possible existence of leakage. These inspections are performed in accordance with ASME Section XI, as modified by NRC-approved Relief Requests. When determining the possible existence of borated water leakage as required by ASME Section XI, either pipe insulation is required to be removed for the inspections or a four-hour at-pressure hold time is required. Insulated portions of the coolant system are examined without removal of the insulation by examining accessible joints and exposed surfaces for evidence of borated water leakage. Vertical components are examined at the lowest elevation. Components and connections that are not accessible are examined by looking for borated water leakage on the surrounding area of the floor or adjacent equipment.

Upon identification of borated water leakage, the boric acid residue is removed, and a visual examination is performed by a qualified individual.

Monitoring and Trending

Monitoring involves examination for evidence of borated water leakage, reviews of inspection results, and evaluations of the effects of leakage. Walkdowns for borated water leakage are performed at a frequency of each refueling outage. All observations of leakage are documented in inspection procedures. Inspection results are compiled and evaluated, as necessary, by Engineering.

Acceptance Criteria

The acceptance criterion for visual inspections is the absence of detectable leakage or boric acid residue. Whenever evidence exists of borated water leakage, a visual examination is performed by a qualified individual. The visual examinations provide

information for an engineering evaluation to determine whether degradation of susceptible components has occurred and whether the observed condition is acceptable without repair. However, bolting that is damaged by borated water leakage may be replaced without further inspection. In all cases, components affected by leakage are evaluated. Occurrence of degradation that is adverse to quality is entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

Ongoing borated water leakage inspections of plant equipment and supports that are potentially affected by borated water leakage provide confirmation that corrective actions have been completed and are effective. The system walkdowns that are performed prior to restart following refueling or maintenance outages provide confirmation that corrective actions for borated water leakage and its effects are properly completed.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

The Boric Acid Corrosion Surveillance activities have been developed to address industry experience reflected in Generic Letter 88-05. Evidence of boric acid residue has been found during the plant walkdown inspections that are performed during refueling outages. Borated water leaks have typically occurred at valve packings or bolted connections. These leaks are usually corrected by minor adjustments, and have had only minor effect on equipment or structures in the vicinity of the leakage. The inspections for borated water leakage and corrective actions have been successful in maintaining reactor coolant system integrity, and will continue into the period of extended operation.

Summary

Operating experience indicates that significant borated water leakage has not occurred, and that inspection activities have located and repaired the leaks that have occurred. Corrective actions have been effectively implemented to mitigate active leakage prior to experiencing a loss of intended function. These activities will continue during the period of extended operation.

Therefore, the effects of aging associated with components within the scope of the Boric Acid Corrosion Surveillance will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.4 Chemistry Control Program for Primary Systems

The purpose of the Chemistry Control Program for Primary Systems is to provide reasonable assurance that water quality is compatible with the materials of construction in the plant systems and equipment in order to minimize loss of material and cracking. The Chemistry Control Program for Primary Systems creates an environment in which material degradation is minimized, therefore, maintaining material integrity and reducing the amount of corrosion product that could accumulate and interfere with equipment operation or heat transfer.

The Chemistry Control Program for Primary Systems is based on Technical Specifications requirements and on Electric Power Research Institute (EPRI) guidelines provided in Technical Report TR-105714, PWR Primary Water Chemistry Guidelines (Reference 3). The EPRI guidelines reflect industry operating experience and are revised based on these experiences to optimize plant chemistry control. The Dominion chemistry control program is revised to maintain consistency with the EPRI guidelines.

An evaluation of the Chemistry Control Program for Primary Systems in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following systems, structures, commodities, and major components credit the Chemistry Control Program for Primary Systems for managing the aging effects of loss of material and cracking.

System	AMR Results Section
Blowdown	Section 3.4, Steam and Power Conversion Systems
Boron Recovery	Section 3.3.7, Drain and Liquid Processing Systems
Chemical and Volume Control	Section 3.3.1, Primary Process Systems
Component Cooling Water	Section 3.3.3, Closed Water Systems
Quench Spray	Section 3.2, Engineered Safety Features
Containment Vacuum	Section 3.3.3, Closed Water Systems
Drains - Gaseous	Section 3.3.7, Drain and Liquid Processing Systems
Fuel Pit Cooling	Section 3.2, Engineered Safety Features

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Heating and Ventilation	Section 3.3.3, Closed Water Systems
High Radiation Sampling	Section 3.3.1, Primary Process Systems
Liquid and Solid Waste	Section 3.3.7, Drain and Liquid Processing Systems
Neutron Shield Tank Cooling	Section 3.3.3, Closed Water Systems
Radwaste	Section 3.3.7, Drain and Liquid Processing Systems
Refueling Purification	Section 3.3.1, Primary Process Systems
Reactor Coolant System	Section 3.1.1, Reactor Coolant System
Reactor Coolant System	Section 3.3.3, Closed Water Systems
Recirculation Spray	Section 3.2, Engineered Safety Features
Residual Heat Removal	Section 3.2, Engineered Safety Features
Safety Injection	Section 3.2, Engineered Safety Features
Sampling System	Section 3.3.1, Primary Process Systems
Structure	**AMR Results Section**
Containment	Section 3.5.1, Containment
Fuel Building	Section 3.5.4, Fuel Building
Load Handling Cranes and Devices	Section 3.5.12, Load-handling Cranes and Devices
NSSS Equipment Supports	Section 3.5.9, NSSS Equipment Supports
Commodity	**AMR Results Section**
General Structural Supports	Section 3.5.10, General Structural Supports
Major Component	**AMR Results Section**
Pressurizer	Section 3.1.4, Pressurizer
Reactor Vessel	Section 3.1.2, Reactor Vessel
Reactor Vessel Internals	Section 3.1.3, Reactor Vessel Internals
Steam Generator	Section 3.1.5, Steam Generator

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Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review).

The scope of the Chemistry Control Program for Primary Systems monitors fluid within the following systems and components:

- Primary Grade Water Tank
- Primary Systems
- Component Cooling
- Spent Fuel Pit
- Refueling Water Storage Tank
- Boric Acid Storage Tank
- Accumulator Tank
- Chemical Addition Tank
- Boron Injection Tank
- Casing Cooling Tank

Preventive Actions

The Chemistry Control Program for Primary Systems is a set of mitigative activities utilized to maintain water chemistry that is compatible with the materials used in the construction of plant systems and equipment. In particular, the concentrations of dissolved oxygen and other impurities are maintained at low levels and system pH is maintained in the optimal range such that the conditions for loss of material or cracking are minimized.

Parameters Monitored or Inspected

The parameters that are monitored by the Chemistry Control Program for Primary Systems are based on information provided in the EPRI Guidelines and the requirements of the station's Technical Specifications to minimize the aging effects of loss of material and cracking. The parameters monitored and their acceptable ranges vary depending on the mode of plant operation, (i.e., operation at full power, operation at a reduced power level, hot standby operation, or plant shutdown). Parameters currently monitored in accordance with EPRI guidelines are listed in the following summary:

Monitored Primary Chemistry Parameters

System/Component	Chemistry Parameters
Primary Grade Water Tank	Aluminum, Calcium, Chloride, Fluoride, Magnesium, Oxygen, Silica, Sodium, Suspended Solids, Tritium
Primary System	Aluminum (required only if silica exceeds 1.0 ppm), Boron, Calcium (required only if silica exceeds 1.0 ppm), Chloride, Crud, Fluoride, Hydrogen, Lithium, Liquid Isotopic, Magnesium (required only if silica exceeds 1.0 ppm), Oxygen, pH, Silica, Specific Conductivity, Sulfate, Suspended Solids, Tritium
Component Cooling	Chloride, Chromate, Fluoride, Liquid Isotopic, pH, Specific Conductivity
Spent Fuel Pit	pH, Aluminum, Boron, Calcium plus Magnesium, Chloride, Fluoride, Liquid Isotopic, Magnesium, Silica, Sodium Sulfate, Specific Conductivity
Refueling Water Storage Tank	Aluminum, Boron, Calcium, Chloride Fluoride, Liquid Isotopic, Magnesium, pH, Silica, Suspended Solids
Boric Acid Storage Tank	Aluminum, Boron, Calcium, Chloride, Fluoride, Magnesium, Silica
Accumulator Tank	Boron, Chloride, Fluoride
Chemical Addition Tank	Chloride, Sodium Hydroxide
Boron Injection Tank	Boron
Casing Cooling Tank	Boron, Chloride, Fluoride, Liquid Isotopic, pH, Silica

Detection of Aging Effects

The Chemistry Control Program for Primary Systems is an aging effects *mitigation* activity which does not directly detect aging effects. The identification of out-of-specification water chemistry conditions indicates the potential for component degradation. The purpose of the Chemistry Control Program for Primary Systems is to maintain a coolant environment that minimizes material degradation.

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Monitoring and Trending

Water chemistry parameters are monitored and the results are trended to provide timely indication of abnormal chemistry conditions. Monitoring and trending guidelines, and sampling frequencies, are included in the Chemistry Control Program for Primary Systems. If adverse trends are indicated, corrective action is initiated prior to chemistry limits being reached. Trending of chemistry data provides a basis for confirming that sampling frequencies are appropriately set to continue the effective monitoring of chemistry trends.

Acceptance Criteria

The acceptance criteria reflect EPRI guidelines for parameters that have been shown to contribute to loss of material (general corrosion) and cracking (SCC). The Chemistry Control Program for Primary Systems maintains a sufficiently low concentration of oxygen that SCC is mitigated in the reactor coolant system. Adherence to the guidelines minimizes the aging effects of loss of material and cracking.

Corrective Actions

The Chemistry Control Program for Primary Systems provides action levels for chemistry parameter values that require corrective action. The purpose of various action levels is to place the plant in a condition such that degradation due to an adverse chemistry condition is minimized. If the deviation from the acceptable range is minimal, operation can continue for a short period of time or can be extended by performing an engineering evaluation that justifies continued operation without adversely affecting system integrity and operability. If the excursion is more severe, system integrity can be ensured only by reducing the power level, and, consequently, the coolant temperatures. In this way, the aggressiveness of the environment is reduced and degradation is minimized. If the excursion is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude recurrence.

For systems that contain primary coolant, Action Level 1 represents the level above which long-term system integrity could be jeopardized, if the parameter is not returned within its acceptable range as soon as practicable. Action Level 2 is applicable if the parameter reaches a level at which significant damage could occur in a relatively short time frame. For Action Level 3, the parameter has deviated sufficiently from its acceptable range that system integrity is a serious concern.

Action Level 1 requires returning the parameter to within the acceptable range in no more than seven days, or performing an evaluation to implement an alternative plan for corrective action. Upon reaching Action Level 2, an orderly shutdown is required if the parameter is outside the acceptable range longer than 24 hours. If Action Level 3 is reached, orderly shutdown is to be initiated immediately.

For all systems and components monitored by the Chemistry Control Program for Primary Systems, chemistry excursions that are frequent or severe utilize the Corrective Action System to resolve conditions that are adverse to quality.

Confirmation Process

The confirmation process for the Chemistry Control Program for Primary Systems involves continued monitoring of plant chemistry to provide reasonable assurance that parameters remain within their acceptable limits. If entry into an action level is required because of measured values exceeding acceptable limits, the confirmation process provides reasonable assurance that corrective actions have been properly completed to return the parameter to within acceptable limits, or that a compensatory power reduction has been implemented.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

Operating experience indicates that chemistry parameters can drift from their acceptable range, but that the Chemistry Control Program for Primary Systems is effective in identifying these anomalies, implementing corrective action, and trending the parameters. When chemistry results have reached a level at which loss of material or cracking could create a concern regarding the loss of intended function, immediate corrective actions have been implemented to minimize the necessity for a plant shutdown. The numerous component inspections that occur during preventive maintenance and corrective maintenance work activities confirm that there has been no significant degradation in the ability of components to perform their intended functions due to chemistry concerns.

Summary

The Chemistry Control Program for Primary Systems creates an environment that minimizes material degradation. Therefore, the effects of aging associated with components within the scope of the Chemistry Control Program for Primary Systems will

be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.5 Chemistry Control Program for Secondary Systems

The purpose of the Chemistry Control Program for Secondary Systems is to provide reasonable assurance that water quality is compatible with the materials of construction in the plant systems and equipment in order to minimize loss of material and cracking. The Chemistry Control Program for Secondary Systems creates an environment in which material degradation is minimized, therefore, maintaining material integrity and reducing the amount of corrosion product that could accumulate and interfere with equipment operation or heat transfer.

The Chemistry Control Program for Secondary Systems is based on the Electric Power Research Institute (EPRI) guidelines provided in Technical Report TR-102134, PWR Secondary Water Chemistry Guidelines (Reference 4). The EPRI guidelines reflect industry operating experience and are revised based on these experiences to optimize plant chemistry control. The Dominion chemistry control program is revised to maintain consistency with EPRI guidelines.

An evaluation of the Chemistry Control Program for Secondary Systems in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following systems and major components credit the Chemistry Control Program for Secondary Systems for managing the aging effects of loss of material and cracking.

System	AMR Results Section
Alternate AC Diesel Generator System	Section 3.3.4, Diesel Generator Support Systems
Auxiliary Steam	Section 3.4, Steam and Power Conversion Systems
Blowdown	Section 3.4, Steam and Power Conversion Systems
Chilled Water	Section 3.3.3, Closed Water Systems
Emergency Diesel Generator System	Section 3.3.4, Diesel Generator Support Systems
Feedwater	Section 3.4, Steam and Power Conversion Systems
Heating and Ventilation	Section 3.3.3, Closed Water Systems
Liquid and Solid Waste	Section 3.3.7, Drain and Liquid Processing Systems

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Main Steam	Section 3.4, Steam and Power Conversion Systems
Sampling System	Section 3.3.1, Primary Process Systems
Security	Section 3.3.4, Diesel Generator Support Systems
Steam Drains	Section 3.4, Steam and Power Conversion Systems

Major Component	**AMR Results Section**
Steam Generator	Section 3.1.5, Steam Generator

Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review).

The scope of the Chemistry Control Program for Secondary Systems monitors fluids in the following systems and components:

- Condensate Storage Tanks
- Condensate System (Alternate Amine Chemistry)
- Condensate Polishing
- Feedwater (Alternate Amine Chemistry)
- Steam Generators (Alternate Amine Chemistry)
- Main Steam
- Steam Generator Wet-Layup
- Diesel Generator Cooling
- Station Makeup Water
- Air Conditioning

Preventive Actions

The Chemistry Control Program for Secondary Systems is a set of mitigative activities utilized to maintain water chemistry that is compatible with the materials used in the construction of plant systems and equipment. The aging effects to be mitigated through the Chemistry Control Program for Secondary Systems are loss of material and cracking.

Parameters Monitored or Inspected

The parameters that are currently monitored by the Chemistry Control Program for Secondary Systems in accordance with the EPRI guidelines are summarized below. The scope of parameters monitored and their acceptable ranges vary depending on the mode of plant operation, (i.e., operation at full power, operation at a reduced power level, hot standby operation, or plant shutdown).

Monitored Secondary Chemistry Parameters

System/Component	Chemistry Parameters
Condensate Storage Tanks	Silica, Sodium, Total Organic Carbon (not required if makeup water is analyzed for TOC)
Condensate	Ammonia, Cation Conductivity, Ethanolamine, Hydrazine, Oxygen, pH, Sodium, Specific Conductivity
Condensate Polishing	Cation Conductivity, Silica, Sodium, Specific Conductivity, Resin fines (when in demineralizer mode versus filter mode)
Feedwater	Acetate, Ammonia, Cation Conductivity, Copper, Formate, Hydrazine, Iron, Ethanolamine, Oxygen, pH, Sodium, Specific Conductivity
Steam Generator	Acetate, Ammonia, Blowdown Rate, Cation Conductivity, Chloride, Formate, Gross Activity, Liquid Isotopic, Molar Ratio (Sodium Chloride), Ethanolamine, pH, Silica, Sodium, Specific Conductivity, Sulfate, Primary-to-secondary Leakrate
Main Steam	Cation Conductivity (monitored in one loop), Chloride (analysis required if corresponding S/G exceeds Action Level 1, Oxygen (analysis required if condensate dissolved oxygen exceeds hotwell Action Level 2), Silica (analysis required if corresponding S/G exceeds Action Level 1), Sodium (analysis required if corresponding S/G exceeds Action Level 1), Sulfate (analysis required if corresponding S/G exceeds Action Level 1)
Steam Generator Wet Layup	Ammonia, Chloride, Hydrazine, pH, Sodium, Sulfate

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System/Component	Chemistry Parameters
Diesel Generator Cooling	Corrosion Inhibitor, Glycol Percent (Conditioner), pH (Boron-nitrite and Glycol Treatment)
Station Makeup Water	Specific Conductivity, Silica, Sodium, Dissolved Oxygen, Total Organic Carbon
Air Conditioning	Corrosion Inhibitor, pH, Specific Conductivity

Detection of Aging Effects

The Chemistry Control Program for Secondary Systems is an aging effects *mitigation* activity which does not directly detect aging effects. The identification of out-of-specification water chemistry conditions indicates the potential for component degradation. The purpose of the Chemistry Control Program for Secondary Systems is to maintain a fluid environment that minimizes material degradation.

Monitoring and Trending

Water chemistry parameters are monitored and the results are trended in order to provide timely indication of abnormal chemistry conditions. Monitoring and trending guidelines, and sampling frequencies, are included in the Chemistry Control Program for Secondary Systems. If adverse trends are indicated, corrective actions are initiated prior to chemistry limits being reached. Trending of chemistry data provides a basis for confirming that sampling frequencies are appropriately set to continue the effective monitoring of chemistry trends.

Acceptance Criteria

The acceptance criteria reflect EPRI guidelines for parameters on the secondary side that have been shown to contribute to component degradation. Adherence to the guidelines minimizes loss of material and cracking.

Corrective Actions

The Chemistry Control Program for Secondary Systems provides action levels for chemistry parameter values that require corrective action. The purpose of action levels is to place the plant in a condition such that degradation due to an adverse chemistry condition is minimized. If the deviation from the acceptable range is minimal, operation can continue for a short period of time or can be extended by performing an engineering evaluation that justifies continued operation without adversely affecting system integrity and operability. If the excursion is more severe, system integrity can be ensured only by reducing the power level, and, consequently, the coolant temperatures. In this way, the

aggressiveness of the environment is reduced and degradation is minimized. If the excursion is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude recurrence.

For the secondary coolant systems, Action Level 1 represents the level above which long-term system integrity could be jeopardized, if the parameter is not returned within its acceptable range as soon as practicable. Action Level 2 is applicable if the parameter reaches a level at which significant damage could occur in a relatively short time frame. For Action Level 3, the parameter has deviated sufficiently from its acceptable range that system integrity is a serious concern.

Action Level 1 requires returning the parameter to within the acceptable range as soon as possible following confirmation of excursion. A transition to Level 2 is required if the deviation exceeds Action Level 2 criteria, or if Action Level 1 criteria (for parameters that have Level 2 criteria) have not been corrected within seven days. Upon reaching Action Level 2, a power reduction is to be initiated. If Action Level 3 is reached, an orderly shutdown is to be initiated immediately.

For all systems and components monitored by the Chemistry Control Program for Secondary Systems, chemistry excursions that are frequent or severe utilize the Corrective Action System to resolve conditions that are adverse to quality.

Confirmation Process

The confirmation process for the Chemistry Control Program for Secondary Systems involves continued monitoring of plant chemistry to provide reasonable assurance that parameters remain within their acceptable limits. Where continuous monitors are installed, these indications are compared to lab sample results. The ongoing surveillance activities for loss of material and cracking provide confirmation that the requirements of the Chemistry Control Program for Secondary Systems are appropriate.

If entry into an action level is required because of measured values exceeding acceptable limits, the confirmation process provides reasonable assurance that corrective actions have been properly completed to return the parameter to within acceptable limits, or that a compensatory power reduction has been implemented.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

Operating experience indicates that chemistry parameters can drift from their acceptable range, but that the Chemistry Control Program for Secondary Systems is effective in identifying these anomalies, implementing corrective action, and trending the parameters. When chemistry results have reached a level at which loss of material could create a concern regarding loss of intended function, plant power reductions have been implemented until corrective actions were completed. With the exception of tubing in steam generators that already have been replaced, the numerous component inspections that occur during preventive maintenance and corrective maintenance work activities confirm that there has been no significant degradation of the ability of components to perform their intended functions due to coolant chemistry concerns. Changes in tubing materials and changes in chemistry controls have resulted in excellent performance for tubing in the replacement steam generators.

Summary

The Chemistry Control Program for Secondary Systems creates an environment that minimizes material degradation. The effects of aging associated with components within the scope of the Chemistry Control Program for Secondary Systems will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.6 Civil Engineering Structural Inspection

The Maintenance Rule, 10 CFR 50.65, requires licensees to monitor the performance or condition of structures against established goals. During the period of extended operation, the provisions of the Maintenance Rule Program will be utilized to reasonably assure the continuing capability of civil engineering structures to fulfill their intended functions. Structural monitoring inspections are primarily visual inspections. Criteria for the engineering evaluation of concrete structures are based on recommendations in ACI-349-3R (Reference 9).

A visual indication of: 1) loss of material for concrete and structural steel, 2) significant cracking for concrete and masonry walls, and 3) loss of material or loss of form for soil each requires an engineering evaluation.

Inspections are performed by trained inspectors and include representative samples of both the interior and exterior surfaces of structures. Inspection results are evaluated by Engineering personnel who determine whether analysis, repair, or additional inspections or testing are required to reasonably assure that structures continue to fulfill their intended functions.

Some structural components may be inaccessible. In lieu of performing actual inspections for these inaccessible areas, monitoring of adjacent accessible components in similar environments is performed to determine the condition in the inaccessible areas. If an inaccessible area becomes accessible by such means as dewatering, excavation or shielding installation, an opportunity exist for additional inspections. This approach is consistent with the guidance of 10 CFR 50.55a(b)(2)(ix) for the containment structure.

Inspections of masonry walls are included in this activity. The inspections check for cracks of joints and missing or broken blocks.

An evaluation of the program for Civil Engineering Structural Inspections in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following structures credit the Civil Engineering Structural Inspection for managing the aging effects of cracking, loss of form, and loss of material.

Structure	AMR Results Section
Auxiliary Building	Section 3.5.2, Auxiliary Building Structure
Auxiliary Feedwater Tunnel	Section 3.5.3, Other Class I Structures
Auxiliary Service Water Expansion Joint Enclosure	Section 3.5.7, Yard Structures
Casing Cooling Pump House	Section 3.5.3, Other Class I Structures
Containment	Section 3.5.1, Containment
Quench Spray Pump Building	Section 3.5.3, Other Class I Structures
Emergency Condensate Storage Tank Foundation/Missile Barrier	Section 3.5.7, Yard Structures
Flood Wall West of Turbine Building	Section 3.5.8, Earthen Structures
Fuel Building	Section 3.5.4, Fuel Building
Intake Structure	Section 3.5.6, Intake Structures
Main Steam Valve House	Section 3.5.3, Other Class I Structures
Manholes	Section 3.5.7, Yard Structures
Refueling Water Storage Tank Foundation	Section 3.5.7, Yard Structures
Safeguards Building	Section 3.5.3, Other Class I Structures
Security Lighting Poles	Section 3.5.7, Yard Structures
Service Building	Section 3.5.5, Miscellaneous Structures
Service Water Expansion Joint Enclosure	Section 3.5.3, Other Class I Structures
Service Water Pump House	Section 3.5.3, Other Class I Structures

Service Water Reservoir	Section 3.5.8, Earthen Structures
Service Water Tie-in Vault	Section 3.5.3, Other Class I Structures
Service Water Valve house	Section 3.5.3, Other Class I Structures
Station Blackout Building	Section 3.5.5, Miscellaneous Structures
Turbine Building	Section 3.5.5, Miscellaneous Structures

Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review).

As a Licensee Follow-up Action, Dominion will expand the scope of Civil Engineering Structural inspections to bound the scope of inspections required for license renewal. This expansion will be implemented prior to the end of the current operating license.

The inspection interval typically is five years, but additional inspections may be performed if degradation is observed. Certain structures, or areas of structures, that are infrequently accessed due to radiation, high temperature, or obstructions are subjected to one-time inspections in accordance with the Infrequently Accessed Area Inspection Activities. This inspection will occur between years 30 and 40 of the current license. Engineering evaluation of inspection results will determine the need for any subsequent inspections.

In accordance with guidance provided in 10 CFR 50.55a(b)(2)(ix), assessment of the buried portions of a containment structure can be based on examinations for similar accessible areas. The same approach of using examinations of accessible components may be used to infer the condition of certain inaccessible structural components constructed of concrete, steel, or elastomers.

If an inaccessible area becomes accessible by such means as dewatering, excavation or installation of shielding, an opportunity will exist for additional inspections. A Licensee Follow-up Action will be initiated to provide direction in plant documents to take advantage of such inspection opportunities when they arise for inaccessible areas. This guidance will be provided prior to the end of the current operating license. For inaccessible structural components exposed to groundwater, the values for sulfate, chloride, and pH in the groundwater are monitored to verify that the exposed components do not experience an aggressive environment.

Not all portions of the structures listed above, or components within the structures, are necessarily within the scope of license renewal. Specific details are contained within the license renewal project scoping documents.

Preventive Actions

The Civil Engineering Structural Inspection activities are designated *Condition Monitoring*. No preventive actions are performed.

Parameters Monitored or Inspected

Various concrete, masonry wall, steel, and earthen structures parameters are monitored to reasonably assure that degradation does not lead to the loss of their intended function. These include:

- For concrete structures, both internal and external inspections look for spalling, cracks (other than hairline), delaminations, honeycombs, water in-leakage, chemical leaching, peeling paint, and discoloration. However, for structural concrete located only in a sheltered air environment, there are no aging effects requiring management.
- For masonry walls, inspections check for cracks of joints and missing or broken blocks.
- For steel structures, inspections look for deformation, alteration, and significant rust on structural members; loose, missing, and damaged anchors, fasteners, and pads; missing and degraded grout under base plates; and cracked welds.
- For earthen structures, inspections look for erosion, cracking, depressed areas, evidence of shifting, settlement, movement, seepage, and leakage.

Detection of Aging Effects

The following aging effects are detected by visual inspections:

- Cracking
- Loss of material
- Loss of form

Visual inspections include direct inspection of exposed surfaces. Evaluation of inspection results may require additional tasks such as (1) crack and discontinuity mapping, (2) physical dimensioning, (3) environmental surveying, or (4) protective coatings examination. The scope of the visual inspection includes all exposed surfaces of the structure, as well as attached components such as base plates and anchor bolts for structural columns.

Monitoring and Trending

Structural monitoring activities are intended to assess the overall condition of structures. The inspection activities, which are typically performed at a frequency of once per five years, rely on visual examinations of components in accessible areas during planned plant walkdowns. An inspection log is used to document the findings of the examinations.

Photographs or videotapes may be used to provide additional documentation of the findings. Documentation of inspection results includes a general description of observed conditions, the location and size of discontinuities, and the noted effects of environmental conditions. Inspection results of notable anomalies, as determined by engineering evaluation, are retained in Station Records.

Acceptance Criteria

The acceptance criterion for visual inspections is the absence of anomalous indications that are signs of degradation. Responsibility for the evaluation of inspection results is assigned to Engineering. The engineering evaluation determines whether analysis, repair, or additional inspection or testing is required to reasonably assure that structures will continue to fulfill their intended functions. Occurrence of degradation that is adverse to quality is entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

The Civil Engineering Structural Inspection activities are proving effective in identifying degradation of structures, documenting the observed condition, and implementing corrective actions. The success of these activities allows aging effects to be adequately managed. Aging management provides reasonable assurance that the integrity of concrete, steel, and earthen structures is being maintained so that they will continue to fulfill their intended functions.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

The Civil Engineering Structural Inspection activities are founded on the requirements of the Maintenance Rule (10CFR50.65).

Aging effects of civil engineering structures are noted during routine inspections, and corrective actions are taken as necessary, following engineering evaluation, to reasonably assure that the structures fulfill their intended functions. This is an ongoing process that will continue through the period of extended operation. The structural inspections that have been performed for compliance with the Maintenance Rule (and will continue for purposes of license renewal as well as the Maintenance Rule) have been effective in identifying and correcting structural problems.

Summary

Operating experience indicates that the existing inspection and corrective action activities have successfully maintained the integrity of components within the scope of structural inspections. As a Licensee Follow-up Action, Dominion will expand the scope of Civil Engineering Structural inspections to bound the scope of inspections required for license renewal. A Licensee Follow-up Action will also be initiated to provide direction in plant documents to take advantage of inspection opportunities when they arise for inaccessible areas. These activities are outlined in Section B4.0, Licensee Follow-up Actions of this appendix.

The effects of aging associated with components within the scope of the Civil Engineering Structural Inspection will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.7 Fire Protection Program

Regulatory requirements associated with fire protection systems and implementation plans are provided in 10 CFR 50.48 and 10 CFR 50, Appendix R. The Fire Protection Plan includes applicable National Fire Protection Association commitments and maintains compliance with NRC Branch Technical Position (BTP) 9.5-1 as mentioned in Section 3 of the Standard Review Plan (Reference 5). Aging effects to be addressed for fire protection components include loss of material, heat removal degradation, change in material properties, and separation and cracking/delamination. These aging effects are applicable regardless of whether the fire protection piping contains dry air or is filled with water. Aging management concerns related to fire protection involve visual inspections of fire barriers, including doors, walls, floors, ceilings, penetration seals, fire-retardant coatings (including fire wraps), fire dampers, cable-tray covers and fire stops. Visual inspections also are performed for fire protection equipment including hose stations, hydrants, and sprinklers. Verification of system performance is accomplished by flow tests that are conducted periodically. Verification of system piping integrity (to maintain a pressure boundary for the fire protection system) is accomplished by periodic testing and pressure monitoring.

The station is equipped with a reactor coolant pump (RCP) oil collection system. NRC Information Notice 94-58 (Reference 6) was reviewed for applicability to the station Fire Protection Program. The system materials do not require aging management. The IE Notice is related solely to design considerations and is, therefore, not applicable to License Renewal.

A Licensee Follow-up Action has been identified to revise the Fire Protection Plan to include the replacement or testing of a representative sample of sprinklers that have been in service for 50 years. This task conforms to the requirements of National Fire Protection Association, NFPA-25, Section 2-3.1.1, and will be performed during the period of extended operation. These requirements are not applicable within the time frame of the current operating license.

An evaluation of the Fire Protection Program in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following systems and commodities credit the Fire Protection Program for managing the aging effects of loss of material, separation and cracking/delamination, heat transfer degradation, and change in material properties.

System	AMR Results Section
Fire Protection	Section 3.3.9, Fire Protection and Supporting Systems
Reactor Coolant System	Section 3.3.9, Fire Protection and Supporting Systems

Commodity	AMR Results Section
Miscellaneous Structural Commodities	Section 3.5.11, Miscellaneous Structural Commodities

Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review). The reactor coolant pump oil collection components are included in the Fire Protection System for Surry but in the Reactor Coolant System for North Anna.

The scope of aging management activities for the Fire Protection Program includes barriers (i.e., doors, walls, floors, ceilings, penetration seals, fire-retardant coatings, dampers, cable-tray covers, and fire stops). Piping systems that are dry, or that carry water, are evaluated consistently with similar mechanical systems. This includes such components as pump casings, valve bodies, hose stations, hydrants, and sprinklers. The reactor coolant pump oil collection systems, which are installed for fire protection, also are in scope for license renewal.

Preventative Actions

The aging management activities associated with fire protection components are designated *Condition Monitoring* and *Performance Monitoring*. No preventive actions are performed by this program.

Parameters Monitored or Inspected

Fire barriers are examined for cracking, breaks, holes, and gaps. Doors are verified to be capable of complete closure and latching, and able to fit properly in their frames. Penetration seals are checked for an adequate amount of fire-stop material.

Fire-retardant coatings, cable tray covers, and cable tray fire stops are checked for integrity. Components such as hose stations and hydrants are inspected visually for indications of degradation. Dampers are verified to be free of corrosion that could interfere with their closure. The water systems for fire protection are monitored for adequate system performance and integrity, as indicated by pressure and flow measurements.

Detection of Aging Effects

Degradation of fire protection components is detected by visual examination to reasonably assure the absence of loss of material, separation and cracking/delamination, and change in material properties. The fire protection water system's performance and pressure boundary integrity are monitored by verifying acceptable values of pressure and flow in the underground fire water distribution system. Testing of the fire protection pumps provides indication of heat transfer degradation, and inspections of the pumps provide indication of loss of material.

Air flow testing and visual inspections of sprinklers along dry portions of fire protection piping confirm the absence of blockage. Water flow tests of the deluge system for the station service and main transformers confirm the absence of flow blockage for the entire line from the main header to the spray nozzles.

Monitoring and Trending

Fire barriers are typically inspected visually at 18-month intervals, except that doors are inspected more frequently. Various types of fire protection equipment are visually inspected at frequencies that vary from 31 days to 3 years. The integrity and performance of the fire protection systems are monitored by testing that typically is performed at 18-month intervals. The pressure retaining capability of the main fire protection loop is provided by continuous monitoring of the level and pressure in the hydro-pneumatic tank.

Observations of degraded fire barriers or equipment, or diminished capability of fire protection systems, are documented in inspection and testing procedures. Engineering evaluations determine the extent of corrective actions necessary to maintain fire protection capability.

Acceptance Criteria

Fire protection equipment is examined for indications of visible damage. The acceptance criterion for visual inspections is the absence of anomalous indications that are signs of degradation. Acceptable sizes for breaks, holes, cracks, gaps, or clearances in fire

barriers, and acceptable amounts of sealant in penetrations are established in the inspection procedures. Any questions regarding the ability of the barrier to fulfill its fire protection function are addressed by engineering evaluation. Acceptance criteria for performance tests (i.e., flow and pressure tests) are provided in the appropriate test procedures. Occurrence of degradation that is adverse to quality is entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

Periodic visual inspections and performance testing of the fire protection system and components provide confirmation of integrity. The absence of significant degradation of fire suppression capability confirms the effectiveness of the inspection and testing activities, as well as the Corrective Action System, which effects any repairs that are necessary.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

Component inspections and surveillance tests are performed consistently with guidance provided by NFPA. Degradation of fire barriers has occurred at doors and penetration seals, and is corrected promptly when found through routine walkdowns or planned inspections. Surveillance tests have been performed routinely, and have not identified any significant degradation of the fire suppression system.

Summary

Review of operating experience has indicated no significant problems with fire protection barriers and systems. A Licensee Follow-up Action has been identified to revise the Fire Protection Plan to include the replacement or testing of a representative sample of sprinklers that have been in service for 50 years. This requirement is not applicable within the time frame of the current operating license. This activity is outlined in Section B4.0, Licensee Follow-up Actions of this appendix.

The effects of aging associated with components within the scope of the Fire Protection Program will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.8 Fuel Oil Chemistry

The Fuel Oil Chemistry program manages loss of material by controlling oil quality so that it is compatible with the materials of construction in plant systems and equipment. Poor fuel oil quality could lead either to degradation of storage tanks or accumulations of particulates or biological growth that would interfere with the operation of safety-related equipment. A set of fuel oil analyses, with minimum sampling frequencies and acceptance limits, is identified in the Fuel Oil Chemistry program. The specified limits are intended to reduce the likelihood of loss of material within the fuel oil system. In addition, fuel oil is sampled and preliminary tests are performed prior to any transfer to supply tanks for safety-related equipment.

An evaluation of the program for Fuel Oil Chemistry in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following systems credit the Fuel Oil Chemistry program for managing the aging effect of loss of material.

System	AMR Results Section
Alternate AC Diesel Generator System	Section 3.3.4, Diesel Generator Support Systems
Emergency Diesel Generator System	Section 3.3.4, Diesel Generator Support Systems
Fire Protection	Section 3.3.9, Fire Protection and Supporting Systems
Security	Section 3.3.4, Diesel Generator Support Systems

Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review).

The Fuel Oil Chemistry program involves sampling and testing of fuel oil for equipment related to License Renewal. Acceptable fuel oil quality is required to maintain the integrity of the fuel oil system.

Specific tanks for which Fuel Oil Chemistry criteria apply are included in the following list:

- Above-ground fuel oil storage tank
- Underground emergency diesel generator fuel oil tanks

- Diesel generator day tanks
- Fire pump fuel oil tank
- Security diesel generator fuel oil tank
- Station AAC diesel fuel oil tank

Preventive Actions

The Fuel Oil Chemistry sampling and testing activities are *mitigative*. Acceptable fuel oil quality is required to maintain the integrity of the system. Fuel oil sampling and testing mitigate the aging effects of loss of material in the fuel oil system.

Parameters Monitored or Inspected

The following table lists the fuel oil parameters that are monitored and the applicable reference document for each parameter.

Monitored Fuel Oil Chemistry Parameters

Parameter	Reference
API Gravity at 60° F API	ASTM D-287
Ash, Percent by weight	ASTM D-482
Bacteria, Aerobic and Sulfate Reducing	Vendor literature
Carbon residue (10% bottoms), percent by weight.	ASTM D-524
Cetane index, calculated	ASTM D-976
Cloud point, ° F.	ASTM D-2500
Copper strip corrosion (maximum)	ASTM D-130
Distillation 90% evaporated	ASTM D-86
Flash point, ° F.	ASTM D-93
Particulate testing, mg/l	ASTM D-2276
Water and sediment, percent by volume	ASTM D-1796
Sulfur, percent by weight	ASTM D-1552, D-129, D-2622, or D-4294
Viscosity CST at 100° F.	ASTM D-445
Viscosity SUS at 100° F	ASTM D-88 or D-445

Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Detection of Aging Effects

The Fuel Oil Chemistry program is an aging effects mitigation activity that does not directly detect aging effects. The purpose of the program is to minimize the existence of contaminants such as water, sediment, and bacteria that could degrade fuel oil quality and damage the fuel oil system.

Monitoring and Trending

Sampling and testing of stored fuel oil are performed at a frequency of once per calendar quarter. This sampling and analysis provides the opportunity to detect fuel oil conditions that could lead to internal tank degradation, so that corrective action can be initiated in a timely manner.

In addition, following a new delivery of fuel oil, the fuel oil is sampled and successfully tested for viscosity and water/sediment content prior to any transfer to supply tanks for safety-related equipment.

Results of fuel oil sampling are documented in controlled procedures.

Acceptance Criteria

Acceptance criterion for the measured fuel oil parameters is the absence of anomalous indications that are signs of degradation. The acceptance criteria reflect ASTM guidelines for parameters that have been shown to contribute to component degradation. Adherence to the guidelines mitigates the aging effect of loss of material. Parameters analyzed and found to be outside established limits will be reported to Engineering, and an evaluation will be performed. Occurrence of a significant deviation that is adverse to quality will be entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Filtering of tank contents, cleaning of tanks, and the addition of biocide are among the corrective actions that are considered during the engineering evaluation of increased levels of water, sediment, or bacteria.

Confirmation Process

The confirmation process for the Fuel Oil Chemistry involves sampling and testing each calendar quarter to provide reasonable assurance that parameters remain within acceptable limits. If corrective actions are necessary, follow-up sampling and testing confirm the completeness of corrective actions.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

Past operating experience at Surry identified a biofouling problem in underground fuel oil storage tanks. Corrective action included cleaning the tank, verifying tank integrity, and refilling the tank with biocide-treated fuel oil. Subsequent enhancements to the Fuel Oil Chemistry program include bacteria sampling and addition of biocide as necessary. Fuel Oil tank inspections performed at North Anna in accordance with station Technical Specifications have verified that tank integrity has been maintained.

An event occurred at Surry for which the initial analysis of fuel oil following a new delivery to a non-safety related fuel oil storage tank did not identify that the flash point was out of specifications. The out-of-specification condition was identified during a detailed analysis of the fuel oil several days later. As a result, the scope of the initial analysis was changed at Surry and North Anna to include flash point determination.

Summary

The Fuel Oil Chemistry program maintains suitable fuel oil quality in the fuel oil storage tanks and transfer lines to minimize material degradation.

The effects of aging associated with components within the scope of the Fuel Oil Chemistry program will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.9 General Condition Monitoring Activities

General Condition Monitoring Activities are performed for the assessment and management of aging for components that are located in normally accessible areas. The results of this monitoring are the basis for initiating required corrective action in a timely manner.

An evaluation of the General Condition Monitoring Activities in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

General Condition Monitoring Activities only applies to areas of the plant that contain equipment that is within the scope of license renewal. Aging Management Reviews for the following systems, structures, and commodities credit the General Condition Monitoring Activities for managing the aging effects of loss of material, change in material properties, and cracking.

Additionally, General Condition Monitoring Activities are credited for managing the aging effect of separation and cracking/delamination.

System	AMR Results Section
Alternate AC Diesel Generator System	Section 3.3.4, Diesel Generator Support Systems
Blowdown	Section 3.4, Steam and Power Conversion Systems
Boron Recovery	Section 3.3.7, Drain and Liquid Processing Systems
Chemical and Volume Control	Section 3.3.1, Primary Process Systems
Chilled Water	Section 3.3.3, Closed Water Systems
Component Cooling Water	Section 3.3.3, Closed Water Systems
Containment Vacuum	Section 3.3.6, Ventilation and Vacuum Systems
	Section 3.3.3, Closed Water Systems
Quench Spray	Section 3.2, Engineered Safety Features
Drains - Aerated	Section 3.3.7, Drain and Liquid Processing Systems

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Drains - Gaseous	Section 3.3.7, Drain and Liquid Processing Systems
Emergency Diesel Generator System	Section 3.3.4, Diesel Generator Support Systems
Feedwater	Section 3.4, Steam and Power Conversion Systems
Fire Protection	Section 3.3.9, Fire Protection and Supporting Systems
Fuel Pit Cooling	Section 3.2, Engineered Safety Features
Heating and Ventilation	Section 3.3.6, Ventilation and Vacuum Systems
	Section 3.3.2, Open Water Systems
	Section 3.3.3, Closed Water Systems
High Radiation Sampling	Section 3.3.1, Primary Process Systems
Instrument Air	Section 3.3.5, Air and Gas Systems
	Section 3.3.2, Open Water Systems
Leakage Monitoring	Section 3.3.6, Ventilation and Vacuum Systems
Liquid and Solid Waste	Section 3.3.7, Drain and Liquid Processing Systems
Neutron Shield Tank Cooling	Section 3.3.3, Closed Water Systems
Post-Accident Hydrogen Removal	Section 3.3.8, Vent and Gaseous Processing Systems
Primary and Secondary Plant Gas Supply	Section 3.3.5, Air and Gas Systems
Radiation Monitoring	Section 3.3.8, Vent and Gaseous Processing Systems
Refueling Purification	Section 3.3.1, Primary Process Systems
Reactor Coolant System	Section 3.1.1, Reactor Coolant System
Reactor Coolant System	Section 3.3.3, Closed Water Systems
Recirculation Spray	Section 3.2, Engineered Safety Features
Residual Heat Removal	Section 3.2, Engineered Safety Features
Safety Injection	Section 3.2, Engineered Safety Features

Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

Sampling System	Section 3.3.1, Primary Process Systems
Security	Section 3.3.4, Diesel Generator Support Systems
Service Air	Section 3.3.5, Air and Gas Systems
Service Water	Section 3.3.2, Open Water Systems
Steam Generator Water Treatment	Section 3.4, Steam and Power Conversion Systems

Structure	**AMR Results Section**
Auxiliary Building	Section 3.5.2, Auxiliary Building Structure
Casing Cooling Pump House	Section 3.5.3, Other Class I Structures
Containment	Section 3.5.1, Containment
Quench Spray Pump House	Section 3.5.3, Other Class I Structures
Fuel Building	Section 3.5.4, Fuel Building
Load Handling Cranes and Devices	Section 3.5.12, Load-handling Cranes and Devices
Main Steam Valve House	Section 3.5.3, Other Class I Structures
Safeguards Building	Section 3.5.3, Other Class I Structures
Service Building	Section 3.5.5, Miscellaneous Structures
Service Water Pump House	Section 3.5.3, Other Class I Structures
Service Water Valve house	Section 3.5.3, Other Class I Structures
Turbine Building	Section 3.5.5, Miscellaneous Structures

Commodity	**AMR Results Section**
General Structural Supports	Section 3.5.10, General Structural Supports
Miscellaneous Structural Commodities	Section 3.5.11, Miscellaneous Structural Commodities

Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review).

Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

The General Condition Monitoring Activities are performed in three different ways:

- Inspections of radiologically controlled areas - Boric acid leakage in areas outside Containment is identified during area observations that are made by health physics technicians while performing Radiological Controlled Area surveys. These surveys are performed at least once per week.
- Periodic inspections - System Engineering performs walkdown inspections of piping and equipment both during normal operation and during refueling outages. Inspections may involve preparations, such as the installation of scaffolding or the removal of insulation, to perform a more thorough examination.
- Area inspections for condition of supports and doors - Periodic inspections of structures are performed by Engineering to provide compliance with Maintenance Rule (10 CFR 50.65) requirements. Documented guidance helps ensure that thorough and consistent inspections are performed. Similar to these inspections, periodic area inspections will be performed by Engineering to determine the condition of supports and doors. Supports for major equipment, piping, cables, and general plant components will be included. Doors within areas within the scope of license renewal will be included. Procedural guidance will be developed to help ensure that thorough and consistent inspections are performed.

Preventive Actions

The General Condition Monitoring Activities are designated *Condition Monitoring*. No preventive actions are performed.

Parameters Monitored or Inspected

Inspections by Engineering personnel check the condition of components, equipment, and supports; and provide compliance with the requirements of the Maintenance Rule, 10 CFR 50.65. The following types of degradation or adverse conditions can be detected by visual inspections:

- Component leakage.
- Rust or corrosion products.
- Peeling, bubbling, or flaking coatings.
- Indications of chemical attack.
- Corroded fasteners.
- Cracking (of concrete, supports, equipment, sealants).

- Bubbled, discolored, or cracked electrical insulation.
- Damaged or missing thermal insulation (the concern being material integrity, but not thermal performance).
- Deformed or mispositioned piping and cable supports.
- Wastage due to boric acid leakage.

Walkdowns in radiologically controlled areas by Health Physics personnel check for borated water leakage.

Detection of Aging Effects

The external condition of supports, piping, doors, and equipment is determined by visual inspection. These inspections provide information to manage the aging effects of loss of material, change in material properties, and cracking.

Additionally, General Condition Monitoring Activities are credited for managing the aging effect of separation and cracking/delamination.

As a Licensee Follow-up Action, additional procedural guidance will be developed to direct thorough and consistent inspections of component supports and doors. Initial inspections will be completed, using the additional guidance, prior to the end of the current operating license.

Monitoring and Trending

Visual monitoring of the supports, piping, doors, and equipment in normally accessed areas is accomplished with a spaces approach using guidance provided in administrative procedures. The inspection frequency varies from weekly to once per refueling outage. Observations of significant degradation are identified for engineering evaluation.

As a Licensee Follow-up Action, procedural guidance will be developed for engineers and health physics technicians regarding inspection criteria that focus on detection of aging effects during General Condition Monitoring Activities. The guidance will be developed prior to the end of the current operating license.

Acceptance Criteria

The acceptance criterion for visual inspections is the absence of anomalous indications that are signs of degradation. Responsibility for the evaluation of visual indications is assigned to Engineering personnel. Evaluations of anomalies found during General

Condition Monitoring Activities determine whether analysis, repair, or further inspection is required. Occurrence of degradation that is adverse to quality is entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

If anomalies are found during the monitoring of normally accessed areas such that repairs are needed, corrective action is implemented. If degradation is determined to be a recurrent concern and additional confirmation is needed to minimize degradation, engineering evaluation will recommend periodic inspections.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

The effects of aging are found in normally accessed areas during routine work tasks and inspections. Engineering evaluations and corrective actions are implemented, as necessary, to correct conditions that are adverse to quality. Significant degradation due to aging effects, which requires management, is not typical. Minor degradation is resolved by the Work Control Process. Inspection results for visits from outside organizations such as INPO confirm a continuing high level of management attention to maintaining plant integrity.

Summary

Inspections and evaluations are performed by Engineering personnel. Walkdowns in radiologically controlled areas by health physics personnel check for borated water leakage. As a Licensee Follow-up Action, procedural guidance will be developed to direct thorough and consistent inspection of component supports and doors. Additionally, as a Licensee Follow-up Action, procedural guidance will be developed for engineers and health physics technicians regarding inspection criteria that focus on detection of aging effects during General Condition Monitoring Activities. These activities are outlined in Section B4.0, Licensee Follow-up Actions of this appendix.

The effects of aging associated with supports, piping, doors, and equipment within the scope of the General Condition Monitoring Activities will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.10 Inspection Activities - Load Handling Cranes and Devices

The aging management documents for Inspection Activities - Load Handling Cranes and Devices has been developed in compliance with ASME B30.2 (Reference 16) for cranes and ASME B30.11 (Reference 17) for monorails. Inspection Activities - Load Handling Cranes and Devices also addresses applicable load handling concerns identified in NUREG-0612 (Reference 18) for those cranes designated as heavy-load cranes. This includes the safety related Containment polar cranes which are within the scope of this AMA. In addition, certain load handling cranes and devices of importance to plant operations have been specifically identified for inclusion within the scope of license renewal.

The Work Control Process directs structural integrity inspections of applicable cranes which includes steps to check the condition of structural girders on the cranes, and the runways along which the cranes move. The visual inspection of the girders checks for corrosion. The aging effect of concern is loss of material.

Crane inspections do not include examination of the building structures that support the cranes. The building structures are examined through the Civil Engineering Structural Inspection activities.

An evaluation of the Inspection Activities - Load Handling Cranes and Devices in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following structures credit the Inspection Activities - Load Handling Cranes and Devices for managing the aging effect of loss of material.

Structures	AMR Results Section
Load Handling Cranes and Devices	Section 3.5.12, Load-handling Cranes and Devices

The load handling cranes within the scope of Inspection Activities - Load Handling Cranes and Devices are listed below:

- Containment polar cranes
- Containment jib crane
- Containment annulus monorail
- Refueling manipulator crane
- Fuel handling bridge crane

- New fuel transfer elevator
- Spent fuel crane
- Auxiliary Building monorails

The long-lived passive components of these cranes that are subject to aging management review include rails, towers, load trolley steel, fasteners, base plates, and anchorage.

Preventive Actions

The Inspection Activities - Load Handling Cranes and Devices are designated *Condition Monitoring*. No preventive actions are performed.

Parameters Monitored or Inspected

Inspection Activities - Load Handling Cranes and Devices include the overall condition of the cranes and monorails, but they also include specific steps for checking the condition of the structural members (i.e., rails and towers) and fasteners on the cranes and lifting devices, the runways along which the cranes move, and the baseplates and anchorages for the runways and monorails. A Licensee Follow-up Action will be initiated to implement a one-time internal inspection of a representative sample of the box girders for the polar cranes. The inspection will be performed between year 30 and the end of the current operating license.

Detection of Aging Effects

Loss of material is an aging effect associated with the load handling cranes and devices. Loss of material is found by visual inspections.

Monitoring and Trending

Cranes and devices located inside Containment are inspected at a frequency of once per fuel cycle. The cranes outside Containment are inspected annually. Results are recorded in the applicable inspection procedures.

Acceptance Criteria

The acceptance criterion for visual inspections is the absence of anomalous indications that are signs of degradation. Identified discrepancies are corrected. If the discrepancy cannot be resolved as part of the inspection, appropriate notations are made in the inspection procedure or work control document, and the discrepancy is evaluated by Engineering. Occurrence of degradation that is adverse to quality is entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

Inspection Activities - Load Handling Cranes and Devices reasonably assures the readiness of the equipment to fulfill its intended function. The absence of significant degradation or operational problems with load handling cranes and devices indicates that the inspection intervals are appropriate and that the corrective actions are complete.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

During the operating history of the station, anomalous conditions with cranes and lifting devices have been identified. These anomalies have principally involved misaligned runways. Such misalignment is not a result of age-related degradation and is not a concern for license renewal. The observed runway discrepancies were resolved either during the inspection process or through the Corrective Action System. Operating experience confirms the absence of significant structural degradation of cranes.

Summary

The Inspection Activities - Load Handling Cranes and Devices are consistent with the requirements of ASME B30.2 (Reference 16) and ASME B30.11 (Reference 17), and they address the load handling concerns identified in NUREG-0612 (Reference 18). Operating experience confirms the absence of significant structural degradation of cranes. However, as indicated in the previous discussion, a Licensee Follow-up Action is required to implement a one-time internal inspection of a representative sample of the box girders for the polar cranes. This activity is outlined in Section B4.0, Licensee Follow-up Actions of this appendix.

The effects of aging associated with load handling equipment within the scope of the Inspection Activities - Load Handling Cranes and Devices will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.11 ISI Program - Component and Component Support Inspections

In accordance with 10CFR50.55a, ISI Program - Component and Component Support Inspections are implemented to meet the requirements of Subsections IWB, IWC, and IWF of ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1989 Edition for Unit 1 and 1995 Edition with 1996 Addenda for Unit 2.

The Inservice Inspection (ISI) Program for Class 1 components, Class 2 carbon steel piping in the feedwater and main steam piping systems, and component supports is implemented in accordance with the individual Inservice Inspection Plan for each unit. Each Inservice Inspection Plan provides details for the implementation of inspections required by ASME Section XI, Subsections IWB (Class 1), IWC (Class 2), and IWF (Supports). Each Inservice Inspection Plan is developed and approved by the NRC for a 120-month inspection interval. Inservice Inspection requirements may be modified by applicable Relief Requests and Code Cases, which are approved by the NRC specifically for each unit and are re-evaluated for use during subsequent 120-month intervals.

An evaluation of the ISI Program - Component and Component Support Inspections in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following systems, structures, commodities, and major components credit the ISI Program - Component and Component Support Inspections for managing the aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indication of reduction in fracture toughness.

System	AMR Results Section
Chemical and Volume Control	Section 3.3.1, Primary Process Systems
Feedwater	Section 3.4, Steam and Power Conversion Systems
Main Steam	Section 3.4, Steam and Power Conversion Systems
Reactor Coolant System	Section 3.1.1, Reactor Coolant System
Residual Heat Removal	Section 3.2, Engineered Safety Features
Safety Injection	Section 3.2, Engineered Safety Features
Sampling System	Section 3.3.1, Primary Process Systems

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Structures	**AMR Results Section**
NSSS Equipment Supports	Section 3.5.9, NSSS Equipment Supports

Commodity	**AMR Results Section**
General Structural Supports	Section 3.5.10, General Structural Supports

Major Component	**AMR Results Section**
Pressurizer	Section 3.1.4, Pressurizer

The scope of the Inservice Inspection Program for ASME Class 1 and Class 2 components and component supports reasonably assures compliance with the requirements of ASME Section XI, Subsections IWB, IWC, and IWF. License renewal concerns with respect to Subsection IWC include only the carbon steel piping that is susceptible to high energy line breaks in the feedwater and main steam systems. Specific components are listed in the ISI Program Plan for each unit along with the type of required examination and the acceptance standards.

A transition to risk informed inservice inspection (RI-ISI) is currently underway. The RI-ISI program evaluates the nondestructive examination (NDE) of components required by ASME Section XI, Categories B-F and B-J. The component inspections are in accordance with the requirements specified in NRC-approved Westinghouse Topical Report WCAP-14572, Revision 1-NP-A (Reference 7). As required by the topical report, examinations performed are based upon the postulated failure mechanism associated with the piping being inspected. ASME Code Case N-577 (Reference 8) contains a table that describes the failure mechanisms and associated examination requirements. Surry Unit 1 is a full-scope RI-ISI program covering piping in Class 1, 2, 3 and non-class systems. The Surry Unit 1 program has been approved by the NRC. Surry Unit 2 has also been approved but includes Class 1 systems only. The inspection programs at the two North Anna units will include risk-informed inspections of Class 1 components. The process of developing the scope for the risk-informed inspection program includes not only an evaluation of risk significance and failure probability, but also considers operating experience.

Surface examinations for Class 1 piping less than 4 NPS are performed as part of the ASME Section XI Inservice Inspection Program. Volumetric examinations of these small-bore pipes would be added to the scope of ISI based upon risk significance and probability of failure. At this time, no small-bore butt welds or socket welds have been designated high safety significant, and no volumetric inspections of Class 1 piping are

planned. However, Surry Unit 1 is performing volumetric examinations on a sample population of welds in several 3-inch lines in the Safety Injection and Chemical Volume and Control systems. These are Class 2 lines but are used as leading indicators for small-bore piping conditions in Class 1 systems. Also, Dominion actively participates in the EPRI sponsored Materials Reliability Project Industry Task Group on thermal fatigue which currently is developing industry guidance for the management of fatigue caused by cyclic thermal stratification and environmental effects. As a Licensee Follow-up Action, Dominion is committed to following industry activities related to failure mechanisms for small-bore piping and will evaluate changes to inspection activities based on industry recommendations.

In accordance with ASME Section XI, Subsections IWB, IWC, and IWF, the categorization and methods for inservice inspections are listed below. The AMAs that are applicable for Class 1 components include ISI Program - Reactor Vessel, Reactor Vessel Internals Inspection, Augmented Inspection Activities, and Steam Generator Inspections.

Component Type Category	**Category**	**Method**
	Class 1	
Pressure-Retaining Welds in Vessels Other Than Reactor Vessel	B-B	Volumetric
Full-Penetration Welds of Nozzles in Vessels	B-D	Volumetric
Pressure-Retaining Partial Penetrations in Welds in Vessels	B-E	Visual
Pressure-Retaining Dissimilar Metal Welds	B-F	Volumetric/Surface
Pressure-Retaining Bolting Greater Than 2 Inches in Diameter	B-G-1	Visual/Surface/Volumetric
Pressure-Retaining Bolting 2 Inches and Less in Diameter	B-G-2	Visual
Integral Attachments for Vessels	B-H	Volumetric/Surface
Pressure-Retaining Welds in Piping	B-J	Volumetric/Surface
Integral Attachments for Piping, Pumps, and Valves	B-K-1	Volumetric/Surface
Pressure-Retaining Welds in Pump Casings	B-L-1	Volumetric

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Component Type Category	Category	Method
Pump Casings	B-L-2	Visual
Pressure-Retaining Welds in Valve Bodies	B-M-1	Volumetric/Surface
Valve Bodies	B-M-2	Visual
Pressure Retaining Welds in Control Rod Housings	B-O	Volumetric/Surface
All Pressure-Retaining Components	B-P	Visual
	Class 2	
Pressure Retaining Welds in Carbon or Low Alloy Steel Piping	C-F-2	Volumetric/Surface
	Component Supports	
Supports	F-A	Visual

Preventive Actions

The ISI Program - Component and Component Support Inspections are designated *Condition Monitoring*. No preventive actions are performed.

Parameters Monitored or Inspected

The types of components and component support examinations performed, which are prescribed by ASME Section XI, include visual inspection, surface examinations, and volumetric examinations. The extent of inspection for each component is defined in the inservice inspection plan for each unit.

Detection of Aging Effects

Inservice inspections are performed to detect component degradation prior to loss of intended function. The examinations required by ASME Section XI utilize visual, surface, and volumetric inspections to detect loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness (which presents itself as cracking of cast-austenitic stainless steel valve bodies due to thermal embrittlement). Surface examinations extend one-half inch on each side of welds. The volumetric examinations include a region equivalent to one-half of the material thickness on each

side of welds for Class 1 components, and one-half inch on each side of welds for Class 2 components. The applicable categories from ASME Section XI, and the required examination types in each category, are listed within the **Scope** statement of this section.

ASME Code Case N-481, Alternate Examination Requirements for Cast Austenitic Pump Casings (Reference 20), lists steps that can be taken in lieu of the volumetric examination requirement of IWB 2500-1 for pump casings. The station invokes this code case for inspection of reactor coolant pump casings. The alternate steps include:

- VT-2 examination of the exterior of pumps during pressure testing.
- VT-1 examination of external surfaces of one pump casing.
- VT-3 examination of internal surfaces whenever a pump is disassembled for maintenance.
- Evaluation to demonstrate safety and serviceability of pump casings.

The US Nuclear Regulatory Commission, in a letter from C. I. Grimes to D. J. Walters (Nuclear Energy Institute) (Reference 21), stated that detection of a reduction of fracture toughness for pump casings and valve bodies can be adequately detected by existing ASME Code inspections. No additional evaluation for reduction of fracture toughness is required.

Monitoring and Trending

Details of the scope of the ASME Section XI inservice inspections are documented in the Inservice Inspection Plan. During the course of the inspections, the extent of surface or volumetric flaws are characterized by the non-destructive examinations. Anomalous indications that are signs of degradation are recorded on non-destructive examination (NDE) Reports which are kept in Station Records.

Information in Table IWB 2500-1 describes the inspection sampling requirements, the examination methods, and the examination frequencies for Class 1 components. Subsection IWC addresses the Class 2 carbon-steel piping of the feedwater and main steam systems and Subsection IWF addresses component supports.

Inspection results that do not satisfy the acceptance standards of Section XI, Subsections IWB, IWC, and IWF, are evaluated by Engineering to determine required action. An anomalous indication that is a sign of degradation will require a disposition of acceptability, component repair, or component replacement, as determined by engineering evaluation. Reportable weld indications that are revealed by the inservice inspections in Class 1 components require additional inspections of similar components in accordance with IWB 2430.

Acceptance Criteria

Acceptance standards for inservice inspections are identified in Subsection IWB for Class 1 components, Subsection IWC for Class 2 components, and Subsection IWF for component supports. Table IWB 2500-1 refers to acceptance standards listed in Paragraph IWB 3500 for Class 1 components. Similarly, acceptance standards for Class 2 welds are listed in Section IWC 3500. Anomalous indications that are signs of degradation that are revealed by the inservice inspections would require additional inspections of similar components in accordance with Section XI. Evidence of loss of material, cracking, gross indication of either loss of pre-load or reduction of fracture toughness requires engineering evaluation for determination of corrective action. The occurrence of degradation that is adverse to quality will be entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

The early detection of degradation of in-scope license renewal components included in the ISI Program - Component and Component Support Inspections confirms the effectiveness of the program, the appropriateness of the inspection frequencies, and the completeness of the corrective actions that are taken if degradation is found.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

The station has extensive operating experience and ASME Section XI inspection histories indicating a minimal number of leaks at the reactor coolant system pressure boundary. These experiences similarly include reactor coolant system leakage monitoring as required by Technical Specifications and a determination of the source of leakage if an event occurs during power operation. Degradation of components and component supports that is found through these inspections is recorded and corrected as directed by engineering evaluation to maintain component intended function. Early detection of component degradation confirms the effectiveness of the inspection program. This is typical of the inservice inspections that have been performed throughout the utility industry.

Flaws exceeding the allowable flaw size are evaluated for acceptability. Continued service is allowed based on the evaluation along with re-examination during future inspection periods as required by ASME Section XI. If the subsequent examinations reveal that the flaw has not grown, it is considered stable and no further monitoring of that flaw is required. Dominion has no known flaws exceeding ASME Section XI acceptance criteria that have not been evaluated and reinspected per ASME Section XI requirements.

Summary

Operating experience indicates that the inspection and corrective action activities have successfully maintained the integrity of components within the scope of Inservice Inspection. As a Licensee Follow-up Action, Dominion is committed to following industry activities related to failure mechanisms for small-bore piping and will evaluate changes to inspection activities based on industry recommendations. This activity is outlined in Section B4.0, Licensee Follow-up Actions of this appendix.

The effects of aging associated with components and supports within the scope of the ISI Program - Component and Component Support Inspections will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.12 ISI Program - Containment Inspection

The station has developed an ISI Program - Containment Inspection for concrete containments and containment steel liners that implements the requirements in 10CFR50.55a and Subsections IWE and IWL of ASME Section XI, 1992 edition through 1992 addenda. The program incorporates applicable code cases and approved relief requests. The provisions of 10CFR50.55a are invoked for inaccessible areas within the Containment structure. Within the scope of license renewal, only Subsection IWE is credited for managing aging effects for the Containment structure.

An evaluation of the ISI Program - Containment Inspection in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following structures credit the ISI Program - Containment Inspection for managing the aging effect of loss of material.

Structure	AMR Results Section
Containment	Section 3.5.1, Containment

The scope of the Subsection IWE Inspection Program for the containment steel liner is in compliance with the requirements of 10CFR50.55a, which invokes ASME Section XI. Specific items to be inspected are listed in the IWE/IWL Program Plan for each unit, along with the type of required examination.

The scope of Subsection IWE inspections include the following items and is implemented for accessible areas:

Component Type Category	Category	Method
Containment Surfaces	E-A[1]	Visual, VT-3
Containment Surfaces requiring Augmented Inspections	E-C	Visual, VT-1 Volumetric
Pressure-Retaining Bolting	E-G	Visual, VT-1
All Pressure Retaining Components	E-P	Visual, VT-2

[1]Examination includes attachment welds between structural attachments and the pressure-retaining boundary (i.e., the containment liner).

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Preventive Actions

The ISI Program - Containment Inspection for the containment steel liner is designated *Condition Monitoring*. No preventive actions are performed.

Parameters Monitored or Inspected

Required inservice examinations for the containment steel liner are listed in Table IWE 2500-1 of ASME Section XI as modified by applicable code cases and relief requests. Visual and volumetric inspections are described. Exempted items, such as inaccessible areas, are listed in Paragraph IWE 1220. Table IWE 2500-1 identifies inspection sampling requirements, examination methods, and examination frequencies.

In accordance with IWE-3511, when areas of the liner to be inspected are painted or coated, the examination also checks for evidence of flaking, blistering, peeling, discoloration, and other signs of distress.

Detection of Aging Effects

Loss of material is the aging effect for the containment steel liner. Surface degradation and wall thinning are two indications of this aging effect which are determined by visual and volumetric examinations. The frequency and scope of examination requirements specified in 10CFR50.55a and Subsection IWE provide reasonable assurance that the aging effect is detected prior to compromising design basis requirements.

The component material degradation conditions that the inspections are intended to detect are listed in Subsections IWE for the containment steel liner. Guidance for performing VT examinations, and evaluating VT results with respect to the acceptance standards of IWE, is provided in an administrative procedure.

Monitoring and Trending

Details of the scope for the ASME Section XI, Subsection IWE inspections are documented in the IWE/IWL Program Plan for each station. The inspections are performed to identify degraded conditions in areas that are accessible. The evaluations of these accessible areas provide the basis for extrapolation to the expected condition of inaccessible areas, and an assessment of degradation in such areas.

The inspection program required by Subsection IWE is divided into 120-month (10-years) intervals. The 10-year interval for IWE is further divided into three periods. However, the initial implementation of these inspections on September 9, 1996 allowed five years for the initial IWE inspection period, and 12 years for the initial interval. Portions of the IWE examinations are performed during each 40-month (i.e. three-year) period such that the

entire scope of examinations is completed during the 10-year interval. Prior to the end of each interval, the IWE/IWL Program Plan for each unit is revised to reflect the appropriate update of the ASME Code, and to reflect any revised inspection requirements.

During the course of IWE inspections, surface condition is characterized using visual examinations. Anomalous indications that are signs of degradation are recorded on inspection reports that are kept in Station Records. Engineering evaluations are performed for inspection results that do not meet established acceptance standards.

Acceptance Criteria

Acceptance standards for the IWE inspection are identified in ASME Section XI Table IWE 2500-1 and refer to 10CFR50, Appendix J, Option B.

Occurrence of degradation that is adverse to quality will be entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

The ASME Section XI, Subsection IWE inspections, and any resultant corrective actions, are effective in identifying degradation of the containment liner as indicated by the maintenance of containment integrity and compliance with 10CFR50, Appendix J.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

Compliance with the inspection requirements of ASME Section XI, Subsection IWE, has been in place at Surry and North Anna since September 9, 1996. Any degradation of the containment steel liner that is found during inspections is noted and corrected, as necessary, to preclude adverse effects on plant safety and operability.

Containment liner inspections at Surry Units 1 and 2 occasionally find corroded areas of the steel liner. Such areas are cleaned and re-coated. IWE inspection results for Unit 1 in 1998 and for Unit 2 in 1999 found no significant degradation down to level of the interface joint with the floor. A decision was made to excavate several areas of concrete to check the condition of the steel liner below the interface joint. Excavation of concrete in seven areas of the Unit 1 containment confirmed the absence of significant degradation for the liner. Wall thickness measurements showed that considerable margin remains with respect to minimum acceptable values. Observations of the condition of the interface joint for Unit 2 similarly confirmed good material condition and concluded that no further destructive examination was warranted based on the favorable findings for Unit 1.

During the North Anna Unit 2 refueling outage in 1999, a localized area of the Containment liner was found to be corroded. Successful restoration efforts were completed.

Summary

Operating experience indicates that the inspection and corrective action activities have successfully maintained the integrity of the containment steel liner. The effects of aging associated with components within the scope of the ISI Program - Containment Inspection will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.13 ISI Program - Reactor Vessel

In accordance with 10CFR50.55a, ISI Program - Reactor Vessel is implemented to meet the requirements of Subsections IWB of ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1989 Edition for Unit 1 and 1995 Edition with 1996 Addenda for Unit 2.

The Inservice Inspection (ISI) Program for the reactor vessel is implemented in accordance with the individual Inservice Inspection Plan for each unit. Each Inservice Inspection Plan provides details for the implementation of inspections required by ASME Section XI, Subsections IWB (Class 1). Each Inservice Inspection Plan is developed and approved by the NRC for a 120-month inspection interval. Inservice Inspection requirements may be modified by applicable Relief Requests and Code Cases, which are approved by the NRC specifically for each unit and are re-evaluated for use during subsequent 120-month intervals. Additional inspections, in accordance with the Augmented Inspection Activities, enhanced the ASME Section XI inspections for two areas identified by industry concerns. For the reactor vessel, these areas are the control rod drive housings on the upper head and the incore flux thimble tubes in the reactor vessel bottom. NRC Bulletin 88-09, Thimble Tube Thinning in Westinghouse Reactors, (Reference 22) provides a basis for the thimble tube inspections.

An evaluation of the ISI Program - Reactor Vessel in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following major components credit the ISI Program - Reactor Vessel for managing the aging effects of loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness.

Major Component	AMR Results Section
Reactor Vessel	Section 3.1.2, Reactor Vessel

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The ISI Program - Reactor Vessel reasonably assures the pressure retaining capability of the reactor vessel welds; the studs, nuts, and washers that are used for vessel closure; the surface and attachments on the interior of the vessel; the housings and housing tubes for control rod drive mechanisms on the upper head; the incore flux thimbles and guide tubes that penetrate the lower head; and the seal table and fittings.

Among the vessel welds included in the scope of license renewal are the head-to-flange weld, the shell-to-flange weld, the nozzle welds, the circumferential vessel welds, and integrally-welded attachments.

The relevant ASME Section XI categories of examinations that address aging effects for the reactor vessel components are listed in the following table:

Component Type Category	Category	Method
Pressure-Retaining Welds in Reactor Vessel	B-A	Volumetric/Surface
Full-Penetration Welds of Nozzles in Vessels	B-D	Volumetric
Pressure-Retaining Partial Penetration Metal Welds in Vessels	B-E	Visual
Pressure-Retaining Dissimilar Metal Weld	B-F	Volumetric/Surface
Pressure-Retaining Bolting Greater that 2 Inches in Diameter	B-G-1	Visual/Surface/Volumetric
Interior of Reactor Vessel	B-N-1	Visual
Integrally Welded Core Support Structures and Interior Attachments to Reactor Vessel	B-N-2	Visual
Pressure-Retaining Welds in Control Rod Housings	B-O	Volumetric/Surface
All Pressure-Retaining Components	B-P	Visual

Preventive Actions

The ISI Program - Reactor Vessel is designated *Condition Monitoring*. No preventive actions are performed.

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Parameters Monitored or Inspected

In accordance with ASME Section XI, the following components are inspected using a combination of surface examinations, volumetric examinations, and visual examinations.

- Reactor vessel welds
- Reactor vessel studs, nuts, and washers
- Incore flux thimble guide tubes
- Peripheral CRDM locations

Augmented Inspection Activities are performed at the reactor vessel's upper head region to visually check for evidence of leakage at mechanical closures and to provide compliance with NRC Generic Letter 97-01 (Reference 10). Also, Augmented Inspection Activities perform eddy current examinations of the incore flux thimble tubes to check wall thickness.

These examinations are performed during each refueling outage.

Detection of Aging Effects

The examinations required by ASME Section XI utilize volumetric, visual and surface inspections to detect loss of material, cracking, and gross indications of either loss of pre-load (as indicated by loose bolting), or reduction of fracture toughness. The Augmented Inspection Activities also include visual examinations of the vessel head area. Cracking can be evidenced by accumulations of boric acid due to pressure boundary leakage. Augmented Inspection Activities also perform Eddy current testing of the incore flux thimble tubes to detect loss of material. During power operation, reactor coolant system leakage is routinely monitored as required by the Technical Specifications.

As a Licensee Follow-up Action, Dominion will remain active in industry groups to stay aware of any new industry recommendations (in addition to the existing reliance on chemistry control and ASME Section XI inspections) regarding inspection of core support lugs. Industry recommendations will be considered to determine the need for enhanced inspections.

Monitoring and Trending

Non-destructive examinations provide indication of loss of material, cracking, loss of pre-load (as indicated by loose bolting), and reduction in fracture toughness. ASME Section XI inspections are performed at a frequency of once per 10-year interval. Anomalous indications that are signs of degradation are documented on non-destructive

examination reports which are kept in Station Records. Engineering evaluations are performed for inspection results that do not meet established acceptance standards. The engineering evaluations consider the extent of degradation to reasonably assure that timely corrective or mitigative actions are taken.

Augmented inspections to check for leakage in the vicinity of the reactor vessel head, and to check for wall thinning of incore flux thimble tubes, are performed each refueling outage.

Acceptance Criteria

The acceptance criterion for non-destructive examinations is the absence of anomalous indications that are signs of degradation. Acceptance standards for the inspections of reactor vessel pressure-retaining welds are provided in ASME Section XI, Subsection IWB 3500. Evidence of loss of material, cracking, gross indication of loss of pre-load (as indicated by loose bolting), or gross indication of reduction in fracture toughness requires engineering evaluation for determination of corrective action. Occurrence of degradation that is adverse to quality is entered into the Corrective Action System.

For Augmented Inspection Activities, the acceptance criterion for inspection of the reactor vessel head area is the absence of evidence of leakage. The acceptance criterion for inspections of incore flux thimble tubes is to remain above the established minimum allowable wall thickness value.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

Operational surveillances confirm that the reactor vessel (including the CRDM penetrations and incore flux thimble tubes) is not degrading to the point of allowing leakage from the pressure boundary. Such assurance is provided by the leakage calculations that are routinely performed, and by the ASME Section XI and Augmented Inspection Activities that are performed during refueling outages. Corrective actions typically are not required for the reactor vessel because degradation is not prevalent.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

The station has extensive operating experience and inspection histories indicating the absence of reactor pressure vessel degradation. These experiences similarly include reactor coolant system pressure boundary leakage monitoring as required by Technical Specifications, and a determination of the source of leakage, if an event occurs during power operation.

Extensive experience also exists with respect to reactor vessel inservice and Augmented Inspection Activities during refueling outages to reasonably assure pressure boundary integrity. Augmented Inspection Activities of the reactor vessel's upper head and the incore flux thimble tubes have been implemented as a result of industry experience. Industry experiences will continue to be assessed as issues occur into the future to determine whether additional inspections are needed. However, there has been no significant indication of loss of material, cracking, gross loss of pre-load, or gross reduction in fracture toughness in the reactor vessel.

With respect to the vessel head penetration (VHP) concerns raised by the NRC in Generic Letter 97-01, Dominion provides the following information for the period of extended operation. The criteria for ranking the VHP's are based on establishing a benchmark probability that the CRDM nozzles for a given reactor would equal the probability that a 75% through-wall crack would be detected and exist in the most PWSCC-degraded CRDM nozzle at D.C. Cook Unit 2 relative to the time of VHP inspections at D.C. Cook Unit 2 in 1994. NEI normalized the benchmark probability of

CRDM nozzle failure at the U.S reactors relative to the date of January 1, 1997. The most susceptible reactors were placed into Tier 1 which predicted reaching the probability of the 75% through-wall failure within 5 years. For the intermediate susceptibility reactors (Tier 2), reaching the probability was predicted to occur within 5 to 10 years. Specifically for Surry and North Anna, information was provided to the NRC in response to requests regarding the following three items:

1. "An assessment of the susceptibility of your VHP's to develop PWSCC during the extended license terms for the facilities."

The susceptibility ranking of the Surry and North Anna VHP's was provided by letter to an NRC request for additional information (RAI) regarding utility participation in the Westinghouse Owners Group response to Generic Letter (GL) 97-01 (Reference 11). That letter indicated that Surry Unit 1 and North Anna Unit 1 were grouped in the industry category as most susceptible to cracking. Surry Unit 2 and North Anna Unit 2 were in the intermediate cracking susceptibility group. The susceptibility rankings were reviewed at the May 10, 2000 Materials Research Project CRDM/Alloy 600 Issues Task Group (ITG) meeting held at the EPRI office in Washington, DC. The Alloy 600 ITG members at that meeting agreed to update the susceptibility histogram to January 1, 2000 as part of the integrated industry inspection program cited in responses to GL 97-01 requests for additional information from the NRC. In the updated histogram, Surry Unit 1 and North Anna Unit 1 remained in the most susceptible category, while Surry Unit 2 and North Anna Unit 2 remained in the intermediate category. These rankings are appropriately reflected in the augmented inspections of the VHP's.

2. "A confirmation that the VHP's at your facilities are included under the scope of your boric acid corrosion inspection program."

Augmented Inspection Manual Attachment 36 for Surry, and Attachment 18 for North Anna, were developed based on cracking concerns for VHP's as identified in GL 97-01. Modified visual (VT-2) inspections are performed every refueling outage to identify the presence of boric acid crystals. This inspection is included as part of the Augmented Inspection Activities, but is not part of Boric Acid Corrosion Surveillance program.

3. "A summary of the results of any inspections that have been completed on your VHP's prior to the license renewal application, as appropriate."

In a letter to the NRC (Reference 12), Virginia Power provided a summary of the VHP inspection results through the fall 1995 outage for Surry Unit 1, the fall 1997 outage for Surry Unit 2, the spring 1997 outage for North Anna Unit 1, and the fall 1996 outage for

North Anna Unit 2. VHP's are inspected at every refueling outage in accordance with the requirements of Attachment 18 of the Augmented Inspection Activities. Inspections to date have found no evidence of leaking VHP's due to stress corrosion cracking.

Summary

Operating experience indicates that the inspection and corrective action activities have successfully maintained reactor pressure vessel integrity. However, as a Licensee Follow-up Action, Dominion will remain active in industry groups to stay aware of any new industry recommendations (in addition to the existing reliance on chemistry control and ASME Section XI inspections) regarding inspection of core support lugs. Industry recommendations will be considered to determine the need for enhanced inspections. This activity is outlined in Section B4.0, Licensee Follow-up Actions of this appendix.

The effects of aging associated with components within the scope of the ISI Program - Reactor Vessel will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.14 Reactor Vessel Integrity Management

Reactor Vessel Integrity Management includes the irradiation capsule surveillance activity, the reactor vessel fast neutron fluence calculations, the analysis to determine the temperature for nil-ductility transition (RT_{NDT}) for the reactor vessel beltline materials, the analysis to determine the Charpy Upper Shelf Energy (CvUSE) for the reactor vessel beltline materials, the analysis to determine reactor coolant system pressure/temperature operating limits and Low Temperature Overpressure Protection System (LTOPS) setpoints, and Pressurized Thermal Shock (PTS) screening calculations.

Specimen capsules were placed in each of the reactors prior to initial irradiation. The baseline mechanical properties of reactor vessel steels was determined from pre-irradiation testing of Charpy V-notch and tensile specimens. Post irradiation testing of similar specimens provide a measure of radiation damage. This surveillance activity fulfills the requirements of ASTM-E-185, Standard Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels (Reference 23). ASTM-E-185 is endorsed for use by 10 CFR 50, Appendix H, Reactor Vessel Material Surveillance Program Requirements.

Reactor vessel fluence is calculated using a neutron transport computer code in accordance with the approved Reactor Vessel Fluence Analysis Methodology (Reference 13). This analysis is performed according to the draft NRC Regulatory Guide DG-1053, Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence (Reference 24). The calculated fluence result is benchmarked utilizing dosimeter information from the irradiation surveillance activity.

Measured values of transition temperatures are obtained from mechanical testing of irradiation surveillance specimens. These values are used to determine the reference temperature for nil-ductility transition (RT_{NDT}) and the Charpy Upper Shelf Energy (CvUSE) for the limiting reactor vessel beltline materials. RT_{NDT} is a key analysis input for the determination of reactor coolant system pressure/temperature operating limits and LTOPS setpoints. Measured values of transition temperature shift are similarly utilized in PTS screening calculations required by 10 CFR 50.61.

Additional North Anna Units 1 and 2 surveillance capsules are available for compliance with 10 CFR 50, Appendix H material properties evaluation and fluence monitoring requirements during the period of extended operation. The surveillance program provides sufficient data to predict the condition of the limiting reactor vessel beltline materials

Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

An evaluation of the program for Reactor Vessel Integrity Management, in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1), is as follows:

Scope

Aging Management Reviews for the following major components credit the Reactor Vessel Integrity Management for managing the aging effect of reduction in fracture toughness.

Major Component	AMR Results Section
Reactor Vessel	Section 3.1.2, Reactor Vessel

The scope of the Reactor Vessel Integrity Management activities is focused on providing adequate fracture toughness of the reactor vessel beltline plate and weld materials. Neutron dosimetry and material properties data derived from the reactor vessel materials irradiation surveillance program are used in calculations and evaluations that demonstrate compliance with applicable regulations.

Preventive Actions

Reactor Vessel Integrity Management is designated *Condition Monitoring*. No preventive actions are performed.

Parameters Monitored or Inspected

The parameter that is monitored is reactor vessel material fracture toughness, based on Charpy V-notch and tensile test results for irradiated specimens of reactor vessel plate and weld material. Neutron dosimetry from irradiated surveillance capsules provides benchmark data for calculations of reactor vessel and surveillance capsule neutron fluence.

Detection of Aging Effects

The aging effect for the reactor vessel steel is the reduction in fracture toughness. The extent of this aging effect is determined by testing and evaluating irradiated samples of the reactor vessel material.

Monitoring and Trending

Neutron dosimetry and material properties data derived from the reactor vessel materials irradiation surveillance program are used to evaluate the reactor vessel and surveillance capsule neutron fluence, RT_{NDT}, and CvUSE. This information is used to develop reactor coolant system pressure/temperature operating limits and LTOPS setpoints, and to demonstrate compliance with applicable regulations governing reactor vessel integrity. Re-evaluation of reactor vessel capsule surveillance data is performed at the frequency established in the Engineering activity for vessel integrity, which has been provided to the NRC.

Acceptance Criteria

Acceptable values are established in the Engineering basis for the vessel capsule surveillance activities to include the following parameters:

- Heatup and cooldown limits, as implemented by Technical Specifications, to reasonably assure reactor vessel integrity.
- A pressurized thermal shock reference temperature that is within the screening criteria of 10 CFR 50.61.
- A fast fluence value for the surveillance capsule that bounds the expected fluence at the affected vessel beltline material through the period of extended operation.
- Compliance with the acceptance criteria governing Charpy Upper Shelf Energy (CvUSE) enumerated in 10CFR50, Appendix G.

Based on established parameters, calculations are performed to reasonably assure that the units will remain within the acceptable values.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Empirical transition temperature shift data from analyses of irradiated vessel specimens are used periodically to re-calculate the value of RT_{NDT}, which is used as an index of changes in reactor vessel material fracture toughness. The heatup and cooldown limits implement these values. The vessel capsule surveillance program provides continued compliance with the requirements of 10 CFR 50, Appendices G and H, and 10 CFR 50.61; and provides the necessary basis for any mitigating actions necessary to reasonably assure reactor vessel integrity.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

The heatup and cooldown curves (pressure and temperature limits) that are used for station operation have been updated using results from the vessel surveillance specimen evaluations. Evaluations for RT_{PTS} confirm compliance with the acceptance criteria of 10 CFR 50.61. Values for the Charpy upper shelf energy either have been verified to remain above the Appendix G limit, or an equivalent margin analysis has been performed.

Summary

The effects of aging associated with reactor vessel plates and welds will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.15 Reactor Vessel Internals Inspection

In accordance with 10CFR50.55a, Reactor Vessel Internals Inspection is implemented to meet the requirements of Subsections IWB of ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1989 Edition for Unit 1 and 1995 Edition with 1996 Addenda for Unit 2.

The Inservice Inspection (ISI) Program for reactor vessel internals is implemented in accordance with the individual Inservice Inspection Plan for each unit. Each Inservice Inspection Plan provides details for the implementation of inspections required by ASME Section XI, Subsections IWB (Class 1). Table IWB 2500-1 includes examination category B-N-3, Removable Core Support Structures. The acceptance standards for the visual examinations (VT-3) of Category B-N-3 are summarized in paragraph IWB-3520.

Each Inservice Inspection Plan is developed and approved by the NRC for a 120-month inspection interval. Inservice Inspection requirements may be modified by applicable Relief Requests and Code Cases, which are approved by the NRC specifically for each unit and are re-evaluated for use during subsequent 120-month intervals.

In addition to the ASME Section XI Reactor Vessel Internals Inspection that is conducted once per 10 years, a one-time focused inspection of the reactor vessel internals will be performed between year 30 and the end of the current operating license for the single Surry or North Anna reactor that is evaluated to be most susceptible to identified aging effects. Additionally, Augmented Inspection Activities will include an inspection of the core barrel hold-down spring to address the aging effect of gross indication of loss of pre-load.

The station will follow industry events to stay aware of any new developments regarding such issues as neutron embrittlement of baffle and barrel bolting, void swelling, and thermal embrittlement of the reactor internals components made of cast austenitic stainless steel. The scope of the one-time focused inspection will be consistent with industry developments on these issues.

An evaluation of the program for Reactor Vessel Internals Inspection, in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1), is as follows:

Scope

Aging Management Reviews for the following major components credit the Reactor Vessel Internals Inspection for managing the aging effects of loss of material, cracking,

gross indications of loss of pre-load, and gross indications of reduction in fracture toughness.

Major Component	AMR Results Section
Reactor Vessel Internals	Section 3.1.3, Reactor Vessel Internals

The scope of components that comprise the reactor internals includes the upper and lower core internal assemblies.

Preventive Actions

The Reactor Vessel Internals Inspection activities are designated *Condition Monitoring*. No preventive actions are performed.

Parameters Monitored or Inspected

Visual inservice inspections are performed on the surfaces of reactor vessel internals. Inservice inspection requirements for inspecting the core support structure are listed in ASME Section XI, Subsection IWB, as Examination Category B-N-3. Inspections of reactor vessel internals check for the following occurrences:

- Structural distortion or displacement of parts to the extent that component function may be impaired.
- Loose, missing, cracked, or fractured parts, bolting, or fasteners.
- Corrosion or erosion that reduces the nominal section thickness.
- Structural degradation of interior attachments such that the original cross-sectional area is reduced.

The station will continue to implement all relevant ASME Section XI inspection requirements associated with reactor vessel internals. In addition, the station will remain active in industry groups to stay aware of any new industry developments regarding such issues as void swelling and thermal embrittlement (reduction in fracture toughness) of components made of cast austenitic stainless steel.

Detection of Aging Effects

Visual inspections are utilized to detect loss of material, cracking, gross indications of loss of pre-load, and gross indications of reduction in fracture toughness.

The Augmented Inspection Activities of the core barrel hold-down spring checks for gross indications of loss of pre-load.

Monitoring and Trending

Non-destructive examinations provide indication of loss of material, cracking, gross indication of loss of pre-load (as indicated by loose bolting), and reduction in fracture toughness. ASME Section XI inspections are performed at a frequency of once per 10-year interval. Anomalous indications that are signs of degradation are documented on non-destructive examination reports which are kept in Station Records. Engineering evaluations are performed for inspection results that do not meet established acceptance standards. The engineering evaluations consider the extent of degradation to reasonably assure that timely corrective or mitigative actions are taken.

The additional task of a one-time focused inspection of the internals will check for all five of the aging effects listed above by applying an inspection activity based on the leading indicator approach. This leading indicator approach will be based on several factors such as fluence, stress, and material susceptibility and will identify subcomponents judged to be most susceptible. The inspection will be performed between year 30 and the end of the current operating license on the single Surry or North Anna reactor determined to be the most susceptible to the aging effects identified. Therefore, the leading indicator approach will inspect the most susceptible components in the most susceptible reactor by industry sanctioned techniques. The results of the inspections will determine the need for inspections of the other reactors. If future industry developments suggest the need for an alternate inspection plan during the extended period of operation, or negate the need for a one-time inspection, then Dominion will modify the proposed inspection program.

A Licensee Follow-up Action will be implemented for the Augmented Inspection Activities to check for loss of pre-load at the core barrel hold-down spring.

Acceptance Criteria

Acceptance standards for Reactor Vessel Internals Inspection activities are identified in ASME Section XI, Subsection IWB. Table IWB 2500-1 identifies references to the acceptance standards listed in Paragraph IWB 3500.

Anomalous indications that are signs of degradation that are revealed by the inservice inspections may require additional inspections. Evidence of loss of material, cracking, gross indication of loss of pre-load, or reduction in fracture toughness requires engineering evaluation for the determination of corrective action. Any occurrence of degradation that is adverse to quality will be entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

The ASME Section XI Inservice Inspection Program provides guidance to confirm that corrective actions have been effective in reasonably assuring the integrity of the reactor vessel internals. Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

Compliance with the inspection requirements of ASME Section XI has been in place at the station since initial operation. Inspection results to-date have not indicated age-related degradation problems with the reactor vessel internals.

Industry experience indicates a concern regarding degradation of the control rod guide tube split pins that are used in the upper internals. The split pins are manufactured from nickel-based alloy X750, which is susceptible to stress corrosion cracking. Replacement split pins were installed at Surry Unit 1, but examination of the original split pins found no degradation. Similarly, replacement split pins, with improved heat treatment characteristics, were installed for North Anna Units 1 and 2. North Anna did experience a failure of an original split pin on Unit 1; however, examination of the remaining original split pins found no additional problems. Based on the favorable examinations of the split

pins for Surry Unit 1, and the North Anna units, and the fact that split pin cracking has no adverse effect on safety-related functions since the internals package would maintain its intended configuration, split pins have not been replaced for Surry Unit 2.

Summary

Continued involvement in industry efforts to better define the inspection requirements of the Reactor Vessel Internals Inspection is required. As a Licensee Follow-up Action, a one-time focused inspection will be performed to implement industry recommendations. This activity is outlined in Section B4.0, Licensee Follow-up Actions of this appendix. Operating experience has indicated no significant findings from inspection activities that have required corrective action.

The effects of aging associated with components within the scope of the Reactor Vessel Internals Inspection program will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.16 Secondary Piping and Component Inspection

The Secondary Piping and Component Inspection program implements a standardized method of identifying, inspecting, and tracking components which are susceptible to Flow Accelerated Corrosion (FAC) in both single and two-phase flow conditions. This program has been developed in accordance with NRC Generic Letter 89-08, Erosion/Corrosion-Induced Pipe Wall Thinning (Reference 25), NUREG-1344, Erosion/Corrosion Induced Pipe Wall Thinning in U.S. Nuclear Power Plants (Reference 26), and EPRI guideline NSAC-202L, Recommendations for an Effective Flow Accelerated Corrosion Program (Reference 27). The failure of a segment of condensate pipe at the Surry Power Station in 1986 was a significant factor in the industry and regulatory efforts to develop effective FAC inspection programs.

FAC is a phenomenon that results in internal metal loss from piping, vessels, and equipment made of carbon steel and occurs only under certain conditions of flow, chemistry, geometry, and material. Susceptibility to FAC occurs in steam or water systems in which all of the following three conditions exist:

- Controlled oxygen levels are low.
- Carbon steel materials are utilized.
- Operating temperatures exceed 100°F.

Susceptibility for FAC is reduced by controlling the feedwater pH value to be toward the upper end of the acceptable range that is listed in the Chemistry Control Program for Secondary Systems.

The Engineering effort supporting the Secondary Piping and Component Inspection program identifies piping locations, as well as pumps and valves that are susceptible to FAC degradation. By performing ultrasonic measurements on piping segments, as directed by the Secondary Piping and Component Inspection program procedures, piping components can be identified for repair or replacement prior to reaching minimum allowable wall thickness. Visual inspections of the internals of non-piping components, such as valves, are performed as the equipment is opened for other repairs and/or maintenance, to determine whether flow-accelerated degradation is occurring. Pump casings and valve bodies retaining pressure in high energy systems are bounded by the piping inspections performed for the program.

The scope of the inspection program for FAC-susceptible components during an inspection period is developed based on the following considerations:

- Piping components that have been categorized as "potential replacement" during previous inspection periods.

- Piping components that have not been inspected during previous inspection periods.
- Piping components that were inspected during previous inspection period and rated as requiring inspection during the current inspection period.
- Piping components that have been replaced in previous inspection periods but require an inspection to verify projected wear rate.
- Piping adjacent to pumps and valves that have been previously repaired or replaced.
- Lessons learned from previous inspection periods and from industry experience.
- Input from a FAC-monitoring computer code (i.e., CHECWORKS-FAC).
- The requirement for baseline inspections on selected components that have been replaced.
- Carbon steel or low-alloy steel piping components located immediately downstream of FAC-resistant materials.
- Consideration of changes in operating conditions that may cause FAC.
- Other appropriate selection tools as may be developed by the industry in the future.

An evaluation of the program for Secondary Piping and Component Inspection, in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1), is as follows:

Scope

Aging Management Reviews for the following systems credit the Secondary Piping and Component Inspection for managing the aging effect of loss of material.

System	AMR Results Section
Auxiliary Steam	Section 3.4, Steam and Power Conversion Systems
Blowdown	Section 3.4, Steam and Power Conversion Systems
Feedwater	Section 3.4, Steam and Power Conversion Systems
Main Steam	Section 3.4, Steam and Power Conversion Systems
Steam Drains	Section 3.4, Steam and Power Conversion Systems

Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review).

With respect to license renewal, the Secondary Piping and Component Inspection program evaluates the FAC-susceptible portions of the systems listed above.

Preventive Actions

The Secondary Piping and Component Inspection program is designated as *Condition Monitoring*. No preventive actions are required.

Parameters Monitored or Inspected

Visual inspections determine if degradation of the internal surface condition is occurring. Ultrasonic thickness measurements determine if loss of material due to wall thinning is occurring.

Detection of Aging Effects

The aging effect of loss of material due to FAC is detected by volumetric inspections and, where possible, internal visual inspections.

Monitoring and Trending

Engineering develops FAC inspection plans using results of past inspections, predictions from the FAC-monitoring computer code, results of water chemistry analyses, and industry experience. Records from ultrasonic wall-thickness measurements are trended. Trending of wall thickness measurements provides reasonable assurance that structural integrity will be maintained between inspections. Engineering evaluates the scope of future inspections and the need for component repair or replacement, based on the FAC examination results and programmatic guidelines. Engineering evaluation of examination results, and the development of inspection, repair, and replacement plans, are performed at a frequency of at least once per 18-months (refueling interval) for each unit.

Acceptance Criteria

Engineering evaluations of trend projections, along with code minimum wall thickness requirements, determines when component repair or replacement is needed. The acceptance criterion for visual inspections is the absence of visible degradation. Engineering evaluations are utilized, however, to determine whether the results of visual surface inspections indicate conditions that require corrective action. Occurrence of degradation that is adverse to quality is entered into the Corrective Action System for resolution.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

The Secondary Piping and Component Inspection program and the Corrective Action System have been effective, as demonstrated by the fact that the aging effect of loss of material due to FAC is addressed through trending, follow-up inspections and component repairs or replacements prior to loss of intended function.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

Wall thinning and pitting have occurred in plant components that are within the scope of the Secondary Piping and Component Inspection program. The major through-wall failure of condensate piping occurred at Surry in 1986. This event resulted in the creation of NRC Bulletin 87-01, Thinning of Pipe Walls in Nuclear Power Plants, and initiated the current FAC inspection and repair activities. Since the Secondary Piping and Component Inspection program has been implemented, continued improvement in the management of FAC has significantly reduced the likelihood of the recurrence of such an event. The FAC-resistant material for replacement components reduces the susceptibility of these

components and the extent of re-inspections. Repairs and replacements have occurred in the condensate, feedwater, extraction steam, and steam drain systems as a result of early detection and implementation of the Corrective Action System.

Summary

Operating experience indicates that while wall thinning and pitting have occurred since implementation of the Secondary Piping and Component Inspection program, the FAC inspection activities have effectively identified degraded components for repair or replacement prior to the loss of intended function of the component. These corrective actions have been effective in maintaining the integrity of FAC-susceptible components.

The effects of aging associated with components within the scope of the Secondary Piping and Component Inspection program will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.17 Service Water System Inspections

Compliance with Generic Letter 89-13 (Reference 28) requires a variety of inspections, non-destructive examinations, and heat transfer testing for components cooled by service water. Generic Letter 89-13 directed utilities to assess the following five aspects of operational problems with service water cooling systems:

- Biofouling
- Heat Transfer Testing
- Routine Inspection and Maintenance
- Single-failure Walkdown
- Procedure Review

The Service Water System Inspections program provides reasonable assurance that corrosion (including microbiologically-influenced corrosion, MIC), erosion, protective coating failure, silting, and biofouling of service water piping and components will not cause a loss of intended functions. The primary objectives of this program are to (1) remove excessive accumulations of biofouling agents, corrosion products, and silt; and (2) repair defective protective coatings and degraded service water system piping and components that could adversely affect performance. Preventive maintenance, inspection, and repair procedures have been developed to provide reasonable assurance that any adverse effects of exposure to service water are adequately addressed. The addition of biocide to the service water system reduces biological growth (including MIC) that could lead to degradation of components exposed to the service water.

An evaluation of the program for Service Water System Inspections, in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1), is as follows:

Scope

Aging Management Reviews for the following systems credit the Service Water System Inspections for managing the aging effects of change in material properties, loss of material and heat transfer degradation.

System	AMR Results Section
Heating and Ventilation	Section 3.3.2, Open Water Systems
Service Water	Section 3.3.2, Open Water Systems
Component Cooling Water	Section 3.3.3, Closed Water Systems
Instrument Air	Section 3.3.2, Open Water Systems

Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review).

Components are included which are within the scope of license renewal, and could experience degradation because of their contact with service water.

Preventive Actions

The inspections and testing of components affected by service water are designated *Condition Monitorin*g and *Performance Monitoring*, respectively. No preventive actions are performed.

Parameters Monitored or Inspected

Inspections of components exposed to service water are performed to check for changes in material properties for components made of copper and copper alloys and for loss of material which could be a result of biofouling or occur in metallic components due to defects in protective coatings.

Heat transfer performance parameters for selected components cooled by service water are periodically monitored.

Detection of Aging Effects

Visual inspections are performed to check for loss of material and changes in material properties. Heat transfer testing is performed to identify the aging effects of loss of material and heat transfer degradation.

Volumetric inspections are also performed to check for loss of material due to MIC.

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Monitoring and Trending

Inspections and testing are performed at different frequencies that range from weekly to every refueling outage for components exposed to service water. Inspection and heat exchanger testing results are recorded in procedures which are retained in Station Records. Engineering evaluations are performed for anomalous inspection or heat transfer testing results.

Acceptance Criteria

The acceptance criterion for visual inspections is the absence of anomalous indications that are signs of degradation. In the case of service water, degradation includes biofouling as well as material degradation. Engineering evaluations determine whether observed deterioration of material condition is sufficiently extensive to lead to loss of intended function for components exposed to the service water. The degraded condition of material or of heat transfer capability may require prompt remediation. Occurrence of degradation that is adverse to quality is entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Evaluation of post-maintenance conditions that occur as a result of required repairs or replacements provides reasonable assurance that the corrective actions have been satisfactorily implemented.

Periodic inspections of the service water system are performed to assess the degree of biofouling, the integrity of surface coatings, and the extent of pipe surface damage or wall thinning; and to provide confirmation of previous corrective actions. Testing determines

degradation of heat transfer capability. Inspections, heat transfer testing, and resultant corrective actions are successful in maintaining the operability of the service water system.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

The station is experienced with identifying and resolving degradation of the service water system. Procedures have been developed for inspections and testing to address the aging effects of loss of material, change in material properties, and heat transfer degradation.

Inspection and testing results have been used as input to the engineering evaluation process to make necessary adjustments to inspection and testing frequencies and scopes.

Inspections and tests have led to numerous piping repairs and design changes that have been implemented to replace degraded portions of the service water system. Continuing adherence to existing service water system inspection and testing activities is necessary to provide reasonable assurance that the intended function of service water components is maintained.

Summary

Past operating experience has identified component degradation in the service water system, and in each case, remediation activities have been completed to correct the deficiencies. The station maintains compliance with the requirements of Generic Letter 89-13.

The effects of aging associated with components within the scope of the Service Water System Inspections program will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.18 Steam Generator Inspections

In accordance with 10CFR50.55a, Steam Generator Inspections are implemented to meet the requirements of Subsections IWB and IWC of ASME Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1989 Edition for Unit 1 and 1995 Edition with 1996 Addenda for Unit 2.

Steam Generator Inspections are implemented in accordance with the individual Inservice Inspection Plan for each unit. Each Inservice Inspection Plan provides details for the implementation of inspections required by Subsections IWB (Class 1) and IWC (Class 2). Each Inservice Inspection Plan is developed and approved by the NRC for a 120-month inspection interval. Inservice Inspections requirements may be modified by applicable Relief Requests and Code Cases, which are approved by the NRC specifically for each unit and are re-evaluated for use during subsequent 120-month intervals.

A concern regarding crack initiation and growth exists for the steam generator primary coolant nozzles (which are carbon steel but are clad with stainless steel) and safe ends (with stainless steel or inconel buttering). A requirement for the occurrence of crack initiation and growth is a high level of stress. The greatest stress occurs in weld areas. In general, welds have considerable residual stress, but the cladding is not highly stressed due to receiving post-weld heat treatment along with the vessel. Weld areas for the nozzles can be stressed by the fact that they are restrained by their proximity to the steam generator and coolant piping supports. Also, the welds are more likely than piping to exhibit anomalies that may serve as stress risers and initiation locations for cracking.

Based on this evaluation, Dominion believes that crack initiation and growth will occur in weld areas before it occurs in piping areas adjacent to the weld. Current inspections, as required by ASME Section XI, are adequate for the weld inspections.

Steam generator inspections are performed in accordance with the requirements of station Technical Specifications. Additional inspections are performed and are based upon the guidelines established by Nuclear Energy Institute document, NEI 97-06 (Reference 14) and the Electric Power Research Institute steam generator inspection guidelines (Reference 15). The inspection of feedwater nozzles in the steam generator are performed as part of the Augmented Inspection Activities.

An evaluation of the program for Steam Generator Inspections, in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1), is as follows:

Scope

Aging Management Reviews for the following major components credit the Steam Generator Inspections for managing the aging effects of loss of material, cracking, and loss of pre-load.

Major Component	AMR Results Section
Steam Generator	Section 3.1.5, Steam Generator

The scope of the inspection activities to monitor steam generator integrity includes both the primary side and the secondary side. Primary side inspections focus on the following areas:

- General inspection of the full length of the tubes, from the hot end to the cold end.
- Special interest inspections of suspected anomalous indications in accordance with site specific analysis guidelines. Such indications typically occur in the tubing free span but they may appear at or near tube support plates.
- U-bend areas of anti-vibration bar contact points.
- Critical area inspections at the U-bend transition of Row 1 tubes.
- Critical area inspections of the hot leg top-of-tubesheet expansion area.
- Video inspections for general condition assessment of the tubesheet and tube plugs.
- Weld inspections
- Bolting

Secondary side inspection activities typically focus on the following components:

- Inner radii inspections of feedwater and main steam nozzles
- Weld inspections
- Supports
- Routine video inspections of the tubesheet area and the annulus area, as necessary, to detect the presence of deposits, sludge, foreign material, or other general degradation.

In accordance with ASME Section XI, Subsections IWB, IWC and IWF, the categorization and methods for inservice inspections for steam generators are listed in the following table:

Component Type Category	Category	Method
	Class 1	
Pressure-Retaining Welds in Vessels Other Than Reactor Vessels	B-B	Volumetric
Welds of Nozzles in Vessels	B-D	Visual (VT-1 in lieu of volumetric)
Pressure Retaining Dissimilar Metal Welds	B-F	Volumetric/Surface
Pressure-Retaining Bolting 2 Inches and Less in Diameter	B-G-2	Visual
Steam Generator Tubing	B-Q	Volumetric
	Class 2	
Pressure-Retaining Welds in Pressure Vessels	C-A	Volumetric
Pressure-Retaining Nozzle Welds in Vessels	C-B	Volumetric/Surface
	Component Supports	
Supports	F-A	Visual

Preventive Actions

The Steam Generator Inspections are designated *Condition Monitoring*. No preventive actions are performed.

Parameters Monitored or Inspected

The surface conditions of subcomponents in both the primary and secondary sides of the steam generator are monitored for indications of degradation. Volumetric examinations also are performed for the steam generator tubes and for Section XI IWB and IWC welds.

Detection of Aging Effects

Inspections of the steam generators to check for loss of material, cracking, and gross indications of loss of pre-load include a combination of visual inspections, surface examinations, and volumetric examinations. Tubing inspections are performed in accordance with ASME Section XI, Subsection IWB.

Monitoring and Trending

Non-destructive examinations are performed at a frequency of every 18 months (coincident with refueling outages) to check for loss of material, cracking, and gross indications of loss of pre-load. In particular, volumetric examinations are used to check circumferential welds on the steam generator shell (ultrasonic), the steam generator head (ultrasonic), the tubes (eddy current), the inside radii of nozzles (ultrasonic), the nozzle-to-shell weld and nozzle-to-head weld (ultrasonic), and the tubesheet-to-shell weld (ultrasonic). Tube inspections use a combination of bobbin probes and rotating pancake coils. Visual examinations are performed for tube plugs with the steam generator depressurized. (A category B-P test, under pressurized conditions, is not practical due to the plugs being internal components.) Anomalous indications that are signs of degradation are documented on non-destructive examination reports which are kept in Station Records. Engineering evaluations are performed for inspection results that do not meet established acceptance standards.

Acceptance Criteria

Acceptance standards for steam generator component inspections are provided in ASME Section XI, Subsections IWB 3500 and IWC 3500. Evidence of loss of material, cracking, or gross indication of loss of pre-load requires engineering evaluation for determination of corrective action. Occurrence of degradation that is adverse to quality is entered into the Corrective Action System. Similarly, results for steam generator inspections that are outside the scope of ASME Section XI are dispositioned by Engineering.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be

significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

Although not specifically required for Steam Generator Inspections, primary-to-secondary tube leakage detection is performed as directed by Technical Specifications and is determined by several methods, including radiation monitors and coolant chemistry analyses. The absence of recurrent operational problems with the steam generator pressure boundary confirms that the existing inspection and corrective action processes are effective.

Evaluation of post-maintenance conditions, that occur as a result of required repairs or replacements, provides reasonable assurance that the corrective actions have been satisfactorily implemented.

Additionally, walkdowns to identify system leakage are performed as part of the startup process following outages. These walkdowns are performed with the primary and secondary systems at operating pressure. This provides a periodic visual check of the steam generator pressure boundary integrity, as well as, confirmation of system integrity following maintenance.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

The steam generators in both units at Surry and North Anna have been replaced. Extensive cumulative inspection results, in accordance with the ASME Section XI inspection requirements, have been compiled for the Surry and North Anna replacement steam generator tubing. These inspections have resulted in less than 1.0% of the total number of tubes being plugged in the replacement steam generators for Surry Units 1 and 2. The steam generators were replaced at Surry in 1981 for Unit 1 and in 1980 for Unit 2.

Since the replacement of the North Anna Unit 1 steam generators in 1993, there has been one tube that was preventively plugged for an anomalous inspection result. For North Anna Unit 2, which received replacement steam generators in 1995, one tube was

plugged during the 2001 refueling outage due to a localized wear indication at a support plate. These inspection results demonstrate the excellent performance for the tubing in the North Anna and Surry replacement steam generators.

The results of Steam Generator Inspections for non-tubing components are documented on nondestructive examination reports that are maintained in station records. There have been no instances of flaws in components reported by Steam Generator Inspections at North Anna. For Surry, flaws that existed in the secondary side of the replacement steam generators were accepted by repair or evaluation, and the affected areas of the welds were reexamined with volumetric and surface examination methods during subsequent Steam Generator Inspections. There have been no other instances of inservice related flaws reported for the steam generators at Surry or North Anna.

Information Notice 90-04, “Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators,” stated that volumetric examinations (UT) of the shell-to-transition-cone girth welds, required by Section XI of the ASME Code, may not be sufficient to differentiate isolated cracks from inherent geometric conditions. Following this notice, enhanced inspections were performed. At North Anna Unit 2, in addition to inspections required by ASME XI, a steam generator transition cone girth weld was 100% MT inspected. The same inspection was conducted on a Surry Unit 1 steam generator. No degradation indications were observed during either inspection.

Summary

The Steam Generator Inspections are consistent with ASME Section XI requirements, EPRI Guidelines, and NEI 97-06. The inspection results for the replacement steam generators have been excellent.

The effects of aging associated with steam generator tubes and non-tubing components within the scope of the Steam Generator Inspections program will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B2.2.19 Work Control Process

Performance testing and maintenance activities, both preventive and corrective, are planned and conducted in accordance with the station's Work Control Process. The Work Control Process integrates and coordinates the combined efforts of Maintenance, Engineering, Operations, and other support organizations to manage maintenance, predictive analysis, and testing activities. Maintenance activities provide opportunities to visually inspect the surfaces (internal and external) of plant components and adjacent piping. Adjacent piping is primarily the internal piping surface immediately adjacent to a system component that is accessible through the component for visual inspection. Visual inspections performed through the Work Control Process provide data that can be used to determine the effectiveness of aging management activities to detect the aging effects of cracking, loss of material, gross indications of change of material properties, and separation and cracking/delamination.

Performance testing on heat exchangers evaluates the heat transfer capability of the components to determine if heat transfer degradation is occurring.

The Work Control Process also provides opportunities through preventive maintenance sampling (predictive analysis) to collect lubricating oil and engine coolant samples for subsequent analysis. Identification of contaminants would provide early indication of an adverse environment that can lead to material degradation.

EPRI Report TR-107514 (Reference 29), provides a basis for using the available sampling opportunities of the Work Control Process as an aging management tool. The EPRI report provides a relationship of required sample size versus sample population size for a 90/90 confidence level that the sample population adequately identifies occurrences of interest, which in this case are the effects of aging. The EPRI report shows that a population sample size of 25 provides a 90/90 confidence level for an infinite sample population. Seven years of component-level maintenance information for Surry were evaluated to develop a comparison to the EPRI sample size criterion. As shown in the following table on work control opportunities, the number of inspection opportunities afforded by the Work Control Process exceeds the required sample size described in EPRI Report TR-107514.

A similar assessment for North Anna yields comparable results when evaluating the work control activities with respect to the EPRI sample size criterion. The material/environment combinations for North Anna are the same as those for Surry except that Surry has the additional environment of brackish water. The number of work control opportunities is large, and the variety of systems for which aging management activities are performed is

comparable. Therefore, the results shown in the table below are valid for North Anna as well as for Surry.

The selected systems identified in the table represent the range of material/environment combinations that were considered during the aging management review of structures and components. The results of component behavior for each material/environment combination are valid regardless of the system in which the component exists. As indicated in the table, the extent of material/environment combinations, and the ample number of work control opportunities that exist, eliminates the need to schedule specific inspections. The scope and frequency of the Work Control Process are adequate to detect aging and provide reasonable assurance that the intended functions are maintained.

Work Control Opportunities within Material/Environment Combinations

Surry Power Station, June 1993-September 2000

System	Materials	Internal Environments	Sample Opportunities
Feedwater	Carbon, low-alloy and stainless steel	Treated water (with low and saturated oxygen) and lube oil	>100
Recirculation and Containment Spray	Stainless steel (austenitic, cast austenitic, and sensitized)	Treated water (borated), raw water (drainage), and air	>50
Fuel Oil	Carbon and low-alloy steel, cast iron, and copper-alloys	Fuel oil	>50
Chemical Volume Control	Stainless, carbon, and low-alloy steel, nickel-based alloy, and copper-alloys	Treated water (borated and component cooling), and lube oil	>100
Safety Injection	Stainless steel (austenitic, cast austenitic, and sensitized)	Treated water (borated), raw water (drainage), and gas (nitrogen)	>75

Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

System	Materials	Internal Environments	Sample Opportunities
Component Cooling Water	Stainless, carbon, and low-alloy steel, cast iron, titanium, and copper-alloys	Treated water (component cooling) and raw water (brackish)	>300
Service Water	Stainless, carbon, and low-alloy steel, cast iron, nickel-based alloys, copper-alloys and non-metallic materials	Raw water (brackish), lube oil, air, and fuel oil	>300
Instrument Air	Stainless, carbon, and low-alloy steel, and copper-alloys	Air	>150

Based on the data collected, an adequate number of work opportunities occurs for each material/environment combination during a time period of approximately two refueling cycles. For systems, such as component cooling and service water, that have experienced more pronounced aging effects, the requisite number of work opportunities to satisfy the EPRI criterion occurs more frequently. These work opportunities adequately address the set of aging effects requiring management, as listed in the table above.

An evaluation of the program for Work Control Process in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Aging Management Reviews for the following systems, structures, and commodities credit the Work Control Process for managing the aging effects of change in material properties, separation and cracking/delamination, cracking, loss of material, and heat transfer degradation.

System	AMR Results Section
Alternate AC Diesel Generator System	Section 3.3.4, Diesel Generator Support Systems
Auxiliary Steam	Section 3.4, Steam and Power Conversion Systems
Blowdown	Section 3.4, Steam and Power Conversion Systems
Boron Recovery	Section 3.3.7, Drain and Liquid Processing Systems
Chemical and Volume Control	Section 3.3.1, Primary Process Systems
Component Cooling Water	Section 3.3.3, Closed Water Systems
Condensate	Section 3.4, Steam and Power Conversion Systems
Drains - Aerated	Section 3.3.7, Drain and Liquid Processing Systems
Drains - Building Services	Section 3.3.7, Drain and Liquid Processing Systems
Drains - Gaseous	Section 3.3.7, Drain and Liquid Processing Systems
Emergency Diesel Generator System	Section 3.3.4, Diesel Generator Support Systems
Feedwater	Section 3.4, Steam and Power Conversion Systems
Fuel Pit Cooling	Section 3.2, Engineered Safety Features
Heating and Ventilation	Section 3.3.6, Ventilation and Vacuum Systems
Heating and Ventilation	Section 3.3.3, Closed Water Systems
Heating and Ventilation	Section 3.3.2, Open Water Systems
Instrument Air	Section 3.3.2, Open Water Systems
Instrument Air	Section 3.3.5, Air and Gas Systems
Main Steam	Section 3.4, Steam and Power Conversion Systems
Recirculation Spray	Section 3.2, Engineered Safety Features
Residual Heat Removal	Section 3.2, Engineered Safety Features
Secondary Ventilation	Section 3.3.6, Ventilation and Vacuum Systems
Safety Injection	Section 3.2, Engineered Safety Features

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Security	Section 3.3.4, Diesel Generator Support Systems
Service Air	Section 3.3.5, Air and Gas Systems
Service Water	Section 3.3.2, Open Water Systems
Steam Drains	Section 3.4, Steam and Power Conversion Systems
Steam Generator Water Treatment	Section 3.4, Steam and Power Conversion Systems
Vacuum Priming	Section 3.3.6, Ventilation and Vacuum Systems

Structure	**AMR Results Section**
Containment	Section 3.5.1, Containment

Commodity	**AMR Results Section**
Miscellaneous Structural Commodities	Section 3.5.11, Miscellaneous Structural Commodities

Note: Differences between the listings of systems, structures, major components, and/or commodities for Surry and North Anna are identified in Section 2.0 (Structures and Components Subject to Aging Management Review).

Performance testing and maintenance activities, both preventive and corrective, are planned and conducted in accordance with station's Work Control Process. Activities conducted under the Work Control Process provide the opportunity to perform and document visual inspections of the internal and external surfaces of the components. The scope of the Work Control Process includes:

- Visual examination of the internal and external surfaces of mechanical components (e.g., valves, pumps, etc.) and adjacent piping;
- Performance tests of mechanical components and heat exchangers;
- Routine maintenance sampling of motor lubricating oil and engine coolant; and

Adjacent piping is primarily the internal piping surface immediately adjacent to a component that is accessible for visual inspection through a removed or disassembled component.

Preventive Actions

The inspection activities conducted as part of the Work Control Process are designated as *Condition Monitoring*. The testing activities of the Work Control Process are designated as *Performance Monitoring*. The maintenance sampling activities are designated as *Mitigative* actions.

Parameters Monitored or Inspected

Visual inspections of internal and external surfaces are performed for mechanical components and their adjacent piping during the performance of maintenance, in accordance with the Work Control Process, to determine the presence of cracking, loss of material, and gross indications of change in material properties. Visual inspections of structural components are performed to check for cracking, separation and cracking/delamination, change in material properties, and loss of material.

Performance testing for various heat exchangers check heat transfer performance parameters for indications of heat transfer degradation.

Lubricating oil and engine coolant samples are analyzed to detect contaminants as an indication of an adverse environment that can lead to material degradation.

Detection of Aging Effects

Cracking, separation and cracking/delamination, loss of material, and gross indications of change in material properties are the aging effects that are monitored by internal and external maintenance inspections for mechanical components and inspections of structural components.

Changes in heat transfer capability are monitored through periodic performance testing of heat exchangers.

Lubricating oil and engine coolant samples provide indication of an adverse environment that can lead to material degradation.

Monitoring and Trending

Monitoring involves reviews of the documentation generated with the Work Control Process, including completed procedures and peer/technical reviews of engineering evaluations. A review of maintenance data for the past seven years at Surry indicated that the inspection opportunities available through the Work Control Process exceeded the minimum number of random samples necessary to obtain a 90/90 confidence level that aging effects would, if present, be identified. Therefore, sufficient inspection opportunities are available to provide reasonable assurance that systems are adequately

monitored. Additionally, an integral function of the Work Control Process is to maintain an up-to-date component work history database. The frequencies of work activities vary across a range, and some activities are performed only during refueling outages.

As a Licensee Follow-up Action, changes will be implemented into the maintenance procedures to provide reasonable assurance that consistent internal inspections will be completed during the process of performing maintenance tasks. These changes will be implemented prior to the end of the current operating license.

Acceptance Criteria

The acceptance criterion for visual inspections, testing, or sampling is the absence of anomalous indications that are signs of degradation.

Whenever evidence of aging effects exists, an engineering evaluation is performed to determine whether the observed condition is acceptable without repair. Occurrence of significant aging effects that are adverse to quality is entered into the Corrective Action System.

Corrective Actions

Corrective actions for conditions that are adverse to quality are performed in accordance with the Corrective Action System as part of the Quality Assurance Program. Any resultant maintenance or repair activities are performed in accordance with the Work Control Process. The corrective action process provides reasonable assurance that deficiencies adverse to quality are either promptly corrected or are evaluated to be acceptable. Where evaluations are performed without repair or replacement, engineering analysis reasonably assures that the structure or component intended function is maintained consistent with the current licensing basis. If the deficiency is assessed to be significantly adverse to quality, the cause of the condition is determined, and an action plan is developed to preclude repetition. The Corrective Action System identifies repetitive discrepancies and initiates additional corrective action to prevent recurrence.

Confirmation Process

The Work Control Process documentation is reviewed prior to a component's return to service from repair or maintenance activities, both corrective and preventive, for confirmation that the actions have been completed in a satisfactory manner. Likewise, performance testing or sampling results are reviewed to verify satisfactory compliance with acceptance criteria. Additionally, Engineering routinely reviews the system/component work control history database.

The Work Control Process itself is relied upon to reasonably assure the effectiveness of the mitigative function of the lubricating oil and engine coolant sampling program. Either repair or routine maintenance activities provide the inspection opportunities to confirm the absence of aging effects related to the surfaces in contact with the lubricating and coolant fluids.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

Work Control Process activities that involve component inspections, performance testing, and maintenance sampling are performed routinely. A review of the Work Control Process history indicates that the number of inspection opportunities afforded is statistically significant. The excellent physical condition of the station indicates successful experience with the implementation of the Work Control Process. This assessment is based on receiving consistently high marks from NRC and industry group evaluations regarding the station's operation and overall condition.

Summary

The on-going periodic Inspections, testing, and sampling performed in accordance with the Work Control Process provide examination opportunities to monitor the material condition of the systems and components throughout the entire facility. The operating history indicates that the Work Control Process has been effective in monitoring the aging effects and that the sample population provided by the Work Control Process has been representative of the total population of components. The excellent physical condition and operation of the station indicates our successful experiences implementing the Work Control Process and the Corrective Action System. As a Licensee Follow-up Action, changes will be implemented into the maintenance procedures to reasonably assure that consistent inspections for aging effects are completed during the process of performing maintenance tasks. This activity is outlined in Section B4.0, Licensee Follow-up Actions of this appendix.

The effects of aging associated with components inspected within the scope of the Work Control Process program will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B3.0 TLAA SUPPORT ACTIVITIES

B3.1 Environmental Qualification Program

TLAAs are discussed in Section 4.0 of this License Renewal Application. The Environmental Qualification (EQ) Program described below is in support of the TLAA associated with the qualification of electrical equipment discussed in Section 4.4.

The Environmental Qualification (EQ) Program activities are in compliance with the requirements of 10 CFR 50.49. The EQ Program will be continued throughout the period of extended operation. Electrical equipment located in a harsh environment is evaluated for environmental qualification if they are required to function in the conditions that will exist post-accident after being subjected to the normal effects of aging. A harsh environment results from a loss-of-coolant accident (LOCA) or main steam line break inside Containment, high radiation levels due to the post-LOCA effects outside Containment, or high energy line breaks outside Containment.

Guidance regarding environmental qualification was provided in NRC Bulletin 79-01B (Reference 30) for Unit 1 and in NUREG-0588 (Category II) (Reference 33) for Unit 2.

The Equipment Qualification Master List (EQML) provides a listing of electrical equipment that is important to safety and is located in a potentially harsh environment.

Based on the definitions of 10 CFR 54, certain EQ calculations are considered to be Time-Limited Aging Analyses (TLAA). As stated in 10 CFR 54.21(c) and in NEI 95-10 (Reference 31), analyses for TLAAs utilize one of the following three options:

i) The analyses remain valid for the period of extended operation,

ii) The analyses have been projected to the end of extended operation, or

iii) The effects of aging will be effectively managed during the period of extended operation.

For purposes of license renewal, EQ components will be evaluated in accordance with the EQ Program utilizing Option iii identified above. Components with a qualified lifetime of less than 40 years already are included in a program of periodic replacement and are not considered TLAAs.

10 CFR 50.49(j) requires that a qualification record be maintained for all equipment subjected to the EQ Rule. The qualification process verifies that the equipment is capable of performing its safety function when subjected to various postulated environmental conditions. These normal conditions include expected ranges of temperature, pressure, humidity, radiation, and accident conditions such as chemical spray and submergence.

Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

The process of qualifying EQ equipment includes analysis, data collection, and data reduction with appropriate assumptions, acceptance criteria and corrective actions.

Qualification Document Reviews (QDR) provide the basis for qualifying EQ components. The QDR provides the following information for each piece of equipment that is qualified:

- The performance characteristics required under normal, design-basis event (DBE), and post-DBE conditions.
- The voltage, frequency, load, and other electrical characteristics for which equipment performance can be verified.
- The environmental conditions, including temperature, pressure, humidity, radiation, chemical spray, and submergence, at the location where the equipment must function.

Maintenance requirements and replacement intervals for EQ components are based on aging qualification and vendor recommendations. Equipment with age-related limitations or restrictions are included in the preventive maintenance program to reasonably assure replacement prior to the end of the established qualified lifetime.

An evaluation of the EQ Program in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

The EQ Program, as defined in 10 CFR 50.49, is applicable to the following components:

- Safety-related equipment that is relied on to remain functional during and following a design-basis event.
- Non-safety-related electrical equipment whose failure could prevent accomplishment of safety function(s).
- Certain post-accident monitoring equipment as described in Regulatory Guide 1.97 (Reference 32).

EQ concerns for license renewal will consider only those in-scope components that have a qualified lifetime greater than 40 years. Components with a qualified lifetime of less than 40 years already are included in a program of periodic replacement, and are not considered TLAAs.

Preventive Actions

Aging effects are not prevented by the EQ Program. However, components that have been determined by EQ evaluation to have age-related limitations or restrictions are refurbished, re-qualified, or replaced prior to becoming incapable of performing their intended functions.

Parameters Monitored or Inspected

The service histories for EQ components are monitored by the Preventive Maintenance Program to reasonably assure that the components are refurbished, re-qualified, or replaced prior to reaching the end of their established qualified lifetime.

Detection of Aging Effects

The EQ Program does not involve the detection of aging effects.

Monitoring and Trending

Compliance with the EQ Program involves monitoring the installed time for components, comparing this duration to the established qualified lifetime for the component, and providing reasonable assurance that refurbishment, re-qualification, or replacement occurs prior reaching the qualified lifetime limit.

Acceptance Criteria

EQ components must be refurbished, re-qualified, or replaced prior to reaching the end of their established qualified lifetime.

Corrective Actions

Corrective actions for the EQ Program are performed in accordance with the Corrective Action System. Any changes in either 1) the characteristics that define a harsh environment, 2) unexpected adverse conditions, or 3) emerging industry issues for EQ components require engineering evaluation.

Confirmation Process

Confirmation of component tracking and replacement compliance with the EQ Program is accomplished by the Preventive Maintenance Program. The Corrective Action System confirms compliance of any components that may exceed the established qualified lifetime. Plant-specific Safety Evaluation Reports for EQ provide the results of NRC reviews that verify the effectiveness of the EQ Program and confirm its compliance with 10 CFR 50.49.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the Quality Assurance Program.

Operating Experience

Compliance with the EQ requirements of 10 CFR 50.49 is reasonably assured by 1) maintaining QDRs for affected electrical components, 2) evaluating the qualified lifetime for affected components, and 3) providing reasonable assurance of equipment refurbishment, requalification, or replacement prior to the expiration of the qualified lifetime. The preventive maintenance performed, continued incorporation of relevant industry information and experience, and the implementation of corrective actions, when necessary, have been successful in maintaining the qualification of electrical equipment, and will continue into the period of extended operation.

Summary

Environmental qualification records for electrical equipment that could be required to function in a harsh environment are maintained in accordance with 10 CFR 50.49. Engineering evaluations determine the qualified lifetime for these components, and maintenance activities are performed to reasonably assure that components are refurbished, re-qualified, or replaced prior to the expiration of the qualified lifetime. These activities will continue during the period of extended operation.

The effects of aging associated with components inspected within the scope of the Environmental Qualification Program will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

B3.2 Transient Cycle Counting

TLAAs are discussed in Section 4.0 of this License Renewal Application. The program for Transient Cycle Counting described below is in support of the TLAA associated with metal fatigue that is discussed in Section 4.3.

During normal, upset, and test conditions, certain station equipment is subjected to transient temperatures, pressures, and flows, resulting in cyclic changes in internal stresses in the equipment. The cyclic changes in internal stresses can cause metal fatigue. Station equipment has been designed to withstand a number of design transients without experiencing fatigue failures during their operating life. This design includes an ASME Section III, Class 1 fatigue analysis. The purpose of the transient cycle counting activity is to record the number of normal, upset, and test events, and their sequences, that are experienced by plant equipment and compare them to their design limits.

An evaluation of the program for Transient Cycle Counting in terms of the aging management program attributes provided in the Standard Review Plan for License Renewal (Reference 1) is as follows:

Scope

Transient Cycle Counting activities are applicable to the reactor coolant system pressure boundary components for which the design analysis assumes a specific number of design transients to accommodate fatigue.

Preventive Actions

The Transient Cycle Counting activities are mitigative. Reasonably assuring compliance with the design assumptions during the lifetime of the plant mitigates aging effects.

Parameters Monitored or Inspected

The Transient Cycle Counting activities record the number of normal operational cycles and upset operational transients, identified in the following list:

- Heatup/Cooldown $\leq 100^{o}$F/Hr
- Step load increase/decrease of 10%
- Large load reduction of 50%
- Loss of load >15%
- Loss of AC power
- Loss of flow in one loop
- Full power reactor trip

- Inadvertent auxiliary pressurizer spray
- Inadvertent safety injection
- Normal charging and letdown return to service
- Charging trip with delayed return to service

Detection of Aging Effects

The aging effect of cracking due to fatigue is mitigated by monitoring the number of transient cycles.

Monitoring and Trending

The Transient Cycle Counting activities monitor the number of transient cycles that have been experienced by each unit and compare the actual number of cycles to a design limit. The number of transient cycles experienced is updated quarterly.

Acceptance Criteria

Any concerns related to fatigue are mitigated as long as the number and magnitude of transient cycles are within the design assumptions. Approaching a design limit may indicate a situation where an evaluation of cumulative usage factors is required and an entry will be made into the Corrective Action System.

Corrective Actions

If the number of transient cycles approaches the assumed bases for the plant design, further analysis will be performed to account for the magnitude of the transient cycles experienced. An engineering analysis will determine the remaining design margin, taking credit for the actual magnitude of transients and their sequence to confirm that the allowable cumulative usage factor has not been exceeded. If warranted, component repair or replacement would be initiated.

Confirmation Process

A formal log is maintained for each unit to record transient cycles experienced. Periodic reviews of the logged information are performed to reasonably assure compliance with the design assumptions for transient cycles.

Administrative Controls

Administrative and implementation procedures are reviewed, approved, and maintained as controlled documents in accordance with the procedure control process and the

Operating Experience

Transient cycle counting has been performed in accordance with Technical Specifications since initial unit operation. Improved unit reliability and longer fuel cycle durations have resulted in fewer transient cycles during the past 10 years. Except for charging line flow isolation events, it is not anticipated that any of the transient cycle limits will be exceeded during the period of extended operation to 60 years. Accordingly, a charging line nozzle has been instrumented to evaluate the impact of charging line flow transients.

Summary

Transient Cycle Counting will continue to monitor transient cycles included in the design basis for the current licensing period. Maintaining compliance with these bases during the period of extended operation will reasonably assure that the effects of aging associated with components within the scope of the Transient Cycle Counting program will be adequately managed so that there is reasonable assurance that their intended function(s) will be performed consistent with the current licensing basis during the period of extended operation.

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B4.0 LICENSEE FOLLOW-UP ACTIONS

The assessment of Aging Management Activities (AMAs) required for license renewal indicated the need for enhancement of certain existing activities, and the development of some new activities. These required changes are designated as Licensee Follow-up Actions for the license renewal application. Table B4.0-1 lists the AMAs for which the Licensee Follow-up Actions are applicable. A brief description of the necessary aging management changes, and an implementation schedule, are provided in the table.

Table B4.0-1 Licensee Follow-up Actions for Aging Management Activities

Aging Management Activity	Licensee Follow-up Action
Augmented Inspection Activities	Implement an augmented inspection of the pressurizer surge line connection to the reactor coolant system hot-leg loop piping. The inspection will address the issue of thermal fatigue failure of the weld due to environmental effects, as described in GSI-190. The initial inspection will be completed prior to the end of the current operating license.
Augmented Inspection Activities	Implement an augmented inspection of the core barrel hold-down spring. The inspection will address the issue of loss of pre-load. The initial inspection will be performed prior to the end of the current operating license.
Buried Piping and Valve Inspection Activities	Develop inspection activities for representative samples of buried piping and valves. The inspection for each of the representative samples will be one-time only, and will be performed between year 30 and the end of the current operating license. An engineering evaluation will determine whether subsequent inspections are required.
Civil Engineering Structural Inspection	Expand the scope of Civil Engineering Structural inspections to bound the scope of inspections required for license renewal. This expansion will be implemented prior to the end of the current operating license.

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Table B4.0-1 Licensee Follow-up Actions for Aging Management Activities

Aging Management Activity	Licensee Follow-up Action
Civil Engineering Structural Inspection	Provide direction in plant documents to take advantage of inspection opportunities that occur as the result of inaccessible areas becoming accessible during work activities. This guidance will be provided prior to the end of the current operating license.
Fire Protection Program	Replace or test a representative sample of sprinklers that have been in service for 50 years. This task conforms to the requirements of NFPA-25, Section 2-3.1.1, and will be performed during the period of extended operation.
General Condition Monitoring Activities	Develop inspection criteria for non-ASME Section XI component supports and doors as part of General Condition Monitoring. Initial inspections will be completed, using the criteria, prior to the end of the current operating license.
General Condition Monitoring Activities	Procedural guidance will be developed for engineers and health physics technicians regarding inspection criteria that focus on detection of aging effects during General Condition Monitoring Activities. This guidance will be provided prior to the end of the current operating license.
Infrequently Accessed Area Inspection Activities	Develop inspection activities for infrequently accessed areas. The inspections will be one-time only, and will be performed between year 30 and the end of the current operating license. An engineering evaluation will determine whether subsequent inspections are required.

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Table B4.0-1 Licensee Follow-up Actions for Aging Management Activities

Aging Management Activity	Licensee Follow-up Action
ISI Program - Component and Component Support Inspections	At this time, no butt welds or socket welds in small-bore piping have been designated high safety significant, and no volumetric inspections of small-bore Class 1 piping are planned. However, Dominion actively participates in the EPRI-sponsored Materials Reliability Project Industry Task Group on thermal fatigue which currently is developing industry guidance for the management of fatigue caused by cyclic thermal stratification and environmental effects. Dominion is committed to following industry activities related to failure mechanisms for small-bore piping and will evaluate changes to inspection activities based on industry recommendations.
ISI Program - Reactor Vessel	Dominion will follow industry efforts to stay aware of any new industry recommendations (in addition to the existing reliance on chemistry control and ASME Section XI inspections) regarding inspection of core support lugs. Industry recommendations will be considered to determine the need for enhanced inspections.
Inspection Activities - Load Handling Cranes and Devices	Implement an internal inspection of representative sections of the box girders for the polar cranes. The inspection will be one-time only, and will be performed between year 30 and the end of the current operating license. An engineering evaluation will determine whether subsequent inspections are required.

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Table B4.0-1 Licensee Follow-up Actions for Aging Management Activities

Aging Management Activity	Licensee Follow-up Action
Reactor Vessel Internals Inspection	Dominion will remain active in Industry Groups, including the EPRI-sponsored Materials Reliability Project Industry Task Group, to stay aware of any new industry recommendations regarding such issues as neutron embrittlement, void swelling, and the synergistic effect of thermal and neutron embrittlement of internals sub-components. The inspection will be one-time only, and will be performed between year 30 and the end of the current operating license for the single Surry or North Anna reactor that is evaluated to be most susceptible to aging effects. An engineering evaluation will determine whether subsequent inspections are required. If future industry developments suggest the need for an alternate inspection plan during the period of extended operation, or negate the need for a one-time inspection, then Dominion will modify the proposed inspection plan.
Tank Inspection Activities	Implement inspections for a representative sample of tanks that require aging management for license renewal. The inspections will be one-time only, and will be performed between year 30 and the end of the current operating license. An engineering evaluation will determine whether subsequent inspections are required.
Work Control Process	Implement changes into procedures to reasonably assure that consistent inspections of components are completed during the process of performing work activities (Work Control Process). The changes will be implemented prior to the end of the current operating license.

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APPENDIX C

AGING MANAGEMENT REVIEW METHODOLOGY

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C1.0 INTRODUCTION

The scoping effort (Section 2.1.4) has identified the plant systems and structures that are within the scope of license renewal. For each of these systems and structures, screening has been performed (Section 2.1.5) to identify the passive components and structural members that support an intended function of the system or structure. This appendix describes the methodology for performing the aging management review (AMR) of the long-lived passive components and structural members. Specifically, Section C2.0 provides an overview of the AMR process, including the process for identifying the in-scope passive components that are short-lived and, therefore, do not require an AMR. Section C3.0 provides a discussion of the aging effects and associated mechanisms evaluated for structures and components. Section C4.0 provides information on selected AMR topics. And Section C5.0 provides a description of the organization and general content of the AMR results presented in the application.

Most of the information in this section is common to both North Anna and Surry Power Stations. Plant-specific information has been identified using the conventions described in Table 1.1-1 so the reviewer can quickly identify station differences.

A listing of the abbreviations used in this appendix is provided in Section 1.4.1.

C2.0 OVERVIEW OF THE AMR PROCESS

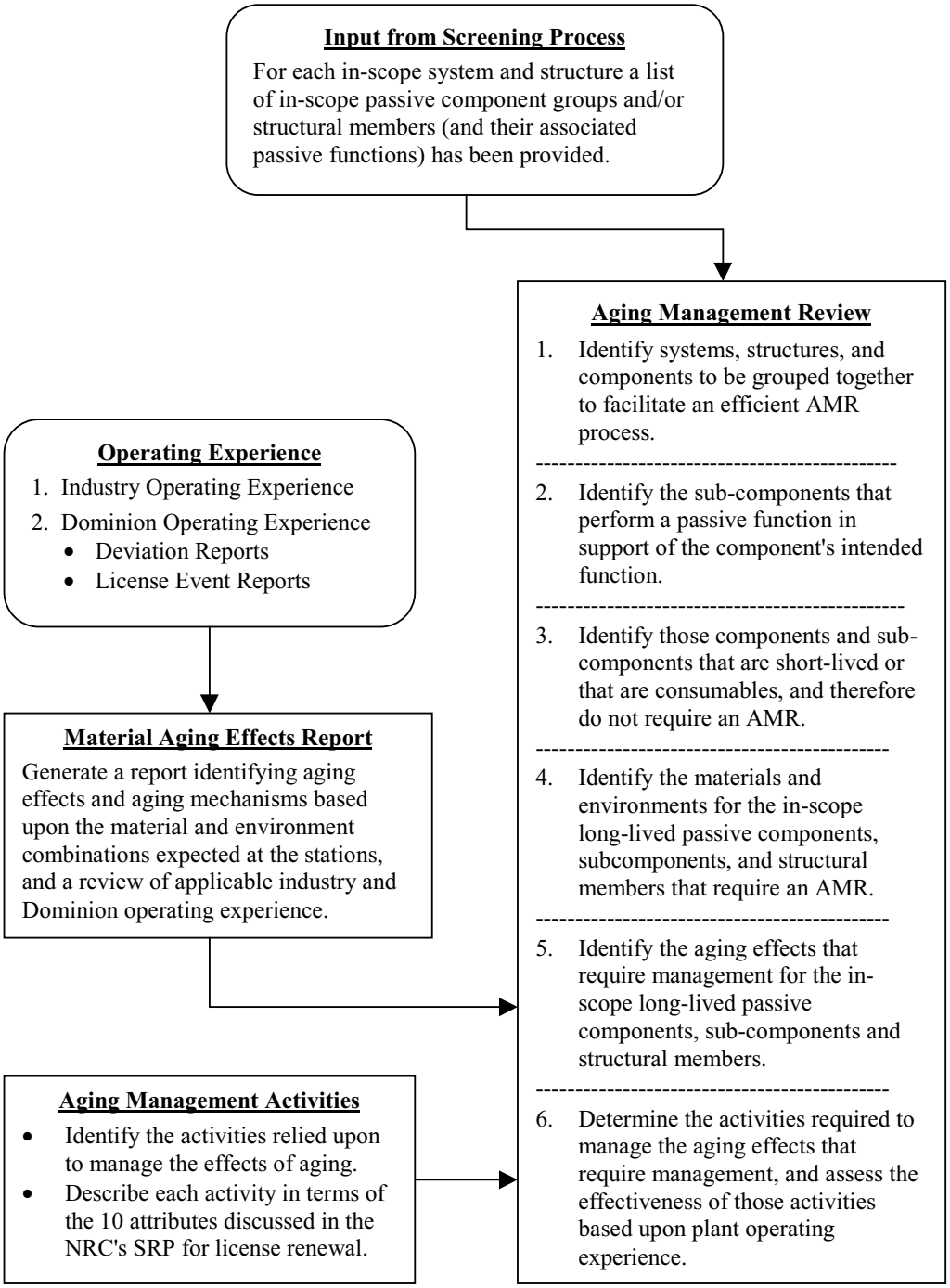
The aging management review process for the station has involved the following six (6) major steps:

1. Grouping of systems, structures, and components for evaluation
2. Identification of in-scope passive subcomponents
3. Identification of short-lived components and consumables
4. Identification of materials and environments
5. Identification of aging effects requiring management
6. Determination of the activities required to manage the effects of aging

Each of these steps are discussed in Subsections C3.2.2.1 through C3.2.2.6, respectively. A simplified flow chart that illustrates the AMR process is provided in Figure C2.0-1.

The Dominion AMR process is consistent with the AMR process delineated in NEI 95-10 (Reference 1).

Figure C2.0-1 Simplified AMR Process Flow Chart



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C2.1 Grouping of Systems, Structures and Components for Evaluation

The initial step of the AMR process has involved the grouping of systems, structures, and components (SSCs) for the purpose of facilitating an efficient AMR process. The AMRs for SSCs have initially been divided into the following major divisions, consistent with the format requirements specified in NEI 95-10 (Reference 1):

Structure, System, or Component	AMR Results
1. System (Mechanical)	
- Reactor Coolant System	Section 3.1
- Engineered Safety Features	Section 3.2
- Auxiliary Systems	Section 3.3
- Steam and Power Conversion Systems	Section 3.4
2. Structures and Structural Components	Section 3.5
3. Electrical and I&C	Section 3.6

These major divisions have been broken down further (where appropriate) into AMR groupings with similar materials and environments. Separate AMRs have also been performed for the reactor vessel, reactor vessel internals, steam generators, and pressurizers, since they are major components with numerous subcomponents that require individual consideration. The groupings of SSCs (including plant commodities) used for the AMR evaluations have also been used to present the AMR results in the application. These groupings are represented by the subsections of Section 3.0 as indicated in the LRA Table of Contents.

Several terms have been used to refer to plant equipment in terms of their form and function. For mechanical and electrical system equipment, the term "component group" is used to identify system components. Examples of component groups include valve bodies, pump casings, pipe, tanks, filters/strainers, flow elements, tubing, instrument valve assemblies, bolting, bus duct, and cables and connectors. For buildings and structures, the term "structural member" is used to identify the parts of a building or structure. Examples of structural members include walls, floor slabs, columns, and missile protection doors.

The aging management review for most component groups and structural members is performed on a system-by-system or structure-by-structure basis. However, the aging management review for some component groups and structural members has been performed on a plant-wide basis. For this situation, each component group or structural member evaluated is referred to as a "commodity". Examples of equipment evaluated as a commodity include general structural supports and other miscellaneous structural and

electrical/I&C components such as cable tray covers, fire/EQ barrier doors, fire penetration materials, cabinets, panels, benchboards, cable, and connectors. The AMR results for systems and structures do not list commodities because commodities have their own AMR evaluations. NSSS equipment supports and load handling cranes and devices also have their own AMR evaluations and are not identified in the AMR results for individual systems and structures.

C2.2 Identification of In-scope Passive Subcomponents

The screening process has identified the passive components and structural members within the scope of license renewal. That process, as described in Section 2.1.5, Screening Methodology, has not gone below the component level. Therefore, where applicable, the AMR process has included the screening of the subcomponents of the in-scope components.

The reactor vessels, reactor vessel internals, steam generators, and pressurizers are major components with numerous subcomponents. Each of these components has been individually screened to identify the subcomponents that perform a passive function in support of an intended function of the component and, therefore, would require an aging management review.

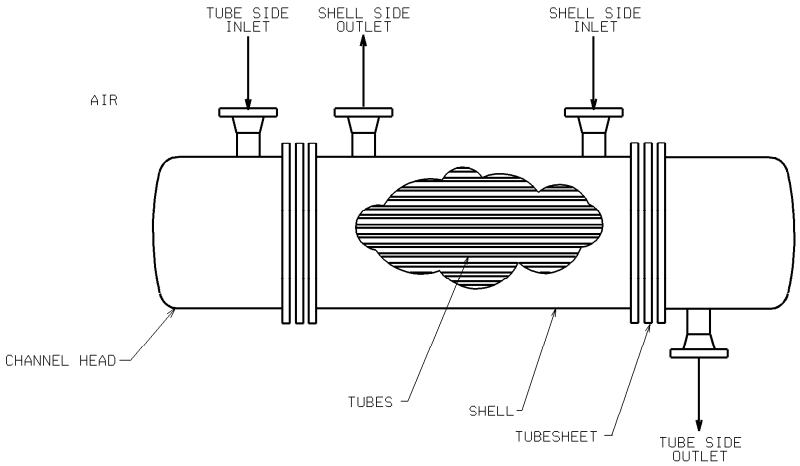
Heat exchangers, though not as complex as major components, have a number of subcomponents potentially made of different materials and subject to different environments, as shown in Figure C2.2-1. The AMR process has included the entire heat exchanger within the scope of license renewal, unless it can be shown that a particular subcomponent is not required to support the intended function(s) of the component. For example, the shell can be excluded in those instances where the only intended function is to maintain the pressure boundary for the tube side of the heat exchanger.

The typical heat exchanger has been divided into four subcomponents for the purposes of the aging management review: the channel head, the tubes, the tubesheet, and the shell. Each heat exchanger subcomponent is assigned an internal and an external environment. For the tubes and tubesheet heat exchanger subcomponents, the tube-side is considered the internal environment and the shell-side is considered the external environment. The assignment of environments in this manner results in internal system environments assigned as external environments for the tubes and tubesheet subcomponents. Heat exchanger subcomponents are evaluated together and the AMR results are reported based on the system designator for the heat exchanger.

Although most heat exchangers have been divided according to the convention described above, certain non shell-and-tube type heat exchangers require special handling for parts

break-out and do not conform to this typical example. In these instances, there may be less than four subcomponents identified for the aging management review.

Figure C2.2-1 Simplified Shell-and-Tube Heat Exchanger



Components such as piping, pump casings, and valve bodies are generally far less complex, but still may have more than one subcomponent. Piping includes all of the associated fittings. Because fittings generally are of the same material as the piping and are subject to the same environmental conditions, fittings are not uniquely identified. Subcomponents such as packing, gaskets, component seals, O-rings, structural sealants, oil, grease, and component filters generally have generally been treated as consumables and have been evaluated as explained in the next section.

Bolting applications within the scope of license renewal are divided into pressure boundary bolting and structural bolting.

Pressure boundary bolting applications include bolted flange connections for vessels (i.e., manways and inspection ports), flanged joints in piping, body-to-bonnet joints in valves, and pressure-retaining bolting associated with pumps and miscellaneous process components. Pressure boundary bolting includes nuts, bolts, studs, and cap screws.

Structural bolting applications include bolted or riveted joints and threaded connections for structural steel and steel components used in the construction of building structures, mechanical and electrical component supports, and other structural members. Structural bolting includes bolts, studs, rivets, nuts, screws, and anchorage to concrete.

Plant Technical Specifications maintain strict leakage controls on the reactor coolant pressure boundary so that leakage can be quickly identified and accounted for during plant operations. As such, fasteners used in systems to maintain the reactor coolant pressure boundary (i.e. ASME Class 1) warrant additional assurances inherent in nuclear safety beyond those required for ASME Class 2, 3, and Non Class fasteners. In addition to Class 1 applications, Dominion has uniquely identified bolting for systems constructed primarily of stainless steel because of the susceptibility of low-alloy steel bolting to boric acid wastage. Bolting has also been uniquely identified in applications where high-strength requirements are required for joint make-up.

Bolting used in other applications has been evaluated as part of the larger host component and has not been uniquely identified in the LRA. However, the aging management reviews performed for the host components are based on materials of construction that bound the bolting material.

C2.3 Identification of Short-lived Components and Consumables

The screening process has identified the passive components and structural members within the scope of license renewal. That process, as described in Section 2.1.5, Screening Methodology, has not attempted to identify those components that can be treated as short-lived and, therefore, do not require an AMR. These determinations have been made during the AMR process. It was during this part of the process that the plant procedures being credited for managing the effects of aging have been reviewed. If a procedure was found to provide for the periodic replacement of the component, or the component was found to have an established qualified life (e.g., for EQ purposes), the component has been identified as short-lived and an aging management review has not been required for that component.

Consumables are a special class of short-lived items that can include packing, gaskets, component seals, O-rings, structural sealants, oil, grease, component filters, system filters, fire extinguishers, fire hoses, and air packs. Many types of consumables are part of a component such as a valve or a pump and, therefore, have not been identified during screening. Items potentially treatable as consumables have been evaluated consistent with the information presented in Reference 2. The results of that evaluation are presented below.

Packing, Gaskets, Components Seals, and O-Rings

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

subcomponents of the identified components and, therefore, are not subject to their own condition or performance monitoring. Therefore, the AMR for the component has included an evaluation of the sealing materials in those instances where it could not be demonstrated that one of the following conditions exist:

1. The sealing materials are short-lived because they are replaced on a fixed frequency or have a qualified life established (e.g., for EQ purposes), or
2. The sealing materials are not relied on in the CLB to maintain any of the following:
   - Leakage below established limits
   - System pressure high enough to deliver specified flow rates
   - A pressure envelope for a space

Oil, Grease, and Filters

Oil, grease, and filters (both system and component filters) have been treated as consumables because either:

- A program for periodic replacement exists, or
- A monitoring program (e.g., predictive analysis activities, condition monitoring) exists that replaces these consumables, based on an established performance criteria, when their condition begins to degrade but before there is a loss of intended function.

Fire Extinguishers, Fire Hoses, and Air Packs

Components such as fire hoses, fire extinguishers, self-contained breathing apparatus (SCBA), and SCBA cylinders are considered to be consumables and are routinely tested or inspected. The Fire Protection Program complies with the applicable safety standards (NFPA-10 for fire extinguishers; NFPA-1962 for fire hoses; 42 CFR 84, 29 CFR 19.10, 29 CFR 19.26, NUREG-41, and ANSI-Z88.2 for air packs), which specify performance and condition monitoring programs for these specific components. Fire hoses and fire extinguishers are inspected and hydrostatically tested periodically and must be replaced if they do not pass the test or inspection. SCBA and SCBA cylinders are inspected and periodically tested and must be replaced if they do not pass the test or inspection. The Fire Protection Program determines the replacement criterion of these components that are routinely checked by tests or inspections to assure operability. Therefore, while these consumables are in the scope of license renewal, they do not require an AMR.

Structural Sealants

Structural sealants are associated with fire barriers, flood barriers, and the concrete liner in the intake canal. These types of sealants historically are not replaced on a fixed interval and do not have established qualified lives. Therefore, they are treated as long-lived items.

The structural sealants associated with fire and flood barriers identified as requiring an AMR have been treated as commodities and are evaluated in Section 3.5.11, Miscellaneous Structural Commodities. The structural sealant associated with the concrete liner in the intake canal has been evaluated in Section 3.5.8, Earthen Structures.

The charging pump cubicle walls in the Auxiliary Building have removable concrete barrier walls. To prevent flooding into the cubicles, these walls are sealed up to a height of 44 inches from floor with a silicone sealant. The flood barrier walls are removed and reinstalled during major maintenance work on the charging pumps. The sealants are replaced during this process. These flood barrier walls are removed and reinstalled at least once every five years. These silicone sealants are, therefore, considered to be short-lived items; and are not subject to an aging evaluation.

C2.4 Identification of Materials and Environments

The fourth step of the AMR process has involved the identification of the materials and the service environments of the components and structural members that require an AMR.

For many mark-numbered components, the materials have been identified within the Equipment Data System (Section 2.1.3.5). In other instances, the information has been obtained by consulting documentation sources such as equipment specifications, purchase orders, vendor manuals, and drawings. The materials have been documented in the AMR report.

Some components contain internal or external coatings or linings. Although these features perform a preventative function, they are not credited for the elimination of aging effects requiring management.

The component service environments include any conditions known to exist on a recurring basis based on operating experience, unless design features have been implemented to preclude those conditions from reoccurring. Descriptions of the internal and external service environments which have been used in the aging management review to determine aging effects requiring management are included in Table 3.0-1, Internal Service Environments and Table 3.0-2, External Service Environments. The general environments of individual components, subcomponents, and structural members have been documented in the applicable AMR report, and are reflected in the AMR results tables presented in this application. For example, the fluids internal to plant systems have generally been characterized as raw water, treated water, etc. However, in many instances, the aging effects considered have been dependent on more specific environmental parameters, such as the fluid temperature, fluid flow, chloride concentrations, accumulated radiation exposure, and intermittent wetting. Therefore, when required, the environments that come in contact

with the equipment (internal and external) have been further characterized in the AMR in terms of chemistry parameters, temperature, flow rates, etc.

Embedded steel is contained in concrete structural components as reinforcement, embedded bolting (a portion of the bolt is embedded), embedded structural shapes for anchorage, wall penetration sleeves, and piping. The embedded steel is placed in the concrete (or grout) while it is being poured. It is surrounded by the concrete and is considered to be an integral part of the concrete. Therefore, embedded steel is evaluated along with the concrete in which it exists. This evaluation has considered the alkalinity of the surrounding concrete and external environment, such as air, soil, and aggressive water, for loss of material and cracking of the concrete. The result of this review has been documented in Section C3.1.17, Corrosion of Embedded Steel. The protruding portion of the embedded steel has been evaluated for exposure to appropriate environments (such as air, borated water leakage etc.) as any other structural steel in the IPA process.

Waterstops are generally provided in structures along the junctions of the foundation mat and concrete walls, at each vertical construction joint, and in the seismic gap space. In these applications, waterstops are not defined as unique components, but are considered part of these concrete structural members.

The surfaces of the carbon steel or low-alloy steel subcomponents in contact with the primary coolant are clad with a weld overlay of stainless steel, with the exception of selected locations that are clad with nickel-based alloy. The cladding is considered a "design feature" for corrosion control and is included for completeness. The metal-to-metal interface between the cladding and the carbon steel or low-alloy steel was not evaluated for age-related degradation because of the material compatibility.

C2.5 Identification of Aging Effects Requiring Management

The fifth step in the AMR process has involved the identification of the aging effects requiring management. To provide for consistency throughout the AMR process, the aging effects requiring management for Surry and North Anna Power Stations have been incorporated into a material aging effects report. This report has incorporated aging effects that have actually occurred based upon industry operating experience and to a lesser extent Dominion operating experience. The aging effects have been presented in terms of material and environment combinations expected at the stations. Therefore, the information is applied to plant equipment, regardless of form (i.e., piping, pump casings, valve bodies, tanks, structural beams, etc.). The environments considered in the report are the environments that components, subcomponents, and structural members experience during routine operation. Environmental stressors that are not conditions normally experienced by equipment, or that may be caused by a design problem (such as vibration-induced fatigue),

are called event-driven or service-driven situations and have not been characterized as sources of aging as discussed in Section C3.0, Aging Effects.

The License Renewal Rule requires that aging effects be identified and managed to maintain system or structure intended functions. The Rule does not require that the associated aging mechanisms be addressed in a license renewal application. However, aging effects are the manifestation of aging mechanisms. Therefore, to effectively manage an aging effect, it has been necessary to first determine the aging mechanisms that are potentially at work for a given equipment application. Then the aging mechanism and the associated aging effect can be dealt with in the AMR. Therefore the AMR process has addressed both the aging effects and the associated aging mechanisms.

The material aging effects report has been used in the development of AMRs to identify the aging mechanisms/effects that require management for in-scope long-lived passive components and structural members. If a plant material-environment combination has not already been addressed in the material aging effects report, a review of Dominion operating experience and other industry sources has been initiated to identify any aging effects that require management. Where appropriate, the report has been revised to incorporate the information from those sources. The report has also been revised to include any aging effects that have been found to exist at North Anna or Surry, but that have not been previously addressed.

The applicability of each aging mechanism and effect identified in the materials aging effects report has been evaluated and a summary of the review is presented in the AMR. Justification has been provided for any aging mechanisms and effects that do not apply to a particular component or group of components.

Dominion's positions on the aging effects of potential concern to the station are presented in Section C3.0, Aging Effects.

C2.6 Determination of the Activities Required to Manage the Effects of Aging

The sixth step in the AMR process has involved the determination of the aging management activities (AMAs) to be credited for managing the aging effects requiring management, and a demonstration of the effectiveness of those AMAs. To provide for consistency throughout the AMR process, a standard set of AMAs have been generated for use in the AMRs. The majority of those AMAs represent existing plant activities. Those activities and any required enhancements to those activities are described in Appendix B, Section B2.2, Existing Aging Management Activities. Several new activities are also needed to address aging issues identified during the AMR process. These proposed new activities are described in Appendix B, Section B2.1, New Aging Management Activities.

The AMA descriptions and guidance provided within the department have been used as a basis for the selection of the AMAs to be credited for managing the aging effects requiring management.

C3.0 AGING EFFECTS

Aging effects have been determined based on materials and environments. Aging effects are considered to require management if the effects can cause the loss of a component's intended function during the period of extended operation. The following aging effects and associated aging mechanisms have been evaluated.

C3.1 Loss of Material

Loss of material may be caused by general corrosion, pitting corrosion, galvanic corrosion, crevice corrosion, erosion-corrosion/flow-accelerated corrosion, microbiologically influenced corrosion, wear, aggressive chemical attack, boric acid wastage, fretting, graphitization, erosion, abrasive erosion and cavitation, subsurface flow (seepage), freeze thaw, elevated temperatures, corrosion of embedded steel, rain impact, surface flow, wave action, wind erosion, abrasion, and flaking.

C3.1.1 General Corrosion

General corrosion is surface deterioration that is characterized by uniform thinning without appreciable localized attack. It is the result of chemical or electrochemical reaction between a material and an aggressive environment. Both oxygen and moisture are necessary for corrosion of iron contained in carbon and low-alloy steels. Corrosion is precluded by the absence of either moisture or oxygen, or by placing a protective coating or liner on the component. Corrosion of carbon and low-alloy steels is possible regardless of whether the water is treated. General corrosion normally is accommodated by a standard corrosion allowance.

External surfaces of carbon and low-alloy steel piping and components, located within structures, have not experienced corrosion degradation that would affect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation.

Wrought austenitic stainless steels, copper, copper alloys, cast austenitic stainless steel (CASS), aluminum and nickel-based alloys are not susceptible to significant general corrosion that would effect the intended function of components.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.2 Pitting Corrosion

Pitting corrosion is a form of localized attack that results in depressions in the metal of treated water systems. Oxygen is required for the initiation of pitting corrosion. Contaminants such as halogens or sulfates, are required for continued metal dissolution. Pitting corrosion occurs when passive films in local areas attack passive materials. Once

a pit penetrates the passive film, galvanic conditions occur, because the metal in this pit is anodic relative to the passive film. Maintaining adequate flow rate over this exposed surface of a component can inhibit pitting corrosion. However, stagnant or low flow conditions are assumed to exist in all systems where dead legs of piping, such as vents or drains, exist. Pitting corrosion is more common in passive materials such as austenitic stainless steels, than with non-passive materials. Most materials of interest are susceptible to pitting corrosion under certain conditions. For treated water environments, stainless steel and carbon steel are assumed susceptible to pitting in the presence of halogens in excess of 150 ppb or sulfates in excess of 100 ppb, when dissolved oxygen is in excess of 100 ppb.

External surfaces of piping and components, located within structures, have not experienced corrosion degradation that would effect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.3 Galvanic Corrosion

Loss of material due to galvanic corrosion can occur only when materials with different electrochemical potentials are in contact within an aqueous environment. Generally, the effects of galvanic corrosion are precluded by design (e.g., isolation to prevent electrolytic connection or using similar materials). In galvanic couples involving brass, carbon steel, cast iron, copper, and stainless steel materials, the lower potential (more anodic) carbon steel, cast iron, and low-alloy steel is preferentially attacked.

Galvanic corrosion normally manifests itself in the form of localized loss of material at the surface of the more active (anodic) metal. The type of damage caused by pitting corrosion is very similar, and, in fact, the difference in the two is visually difficult to distinguish. Typically, it is not until a more in-depth evaluation of materials is performed that a definitive cause determination can be made. Thus, where galvanic corrosion is identified, pitting corrosion has also been identified as requiring evaluation.

When performing aging management reviews, the more obvious types of installations where dissimilar metals are normally used have been identified, but an attempt has not been made to identify all such installations (e.g., dissimilar welds). However, the guidance provided and the combination of the programs credited for detecting both galvanic corrosion and pitting provide for the timely detection of any degradation that results from galvanic corrosion so that there is reasonable assurance that intended functions will be maintained.

External surfaces of piping and components, located within structures, have not experienced corrosion degradation that would effect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.4 Crevice Corrosion

Crevice corrosion is a localized effect that occurs most frequently in joints and connections, or at points of contact between metals and non-metals. Oxygen levels above 100 ppb and stagnant or low-flow conditions (<3 fps for raw water/damp soil; <5 fps for brackish water) are required for crevice corrosion initiation in carbon steel, low-alloy steel, austenitic stainless steel, cast-austenitic stainless steel, copper, and nickel-based alloys.

Crevice corrosion due to under-deposit attack may result from aqueous macro-organisms, silting, or corrosion-product buildup. Routine maintenance to prevent the accumulation of macro-organisms, silting, or corrosion products is sufficient to alleviate the conditions that lead to further corrosion.

Crevice corrosion may occur in all aqueous environments. Crevice corrosion is not expected to cause significant degradation in a properly controlled, high-purity water environment. Conversely, any impurities or a high temperature significantly increase the likelihood of material loss due to crevice corrosion.

External surfaces of piping and components, located within structures, have not experienced corrosion degradation that would effect the intended function of components due to humidity in the absence of cyclic or intermittent wetting conditions, such as condensation.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.5 Erosion-Corrosion/Flow-accelerated Corrosion

Erosion-corrosion is the loss of material due to the combined actions of erosion by a flowing fluid and corrosion of the newly exposed base material that results from the erosion. This combined effect leads to an accelerated loss of material. Two factors that diminish the likelihood of erosion-corrosion in carbon steel are flow rates and pH level. The erosion-corrosion phenomenon is applicable to carbon steel and low-alloy steel Copper alloys also are susceptible, but the amounts of copper alloys in plant systems that have high flow rates are minimal. Erosion-corrosion is not applicable to stainless steels and the chromium-molybdenum alloys.

The temperature threshold used for FAC to occur is 100ºF, and is a conservative value that considers both single and two-phase flow. Single-phase flow does not create a FAC concern below 200ºF. However, no lower limit is assigned for two-phase flow. Therefore, FAC is considered possible above 100ºF for both single-phase and two-phase flow.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.6 Microbiologically Influenced Corrosion

Microbiologically influenced corrosion (MIC) is a form of localized corrosive attack accelerated by the influence of microbiological activity due to the presence of certain organisms. Microbiological organisms can produce corrosive substances, as a byproduct of their biological processes, that disrupt the protective oxide layer on the component materials and lead to a material depression similar to pitting corrosion. Microscopic organisms have been observed in mediums over a wide range of temperatures and pH values. However, for the purpose of aging management review, loss of material due to MIC is not considered significant at temperatures greater than 210ºF or pH greater than 10.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.7 Wear

Mechanical wear (galling) is defined as damage to a solid surface by removal of parts of its material via mechanical action of a contacting solid, liquid, or gas. Galling is not considered to be an aging phenomenon because, in general, the length of time between the onset of galling and the failure of the component is extremely short. Since galling is most likely to occur during maintenance activities, it is not considered as an aging issue. Fretting and erosion are considered applicable aging mechanisms and are evaluated separately.

C3.1.8 Aggressive Chemical Attack

Aggressive chemical attack involves the degradation of concrete by chemical agents that attack the concrete matrix, thus causing staining, material loss, cracking, and/or spalling. Acid attack may increase the porosity and permeability of concrete, may reduce strength, and may render the concrete susceptible to further deterioration. Below grade, sulfate solutions of sodium, potassium, and magnesium may attack concrete, often in combination with chlorides. Continued or frequent cyclic exposure to acidic solutions with a pH <5.5, solutions with >500 ppm chlorides, or solutions with >1500 ppm sulfates

environments is necessary to cause significant degradation due to aggressive chemical attack.

Concrete used below grade can be exposed to chemicals in the ground water, which may be acidic or may contain chlorides and sulfates. The results of ground water analyses indicate that the ground water chemistry is non-aggressive. Ground water sample analyses taken between 1992 and 2000 indicate an average chloride value of 9.0 ppm, sulfate value of 13.52 ppm, and pH value of 7.68.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.9 Boric Acid Wastage

Boric acid, in the presence of moisture on the surface of carbon steel or copper can be quite corrosive. Significant loss of material can occur in the vicinity of an active leak. Inspections of surfaces affected by boric acid leakage or in locations where boric acid residue exists are performed to determine the effect on pressure boundary integrity.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.10 Fretting

Fretting is localized wear that occurs between tight-fitting surfaces that are subject to cyclic motion of very small amplitude. Usually, fretting is accompanied by corrosion of the wear debris. With the exception of heat exchangers, the only other locations susceptible to fretting include the reactor vessel and the reactor vessel internals locations where relative motion is not completely restrained.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.11 Graphitization (Selective Leaching)

Graphitization is the corrosion of gray cast iron, which occurs as the iron matrix is selectively leached away and a porous matrix of graphite remains. This mechanism occurs in relatively mild aqueous solutions and on buried piping and fittings.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.12 Erosion

Erosion is the removal of material from a surface when hard particles slide or roll across the surface under pressure. The particles may be loose or may be part of another surface in contact with the surface being eroded. Additionally, erosion can result from the abrasive action of moving fluids, usually accelerated by the presence of solid particles in suspension or high-velocity flow impingement at flow discontinuities or orifices. The same

type of erosive wear can be caused by water droplets entrained in saturated steam. System flow rates and discontinuities are designed to preclude the occurrence of erosion in fluid systems. Operating experience indicates that erosion on treated water systems may occur at large pressure reduction orifices (e.g., HHSI recirculation orifices, RC system letdown orifices), valves, and pumps.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.13 Abrasive Erosion and Cavitation

Water flowing on concrete surfaces that carries abrasive material (solid particles in suspension) or creates a negative pressure (vacuum) can cause abrasive erosion and cavitation of the concrete surface. When the solid particles are small, and the flow velocity is 12 fps or less, erosion of the concrete surface is negligible. Cavitation damage is also not likely if the flow velocity is less than 40 fps. Loss of material due to abrasive erosion and cavitation is applicable only to concrete structures and components that are exposed to continuously moving water.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.14 Subsurface Flow (Seepage)

Subsurface flow (seepage) is the process by which excess ground water moves from the soil mass and exits to the closest available drainage path. Seepage is generally a problem only during the initial filling of a reservoir or water control structure. Some triggering mechanisms may be clogged drainage systems, excessive movement, erosion, cracked or leaking conduits, or drains.

Seepage may lead to migration of soil fines out of the soil mass. This phenomenon is known as piping. Piping is the loss of soil through internal erosion, which can lead to rapid deterioration or failure of an embankment.

Moderate to highly plastic soils, and granular or open graded soils are inherently piping resistant. Impermeable clay liners may be used to keep the earthen structure sealed to prevent subsurface flow and the detrimental effects of seepage forces. The introduction, into the downstream portion of embankment dikes, of fillers that form a transition in gradation is designed to prevent piping.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.15 Freeze-Thaw

Freeze-thaw degradation occurs as the result of repetitive freezing and thawing of free water that has permeated the concrete. The result can be cracking, spalling, crumbling,

scaling, and exposure of aggregate and reinforcing bar. Resistance to freeze-thaw is dependent on the amount of entrained air and the permeability of the concrete to water penetration. Freeze-thaw is not applicable to concrete structures if the concrete is of an appropriate mix and construction quality. Concrete structures designed and constructed in accordance with Codes ACI 318-63 and ACI 301-66 (or later versions of these codes) provide for low permeability and adequate air entrainment such that the concrete will not be susceptible to freeze-thaw effects.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.16 Elevated Temperatures

Long-term exposure to elevated temperatures in excess of 300°F may cause surface scaling and cracking of concrete. Degradation from exposure to elevated temperature is insignificant for embedded reinforcing steel used in concrete structures that remain below 600°F.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.17 Corrosion of Embedded Steel

The high alkalinity (i.e., pH >12.5) of concrete provides an environment that helps protect the embedded steel (including bolting) from corrosion. Degradation due to the corrosion of embedded steel and reinforcing steel is non-significant for Class I concrete structures (above- or below-grade) not exposed to an aggressive environment (i.e., pH <11.5 or chlorides >500 ppm) for extended periods. Similarly, degradation is not significant if the structure is designed in accordance with ACI 318-63 or ACI 349-85, even if it is exposed to an aggressive environment, as long as it has a low water-to-cement ratio (0.35 to 0.45) and adequate air entrainment (3% to 6%), which results in low permeability. Design in accordance with the ACI codes provides sufficient reinforcement distribution to minimize crack development.

Concrete used below grade can be exposed to chemicals in the ground water, which may be acidic or may contain chlorides and sulfates. The results of ground water analyses indicate that the ground water chemistry is non-aggressive. Ground water sample analyses taken between 1992 and 2000 indicate an average chloride value of 9.0 ppm, sulfate value of 13.52 ppm, and pH value of 7.68.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.18 Rain Impact

Raindrops impacting soil can loosen the particles and cause the loosened soil to be carried away by surface flow erosion. Loss of material (erosion) is not an applicable aging effect for earthen structures subjected to rain impact erosion of they are protected by vegetation and/or rip-rap.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.19 Surface Flow

Surface flow or rain runoff can cause soil surfaces to erode, resulting in surface scour or gullies. If left unchecked, significant loss of soil can occur. Erosion potential of an area is dependent on soil characteristics, soil cover (e.g., vegetation, rip-rap, concrete), topography, and climate.

Four factors that are important in determining soil erodibility are soil texture (particle size and gradation), percentage of organic content, soil structure, and soil permeability. Soils with a high organic content have a higher infiltration rate and the ability to sustain vegetation. Vegetation cover is extremely important in controlling soil erosion because the root system holds the soil particles in place and reduces the velocity of runoff. Soils having cementitous and cohesive properties are more erosion resistant. Soils with higher permeability tend to have higher infiltration rates and thus less surface flow. Soils with high percentages of fine sands and silts are normally the most erodible.

Topography is also a major factor in the erosion process. Limiting embankment slopes to minimize overland flow velocities and providing concrete or rip-rap covers in areas with high fluid velocities can minimize surface flow erosion.

The climate of an area also can have an influence on the potential for erosion. Areas that experience heavy rain, such as hurricane rain, are vulnerable to surface erosion.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.20 Wave Action

The shore line around water-retaining earthen structures may experience a loss of material owing to wave action. This effect is primarily caused by wind blowing across the water surface or by surface flow. This effect could cause a loss of slope stability owing to the undercutting erosion action of the waves. Seepage is an additional condition that could occur due to thinning of impermeable clay liners.

Loss of material through wave action is not a concern if good design practices have been employed such as limiting the slope of the embankment, installing rip-rap, or installing a concrete liner at the shoreline.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.21 Wind Erosion

During dry periods, wind can erode loose surface soil from the earthen structure. Loss of material (erosion) is not an applicable aging effect for earthen structures subjected to wind erosion that is protected by vegetation and/or rip-rap.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.22 Abrasion

Abrasion may occur when a vibrating item is in contact with the surface of the fire wrap. This mechanism can occur in two ways: first, the fire wrapped item may experience continuous movement or vibration. Abrasion can occur at the location where the wrapped item interfaces with the rigid component (e.g., a support member). The second way is similar, except the fire wrapped component is fixed (e.g., steel beam) and it interfaces with another moving or vibrating component (e.g., pipe). In both instances the interaction of the two components may abrade the fire wrap such that the required fireproof rating is not maintained in a localized area. Therefore, loss of material due to abrasion is an aging effect for fire wrap. Fire stops may also be susceptible to abrasion when in contact with vibrating equipment.

This aging mechanism has been evaluated during the aging management reviews.

C3.1.23 Flaking

Flaking may occur as fire wrap fibers are freed from the material surface and either become airborne or fall free from the fire wrap. This mechanism may be expected for sprayed-on fire proofing material. The fibers may be freed over time due to the force of gravity, air flow in the vicinity of the fireproofing, and vibrations induced in the fireproofed members. The rate of flaking is typically linear with respect to time. If flaking occurs for a sufficiently long time, it can potentially reduce the fireproofing thickness such that the required fireproof rating is not maintained. Fire stops are not found to be susceptible to flaking. Therefore, loss of material due to flaking is an applicable aging effect for some fire wraps but not for fire stops.

This aging mechanism has been evaluated during the aging management reviews.

C3.2 Cracking

Cracking is the non-ductile failure of a component due to stress corrosion, flaw initiation and growth, settlement, dry shrinkage, freeze-thaw, expansion and contraction, joint isolation and durability, aggressive chemical attack, alkali-aggregate reaction, corrosion of embedded

steel, elevated temperatures, irradiation, thermal exposure, ultraviolet radiation and ozone, differential movement, shrinkage, or vibration. The analysis of the potential for cracking due to metal fatigue is a time-limited aging analysis and is addressed in Section 4.3, Metal Fatigue, of this application.

C3.2.1 Stress-Corrosion Cracking

Stress-corrosion cracking (SCC) is a cracking process that requires the simultaneous action of a corrosive environment, sustained tensile stress, and a susceptible material. Elimination of any one of these elements will eliminate the susceptibility to SCC.

Cracking can occur along the material grain boundaries, which is designated as intergranular stress-corrosion cracking (IGSCC); across the material grains, which is designated as transgranular stress-corrosion cracking (TGSCC); or both. SCC also can occur as primary-water stress-corrosion cracking (PWSCC) in steam generator tubing or austenitic stainless steels. Exposure to high neutron fluence can lead to irradiation-assisted stress-corrosion cracking (IASCC). Intergranular attack (IGA) is similar to SCC, but it can occur without the presence of stress.

For austenitic stainless steel, SCC can occur at a temperature as low as 140°F (for sensitized material, the temperature threshold is considered to be ambient). SCC can occur in raw water or high-purity water, if the oxygen concentration exceeds 100 ppb, or in the presence of impurities such as sulfates (100 ppb), chlorides (150 ppb), or fluorides (150 ppb). While susceptibility to SCC exists for austenitic stainless steel and cast austenitic stainless steel at the conditions listed above, nickel-based alloys also can experience SCC at the same conditions. However, the temperature threshold for SCC to occur in nickel-based alloys is at a significantly higher value of 500°F.

For sensitized austenitic stainless steel, SCC can occur in air/gas or atmospheric/weather environments with cyclic or intermittent wetting. SCC is not considered an aging mechanism requiring management for non-sensitized stainless steel in an air/gas or atmospheric/weather environment.

Heat trace adhesives have not been used on components within the scope of license renewal. Therefore, external SCC of the associated piping due to chlorides or halogens in heat trace adhesives is not an aging management concern.

Although there have been instances of cracking of carbon steel and low-alloy steel bolting in the industry due to SCC, these failures have been attributed to high yield strength materials (>150 ksi), leaking gaskets, and the exposure to contaminants, such as lubricants containing molybdenum disulfide. For quenched and tempered low-alloy steels (e.g., SA193 Grade B7) used for closure bolting material, susceptibility to SCC is

controlled through the proper use of approved tensioning techniques, lubricants, and sealant, based on NRC guidance provided in Information Bulletin 82-02 (Reference 3) and Generic Letter 91-17 (Reference 4) and other industry initiatives in this area.

Dominion performs random testing of bolting materials (studs, threaded rods, capscrews, and nuts) for hardness, tensile strength, and chemical composition. A sample review of approximately 160 test results, over a five year period, have indicated that all tested samples have maintained yield strengths below 150 ksi, and in only one case did the yield strength exceed 140 ksi. For these reasons, stress-corrosion cracking of low-strength carbon steel bolting with low-yield strength (<150 ksi) is not an aging effect requiring management.

Bolting material identified as having a high-yield-strength (>150 ksi) is evaluated for SCC.

SCC is an aging mechanism that is considered for copper-based alloys in an air environment with the presence of ammonia and under sustained tensile stress.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.2 Flaw Initiation and Growth

Growth of fatigue, stress-corrosion, and original manufacturing flaws by service loading over time can cause cracking. The detection and evaluation of flaws is important in maintaining the structural integrity of the reactor coolant Class 1 pressure boundary and high-energy piping. ASME Section XI inservice examinations of components are intended to detect significant flaw growth and development. Flaw initiation and growth is evaluated and managed only for the reactor coolant Class 1 pressure boundary and high-energy piping pressure boundaries associated with the high-energy line break analysis presented in the UFSAR.

Inservice inspections are performed to detect flaws prior to loss of a component intended function. The examinations required by ASME Section XI utilize visual, surface, and volumetric inspections. Acceptance standards for inservice inspections are identified in Subsection IWB for Class 1 components. Components whose examination confirms the absence of flaws are deemed acceptable for continued service. However, flaws exceeding ASME Section XI allowable flaw size require corrective actions. Corrective actions are taken as outlined in Appendix B, Section B2.2.11, ISI Program - Component and Component Support Inspections.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.3 Settlement

Building settlement occurs as a result of the consolidation, movement, or liquefaction of soils on which the structure is founded. Ongoing settlement may be observed in the form of active structural cracking or as differential movements of structures or the piping and conduits passing between the affected structures. Settlement cracking is a concern when structures are located on soil.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.4 Dry Shrinkage

Dry shrinkage is the main cause of volume changes in masonry block walls. The type of aggregate used, the method of curing, and the methods of storage are the factors that affect dry shrinkage. Blocks made with sand and gravel aggregate will normally exhibit the least shrinkage. High-pressure steam curing and proper drying of concrete masonry blocks reduce the potential shrinkage of the walls. Improper aggregate content or lack of curing will cause cracking of masonry walls.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.5 Freeze-Thaw

Freeze-thaw degradation occurs as the result of repetitive freezing and thawing of free water that has permeated the concrete. The result can be cracking, spalling, crumbling, scaling, and exposure of aggregate and reinforcing bar. Resistance to freeze-thaw is dependent on the amount of entrained air and the permeability of the concrete to water penetration. Freeze-thaw is not applicable for concrete structures if the concrete is of an appropriate mix and construction quality. Concrete structures designed and constructed in accordance with Codes ACI 318-63 and ACI 301-66 (or later versions of these codes) provide for low permeability and adequate air entrainment such that the concrete will not be susceptible to freeze-thaw cracking effects.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.6 Expansion and Contraction

Restraints on a block wall may prevent the wall from freely expanding or contracting and thereby, induce stresses that may result in cracking within the wall. Restraints against expansion generally results in stresses that are small compared to the strength of the wall and, therefore, rarely cause degradation. Restraints against free contraction are much more likely to cause cracks.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.7 Joint Isolation and Durability

A lack of proper isolation at a joint between a masonry block wall and the associated supporting structural steel can allow long-term creep and variation in stiffness of the supporting components, which can result in cracking. The durability of the masonry mortar used at the joints may affect the long-term structural integrity of the masonry block wall.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.8 Aggressive Chemical Attack

Aggressive chemical attack involves the degradation of concrete by chemical agents that attack the concrete matrix, thus causing staining, material loss, cracking, and/or spalling. Acid attack may increase the porosity and permeability of concrete, may reduce strength, and may render the concrete susceptible to further deterioration. Below grade, sulfate solutions of sodium, potassium, and magnesium may attack concrete, often in combination with chlorides. Continued or frequent cyclic exposure to acidic solutions with a pH <5.5, solutions with >500 ppm chlorides, or solutions with >1500 ppm sulfates environments is necessary to cause significant degradation due to aggressive chemical attack.

Concrete used below grade can be exposed to chemicals in the ground water, which may be acidic or may contain chlorides and sulfates. The results of ground water analyses indicate that the ground water chemistry is non-aggressive. Ground water sample analyses taken between 1992 and 2000 indicate an average chloride value of 9.0 ppm, sulfate value of 13.52 ppm, and pH value of 7.68.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.9 Alkali-aggregate Reaction

Alkali-aggregate reactions cause internal expansion stresses in concrete, which can result in internal decomposition, cracking, and reduced strength. Operating history does not indicate that alkali-aggregate reaction is a prevalent phenomenon in nuclear power facilities. Alkali-aggregate reactions are not significant in aggregates that are investigated, tested and subject to petrographic examination conducted in accordance with ASTM-C295 or ASTM-C227, and that are shown to be non-reactive. Alternatively, the aggregate may be designated potentially reactive; however, if the provisions of ACI-201-2R-67 are followed, the alkali-aggregate reactions are not significant.

This aging mechanism has been evaluated during the aging management reviews.

Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

C3.2.10 Corrosion of Embedded Steel

Corrosion of embedded steel can cause cracking, spalling, loss of bond, and loss of concrete material. Corrosion of embedded steel may be applicable to the surfaces of the steel that are in direct contact with concrete. Examples of embedded steel are reinforcing steel, plates, and anchor bolts.

The high alkalinity (i.e., pH >12.5) of the concrete provides an environment that helps protect the embedded steel from corrosion. Degradation due to the corrosion of embedded steel and reinforcing steel is non-significant for Class I concrete structures (above- or below-grade) not exposed to an aggressive environment (i.e., pH <11.5 or chlorides >500 ppm) for extended periods. Similarly, degradation is not significant if the structure is designed in accordance with ACI 318-63 or ACI 349-85, even if it is exposed to an aggressive environment, as long as it has a low water-to-cement ratio (0.35 to 0.45) and adequate air entrainment (3% to 6%), which results in low permeability. Design in accordance with the ACI codes will provide sufficient reinforcement distribution to minimize crack development.

Concrete used below grade can be exposed to chemicals in the ground water, which may be acidic or may contain chlorides and sulfates. The results of ground water analyses indicate that the ground water chemistry is non-aggressive. Ground water sample analyses taken between 1992 and 2000 indicate an average chloride value of 9.0 ppm, sulfate value of 13.52 ppm, and pH value of 7.68.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.11 Elevated Temperatures

Long-term exposure to elevated temperatures in excess of 300°F may cause surface scaling and cracking of the concrete. Degradation from exposure to elevated temperatures is insignificant for embedded reinforcing steel used in concrete structures that remain below 600°F.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.12 Irradiation

Ionizing radiation can profoundly alter the molecular structure and macroscopic properties of elastomers. Effects of radiation-induced degradation of elastomers may include embrittlement, cracking or crazing, swelling, discoloration, and melting. Rubber, neoprene, and silicone elastomers ultimately become harder, stiffer, and eventually brittle, when exposed to radiation.

This aging mechanism has been evaluated during the aging management reviews.

Text enclosed in thick border indicates technical information specific to **NORTH ANNA.**

C3.2.13 Thermal Exposure

Thermal exposure of elastomers can result in decreased tensile strength or ultimate elongation, cracking, chain scission, or cross-linking. Cross-linking refers to the process where long chain molecules typically present in elastomers are bonded together. Cross-linking makes the elastomers brittle, increases the modulus of elasticity, and promotes surface cracking. Chain scission is the breaking of chemical bonds in elastomers, which usually results in reduced tensile strength and modulus of elasticity.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.14 Ultraviolet Radiation and Ozone

Rubber is decomposed by exposure to ultraviolet radiation. Ultraviolet radiation includes solar radiation and ultraviolet or fluorescent lamps. The deterioration of rubber is greatly accelerated in the presence of oxygen. Cracking and checking, which may occur when rubber is exposed to air and sunlight, are due mainly to reaction with ozone. Neoprene and nitrite rubber have good resistance to sunlight and ozone, and silicone and butyl rubber are relatively unaffected by sunlight and ozone. Ultraviolet degradation may be prevented by means of an opaque covering.

Exposure to ultraviolet radiation and ozone can also cause damage to the chemical structure of the epoxy matrix of fiberglass. The earliest signs of this effect can be changes in color and surface cracking or crazing. Fiberglass exposed to direct sun or high levels of ozone that might be found in conjunction with high-voltage electrical equipment would be most prone to this effect. Exposure to indoors ambient lighting and normal environmental ozone is not a concern.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.15 Differential Movement

Differential movement of the fire barriers may cause cracking of fire wrap material if it is attached independently to separate support structures for the wrapped component. This condition is precluded in design and by initial fire proofing inspections. Sprayed-on fire proofing is not affected, since it is applied to structural components that do not experience differential movements during normal plant operation. Therefore, cracking due to movement is not an applicable aging effect for fire wrapping.

Differential movement may initially affect fire stops between adjacent structures. Cracking due to differential movement is an applicable aging effect for fire stops.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.16 Shrinkage

Shrinkage may occur over time where fire penetration seal material is exposed to pipe surfaces. Shrinkage has been observed with silicone foam seal material used for fire stops. Therefore, cracking due to shrinkage is an applicable aging effect for fire stops and not for fire wraps.

This aging mechanism has been evaluated during the aging management reviews.

C3.2.17 Vibration

This section addresses mechanical fatigue resulting from vibration, the impact of component support vibration on concrete and vibration leading to cracking of fire wrap and fire stop material.

Mechanical fatigue resulting from vibration has been observed in the nuclear industry and can result in crack initiation/growth. Vibration-induced fatigue is fast acting and typically detected early in a component's life, and corrective actions are initiated to prevent recurrence. Corrective actions involve design modifications to the plant, such as the addition of supplemental restraints to a piping system, replacement of tubing with flexible hose, etc. Proper design minimizes or eliminates anticipated vibration.

Components and component supports may be subjected to vibratory or cyclic loading. This vibration characteristically leads to support degradation, such as concrete cracking around anchor bolts. Support degradation will occur early in the operational life of the support and is promptly identified and corrected through design modifications to prevent recurrence. Proper design eliminates or compensates for vibration and cyclic loading.

Since these sources of vibration are design considerations, cracking due to vibration is not an applicable aging mechanism for mechanical systems and component supports.

Some vibration sources cannot be abated through design. In these situations, vibration may cause degradation over time. Fire wrap and fire stop materials are subject to cracking due to this mechanism. Cracking will most likely appear in sprayed-on fire proofing that protects steel floor beams and floor decking. Cracking may also form in fire-stop silicone rubber and foams. Over time, the vibration of steel members and decks under rotating equipment or other sources of vibration may break down the bond between steel and the fire proofing, causing cracks to form. Fatigue-based splits may form in flexible fire stop material from the same environment. These degradations may reduce the protective capacity of the fire proofing and may result in inadequate protection of structural components or allow fire and/or hot gases to spread across firewall penetrations. Therefore, cracking due to vibration is an applicable aging mechanism for fire wrap and fire stops.

C3.3 Heat Transfer Degradation

Heat transfer degradation due to fouling is an aging effect requiring management for those heat exchangers cooled by a raw water environment. Degradation of heat transfer in a raw water environment can be detected for a heat exchanger by changes in the temperature across the heat exchanger and/or changes in the flow rate or differential pressure for a given heat load. As a result, degradation in performance is capable of being detected and monitored by changes in these heat exchanger properties.

Treated water systems are demineralized water or chemically controlled water systems that protect against the introduction of materials and organisms that result in fouling. Operating experience indicates that heat exchanger tubes and tube sheets have not experienced a loss of heat transfer that would effect their intended function in treated water environments.

C3.3.1 Fouling

For components cooled by plant service water (raw water), fouling due to silting, corrosion product build-up and macro-organisms (bio-fouling) is a concern due to the potential to restrict design heat transfer. This is considered only a concern for raw water systems because treated water systems have not experienced fouling. For systems exposed to raw water, heat transfer degradation due to fouling is an aging effect requiring management for heat exchanger tubes, tubesheets, and certain unique components, such as the spray array nozzles at the North Anna service water reservoir.

The Service Water Inspection Program has been developed to address these concerns in response to NRC Generic Letter 89-13. For larger heat exchangers, such as the component cooling water heat exchangers and the main control room chillers, heat transfer performance tests were developed and are performed periodically to monitor for degradation. However, for smaller heat exchangers, which lack instrumentation or have considerable margins between design heat transfer capability and heat load, testing is impractical. Instead, routine monitoring of operating parameters, such as bearing or seal temperatures, is relied on and maintenance activities are used to perform inspections and repairs when degradation is observed.

This aging mechanism has been evaluated during the aging management reviews.

C3.4 Loss of Pre-load

Plant Technical Specifications maintain strict leakage controls on the reactor coolant pressure boundary so that leakage can be quickly identified and accounted for during plant operations. As such, fasteners used in systems to maintain the reactor coolant pressure boundary (i.e. ASME Class 1) warrant additional assurances inherent in nuclear safety beyond those required for ASME Class 2, 3, and Non Class fasteners. Therefore, the loss of

pre-load due to stress relaxation is an aging effect associated with only ASME Class 1 bolted connections.

C3.4.1 Stress Relaxation

Stress relaxation is related to the creep phenomenon and causes loss of operating pre-loads in stressed components operating at relatively high temperatures. Stress relaxation is of primary concern in such components as high-strength bolting, which experiences a large pre-load. High operating temperatures increase the probability for stress relaxation. Most stress relaxation occurs early in the component's life. Operating experience does not indicate that stress relaxation is a significant aging effect requiring management for the non-Class 1 components at Dominion. However, stress relaxation is evaluated and managed for the Class 1 components.

This aging mechanism has been evaluated during the aging management reviews.

C3.5 Reduction in Fracture Toughness

Reduction in fracture toughness is due to thermal embrittlement, neutron embrittlement, or hydrogen embrittlement.

C3.5.1 Thermal Embrittlement

Thermal embrittlement is a mechanism by which the mechanical property fracture toughness is affected as a result of exposure to elevated temperature. Cast austenitic stainless steel (CASS) materials are susceptible to thermal embrittlement dependent upon material composition and the time at elevated temperature. CASS materials subjected to temperatures >482°F are considered susceptible. Low-alloy steels may be subject to embrittlement from exposure to temperatures in the range of 570°F - 1100°F. The loss of fracture toughness may not be accompanied by significant changes in other material properties.

This aging mechanism has been evaluated during the aging management reviews.

C3.5.2 Neutron Embrittlement

Neutron embrittlement is the loss of fracture toughness resulting from the bombardment of neutrons. The loss of fracture toughness may be accompanied by detectable increases in material hardness. The overall effects of neutron embrittlement on steel are to increase yield strength, decrease the ultimate tensile ductility, and increase the ductile-to-brittle transition temperature. There is insufficient neutron flux outside the primary shield wall to reduce fracture toughness because of neutron embrittlement. Therefore, components outside the primary shield wall are not evaluated for neutron embrittlement.

This aging mechanism has been evaluated during the aging management reviews.

C3.5.3 Hydrogen Embrittlement

Hydrogen embrittlement is a potential problem only for high-strength steel in environments charged with atomic hydrogen. This mechanism is not likely to occur if the yield strength of the material is less than 120 ksi, or there is no source of atomic hydrogen.

This aging mechanism has been evaluated during the aging management reviews.

C3.6 Formation of Water Trees

Formation of water trees due to water treeing is an aging effect requiring management.

C3.6.1 Water Treeing

Water treeing is a long-term phenomenon that has been documented for medium-voltage (MV) cables with certain extruded polyethylene insulation. Water treeing results when some organic insulation compounds used in MV applications are exposed to voltage stress (are energized) and are exposed to frequent wetting. Water treeing appears most often in cross-linked polyethylene (XLPE) or high molecular weight polyethylene (HMWPE) insulation. Factors that may effect water tree formation are cable construction, insulation and jacket materials' resistance to moisture absorption, degree of wetting, and time energized.

Historically, water treeing has been more prevalent in higher voltage cables. The formation and growth of water trees is much less severe in 5 kV cables than for those operated in the high voltage range. Due to low dielectric stress, water trees do not occur in low voltage cables. Effects are not measurable in relation to the determination of remaining cable life. However, observations can be made which show that precursors exist and actions may be taken to correct the environmental conditions that lead to water treeing and loss of dielectric strength and eventual cable failure.

This aging mechanism has been evaluated during the aging management reviews.

C3.7 Loss of Form

Frost action, sedimentation, settlement, subsurface flow (seepage), or surface flow can cause loss of form.

C3.7.1 Frost Action

If the daily mean temperature remains below 32°F for a period of three or more days, soil moisture begins to freeze. As the ground water continues to freeze, earthen structures

may experience deformation caused by frost heave. Frost heave is caused by water in the soil that expands approximately 10% when it freezes. Over an extended cold period, frost heave may cause permanent deformation to an earthen structure.

Loss of form due to frost heave occurs only in areas with a deep frost line and fine grain soil. It is also not an applicable aging mechanism if the foundation structure is located below the frost line or if the amount of frost heave is not perceivable without instrumentation.

This aging mechanism has been evaluated during the aging management reviews.

C3.7.2 Sedimentation

As surface flow (runoff) travels toward a water-control structure, it collects small particles of soil and organic material. When the runoff reaches the water-control structure, the energy of the flow is dissipated and the suspended particles settle to the bottom of the reservoir or canal. This is a particular concern where the storage capacity of the water-control structure is required for emergency cooling or flood water retention. Water that is withdrawn from a river can contain silt-sized particles. If the water carries an appreciable amount of silt, and water velocities are too low, the water-control structure used to convey the water can experience sedimentation problems. This loss of form can be minimized if good design practices and/or erosion control measures are employed.

This aging mechanism has been evaluated during the aging management reviews.

C3.7.3 Settlement

Settlement occurs as a result of distortion, consolidation, movement, or liquefaction of soils on which a structure is founded. To some degree, settlement is found in all earthen structures. As the below-surface soil is loaded, it settles under the pressure of the overburden. Distortion or immediate settlement generally occurs within the first year following construction and is most prevalent in granular or organic soils.

Consolidation or primary compression occurs in predominately fine-grained soils, as water is pressed out of the voids in the soil and the void ratio is reduced. Consolidation can occur over many years, depending on the thickness of the strata and the characteristics of the soil. However, most settlement occurs early in the life of a structure.

Soil creep or secondary compression is the phenomenon in which soil movement continues long after primary consolidation has dissipated. The settlement occurs primarily after consolidation and is caused by the rearrangement or compression of the soil skeleton. For inorganic soils of low to moderate compressibility, secondary compression seldom produces movement that would present problems to structures or

embankments. Significant movement can occur in compressible clays, highly micaceous soils, fills containing debris or broken rock, and organic materials. Secondary compression is often irregular and estimates to predict movement are seldom accurate.

This aging mechanism has been evaluated during the aging management reviews.

C3.7.4 Subsurface Flow (Seepage)

Subsurface flow (seepage) is the process by which excess ground water moves from the soil mass and exits to the closest available drainage path. Seepage is generally a problem only during the initial filling of a reservoir or water control structure. Some triggering mechanisms may be clogged drainage systems, excessive movement, erosion, cracked or leaking conduits, or drains.

Seepage may lead to migration of soil fines out of the soil mass. This phenomenon is known as piping. Piping is the loss of soil through internal erosion, which can lead to rapid deterioration or failure of an embankment.

Moderate to highly plastic soils, and granular or open-graded soils are inherently piping resistant. Impermeable clay liners may be used to keep the earthen structure sealed to prevent subsurface flow and the detrimental effects of seepage forces. The introduction, into the downstream portion of embankment dikes, of fillers that form a transition in gradation is designed to prevent piping.

This aging mechanism has been evaluated during the aging management reviews.

C3.7.5 Surface Flow

Surface flow or rain runoff can cause soil surfaces to erode, resulting in surface scour or gullies. If left unchecked, significant loss of soil can occur. Erosion potential of an area is dependent on soil characteristics, vegetation cover, topography, and climate.

Four factors that are important in determining soil erodibility are soil texture (particle size and gradation), percentage of organic content, soil structure, and soil permeability. Soils with a high organic content have a higher infiltration rate and the ability to sustain vegetation. Vegetation cover is extremely important in controlling soil erosion because the root system holds the soil particles in place and reduces the velocity of runoff. Soils having cementitous and cohesive properties are more erosion resistant. Soils with higher permeability tend to have higher infiltration rates and thus less surface flow. Soils with high percentages of fine sands and silts are normally the most erodible.

Topography is also a major factor in the erosion process. Limiting embankment slopes to minimize overland flow velocities and providing concrete or rip-rap covers in areas with high fluid velocities can minimize surface flow erosion.

The climate of an area also can have an influence on the potential for erosion. Areas that experience heavy rain, such as hurricane rain, are vulnerable to surface erosion.

This aging mechanism has been evaluated during the aging management reviews.

C3.8 Change in Material Properties

De-alloying (selective leaching), aggressive chemical attack, alkali-aggregate reaction, elevated temperatures, leaching (of calcium hydroxide), desiccation, irradiation, or thermal exposure can cause change in material properties.

C3.8.1 De-alloying (Selective Leaching)

De-alloying is the selective corrosion of one or more components of a solid solution alloy. This mechanism also is called parting or selective leaching. The material so affected loses density and strength. Dezincification affects copper-zinc alloys (brasses) of less than 85% copper when in the presence of water and dissolved oxygen. Denickelification affects copper-nickel alloys after extended service in fresh water. Decarburization affects surface layers of carbon steels exposed to high temperatures and oxygen. Graphitic corrosion (graphitization) is an analogous process in cast irons.

This aging mechanism has been evaluated during the aging management reviews.

C3.8.2 Aggressive Chemical Attack

Aggressive chemical attack involves degradation of concrete by chemical agents that attack the concrete matrix, causing staining, material loss, cracking, and/or spalling. Acid attack may increase porosity and permeability of concrete, reduce strength, and render the concrete susceptible to further deterioration. Below grade, sulfate solutions of sodium, potassium, and magnesium may attack concrete, often in combination with chlorides. Continued or frequent cyclic exposure to acidic solutions with pH<5.5, chloride solutions >500 ppm, and sulfate solutions >1500 ppm is necessary to cause significant degradation.

Concrete used below grade can be exposed to chemicals in the ground water, which may be acidic or may contain chlorides and sulfates. The results of ground water analyses indicate that the ground water chemistry is non-aggressive. Ground water sample analyses taken between 1992 and 2000 indicate an average chloride value of 9.0 ppm, sulfate value of 13.52 ppm, and pH value of 7.68.

This aging mechanism has been evaluated during the aging management reviews.

C3.8.3 Alkali-aggregate Reaction

Alkali-aggregate reactions cause internal expansion stresses in concrete, which can result in internal decomposition, cracking, and reduced strength. Operating history does not indicate that alkali-aggregate reaction is a prevalent phenomenon at nuclear power facilities. Alkali-aggregate reactions are not significant for aggregates that are investigated, tested, and subject to petrographic examination conducted in accordance with ASTM-C295 or ASTM-C227 and are shown non-reactive. Alternatively, the aggregate may be designated potentially reactive; however, if the provisions of ACI-201-2R-67 are followed, the alkali-aggregate reactions are not significant.

This aging mechanism has been evaluated during the aging management reviews.

C3.8.4 Elevated Temperatures

Long-term exposure to elevated temperatures in excess of 300°F may cause surface scaling and cracking of the concrete. Elevated temperatures may cause changes in the material properties of concrete. The compressive strength, tensile strength, and modulus of elasticity are reduced for prolonged exposure to temperatures exceeding 150°F for general area or 200°F localized. Degradation because of exposure to elevated temperature is insignificant for embedded reinforcing steel in concrete structures that remain below 600°F.

This aging mechanism has been evaluated during the aging management reviews.

C3.8.5 Leaching (of calcium hydroxide)

The loss of certain salts, including calcium hydroxide, from the concrete matrix by exposure to flowing or penetrating water, can cause a reduced strength of the concrete. Leaching typically is a concern associated only with low-density concrete. Since Seismic Class I concrete components in the nuclear plant concrete utilizes high-density, low-permeability concrete, and proper arrangement and distribution of reinforcement to control cracking in accordance with the guidance of ACI 201.2R-67, leaching is not an aging mechanism requiring management for Seismic Class I concrete components.

This aging mechanism has been evaluated during the aging management reviews.

C3.8.6 Desiccation

Desiccation may occur when the soil is exposed to the air for extended periods. Desiccation is the process of drying or removing all or nearly all of the moisture not chemically combined with a soil. Highly plastic preloaded marine clays are especially susceptible due to their potential for shrinkage and loss of pliability. This may cause the exposed surface of the clay to become embrittled and crack or flake off to a depth at

which the moisture stabilizes. On an annual basis, the flaking action may cause cracking a fraction of an inch deep. However, volume-change clays can undergo significant cracking or flaking to a depth of one or two feet. Desiccation combined with surface flow, wind, or wave action may accelerate the effects of erosion.

Desiccation is not an applicable aging mechanism for submerged structures, because the soil is continuously exposed to water. The effects of desiccation may be controlled through proper material selection and embankment sloping during design and construction. In addition, the presence of vegetation can minimize this effect, because plants tend to hold moisture in the soil.

This aging mechanism has been evaluated during the aging management reviews.

C3.8.7 Irradiation

For ceramics and polymers, the gamma radiation threshold value is the radiation dose at which at least one of the material's physical properties begins to change. The reported radiation damage threshold value for organic polymers of 10^6 rads is conservative for fire wrap and fire stop material (Bisco SF-20 silicone foam, for example, resists radiation effects up to 2 X 10^8 rads) and radiation may not affect the fire-retarding properties of fire wrap or fire stop materials at these levels. Therefore a change in material properties is not an aging effect for fire wrap and fire stops, provided the radiation dose is below 10^6 rads.

For elastomers, ionizing radiation can profoundly alter the molecular structure and macroscopic properties of elastomers. Effects of radiation-induced degradation of elastomers may include embrittlement, cracking or crazing, swelling, discoloration and melting. Rubber, neoprene, and silicone elastomers ultimately become harder, stiffer and eventually brittle when exposed to radiation.

This aging mechanism has been evaluated during the aging management reviews.

C3.8.8 Thermal Exposure

Thermal exposure of elastomers can result in decreased tensile strength or ultimate elongation, cracking, chain scission, or cross-linking. Cross-linking refers to the process in which long chain molecules typically present in elastomers are bonded together. Cross-linking makes the elastomers brittle, increases the modulus of elasticity, and promotes surface cracking. Chain scission is the breaking of chemical bonds in elastomers, which usually results in reduced tensile strength and modulus of elasticity.

This aging mechanism has been evaluated during the aging management reviews.

C3.9 Change in Dimensions

Change in dimensions due to void swelling is an aging effect associated with the reactor vessel internals.

C3.9.1 Void Swelling

Industry data is currently being evaluated as part of Westinghouse Owners Group and Electric Power Research Institute (EPRI) Material Reliability Project programs with respect to void swelling. At present there have been no indications from the different reactor vessel internals bolt removal programs, or from any of the other inspection and functional evaluations (e.g., refueling), that there are any discernible effects attributable to void swelling. However, an industry initiative to consider the accumulated data, engineering evaluations of the ramifications of void swelling, and the field observations is presently underway, which should be completed in the near future.

Void swelling is defined as a gradual increase in the dimension of a subcomponent as the result of helium bubble nucleation and growth from nuclear transmutation reactions of nickel and boron in the material. The helium bubbles have a diameter of 2 to 3 nanometers or less, but at sufficiently high temperatures, they can grow to a critical diameter larger than 4 nanometers. This growth becomes voids that cause swelling of the material. The irradiation flux level, the alloy composition, and the irradiation temperature affect the degree of void nucleation and growth. Welding that might be part of the irradiated material could be affected by the helium bubbles.

C3.10 Embrittlement

Embrittlement can be caused by irradiation or thermal exposure.

C3.10.1 Irradiation

The two forms of radiation that are of most concern for electrical/I&C components are gamma and neutron. Radiation interacts with matter in two principal ways: ionization/excitation of atoms in the material (radiolysis), and displacement of atoms or subatomic particles; thereby altering the molecular structure of the material. Both processes are applicable to radiation-induced degradation; however, displacement effects are usually not significant in organic materials because of their less rigid molecular structure and covalent bonding. Similarly, ionizing effects are of little significance to inorganic materials because of their ionic bonding and rigid or crystalline structure. In general, radiation effects are much more severe on organic than inorganic materials. Neutron radiation is of the most concern for inorganic and metallic materials. Radiation incident on cable organic components produces aging/degradation through scission,

oxidation, or cross-linking of polymer chains. This process is generally known as radiolysis. The predominant effects on metals are increased hardness and reduced creep rate.

This aging mechanism has been evaluated during the aging management reviews.

C3.10.2 Thermal Exposure

Thermal influences that may induce aging effects on the organic cable components or associated terminations may result from general area ambient temperatures, localized high temperatures, or internal resistive (ohmic) heating due to current flow within the conductors. Localized high temperatures resulting from occurrences such as steam leaks or damaged or missing thermal insulation are considered events and are not considered for long-term aging effects. General area temperatures and ohmic heating provide the sources of thermal stress for long-term aging effects.

Thermal exposure of the organic compounds used for electric conductor insulation can result in decreased tensile strength or ultimate elongation, cracking, crazing, chain scission, or cross-linking. Cross-linking refers to the process where the long chain molecules typically present in organic cable insulation compounds are joined with covalent bonds. Cross-linking generally results in increased tensile strength and hardening of the material. This hardening decreases material flexibility and elongation at the break, which can increase the susceptibility to cracking and crazing. Chain scission is the breaking of the long chain molecules into smaller pieces. Chain scission may reduce tensile strength and increase elongation.

This aging mechanism has been evaluated during the aging management reviews.

C3.11 Reduced Insulation Resistance

Reduced insulation resistance may be caused by irradiation.

C3.11.1 Irradiation

The two forms of radiation that are of most concern for electrical/I&C components are gamma and neutron. Radiation interacts with matter in two principal ways: ionization/excitation of atoms in the material (radiolysis), and displacement of atoms or subatomic particles; thereby altering the molecular structure of the material. Both processes are applicable to radiation-induced degradation; however, displacement effects are usually not significant in organic materials because of their less rigid molecular structure and covalent bonding. Similarly, ionizing effects are of little significance to inorganic materials because of their ionic bonding and rigid or crystalline structure. In general, radiation effects are much more severe on organic than inorganic materials.

Neutron radiation is of the most concern for inorganic and metallic materials. Radiation incident on cable organic components produces aging/degradation through scission, oxidation, or cross-linking of polymer chains. This process is generally known as radiolysis. The predominant effects on metals are increased hardness and reduced creep rate.

This aging mechanism has been evaluated during the aging management reviews.

C4.0 ADDITIONAL AMR TOPICS

C4.1 Review and Application of Generic Topical Reports

Generic topical reports are available that describe the aging effects requiring management for the certain plant equipment. The information in these reports is reviewed for applicability to the station and the AMR report is used to document the comparisons between the equipment, materials, fabrication techniques, installed configuration, modes of operation and environments evaluated in the topical report and those that exist for the station. The LRA includes a review of the topical report applicability for the following components since the NRC has issued a Final Safety Evaluation Report (FSER) on the topical reports:

1. Class 1 piping and associated pressure boundary components - Section 3.1.1, Confirmation of Topical Report Applicability
2. Reactor vessel internals - Section 3.1.3, Confirmation of Topical Report Applicability
3. Pressurizers - Section 3.1.4, Confirmation of Topical Report Applicability
4. Reactor coolant system supports - Section 3.5.9, Confirmation of Topical Report Applicability

Each section includes a reference to the table that contains a point-by-point evaluation of applicant action items delineated in the FSERs.

C4.2 Review of NUREG-0933

NUREG-0933 (Reference 5) has been reviewed in accordance with the guidance provided in Appendix A.3 of the Standard Review Plan (Reference 6). As a result of this review, the following generic safety issues (GSI) have been evaluated for license renewal and have been addressed in the LRA:

1. GSI-168, *Environmental Qualification of Electrical Equipment,* is addressed in Section 4.4, Environmental Qualification (EQ) of Electric Equipment.
2. GSI-190, *Fatigue Evaluation of Metal Components for 60-Year Plant Life,* is addressed Section 4.3.4, Environmentally Assisted Fatigue.

C5.0 PRESENTATION OF AMR RESULTS IN THE APPLICATION

The AMR results for in-scope, long-lived passive SSCs are presented in the following sections of the application:

1. Section 3.1, Aging Management of Reactor Coolant System
2. Section 3.2, Aging Management of Engineered Safety Features Systems
3. Section 3.3, Aging Management of Auxiliary Systems
4. Section 3.4, Aging Management of Steam and Power Conversion Systems
5. Section 3.5, Aging Management of Structures and Component Supports
6. Section 3.6, Aging Management of Electrical and Instrument and Controls

The AMR results presented within these sections are broken down by the same groupings of systems, major components, structures and commodities that were used to develop the AMR reports for the station (Section C2.1, Grouping of Systems, Structures and Components for Evaluation). The AMR results for each grouping of SSCs include:

1. A reference to the section of the application that contains a description of the SSC.
2. A reference to the AMR results table that lists the specific components, subcomponents, or structural members that required an AMR. For each of those items the following information is summarized in that table:
   - Passive functions
   - Materials
   - Internal (if applicable) and external environments
   - Aging effects
   - Activities credited for managing the aging effects

   The AMR results tables for systems (mechanical) and structures do not list commodities, NSSS equipment supports, or load handling cranes and devices. Each of these have their own AMR evaluations and associated AMR results tables.
3. Confirmation of Topical Report Applicability (only when applicable) - A subsection that summarizes the point-by-point comparison between a generic topical report and the SSCs being evaluated, and provides a reference to a table that includes a reconciliation of the final SER applicant action items. As stated in Section C4.1, Review and

Application of Generic Topical Reports, this subsection is only provided when the NRC has issued a Final Safety Evaluation Report on the topical report.

4. Materials - A subsection that summarizes the materials of construction for the SSCs.

5. Environment - A subsection that summarizes the internal (if applicable) and external environments that apply to the SSCs.

6. Aging Effects Requiring Management - A subsection that lists the aging effects that require management.

7. Time-Limited Aging Analysis (only when applicable) - A subsection that lists the time-limited aging analysis associated with the major component or system.

8. Conclusion - A subsection that lists the activities credited for managing the aging effects requiring management and that presents a concluding statement regarding the ability of the selected activities to adequately manage aging. The demonstrations upon which the concluding statements are based are included as an inherent part of the activity descriptions provided in Appendix B, Aging Management Activities.

As discussed in Section C2.3, Identification of Short-lived Components and Consumables, the components and subcomponents that have been determined to be short-lived or categorized as consumables are documented in the AMR reports. The AMR results sections do not identify this information since it is not required by the License Renewal Rule to be provided in the application.

APPENDIX C REFERENCES

1. NEI 95-10, *Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule*, Rev. 2, Nuclear Energy Institute, August 2000.

2. Letter of April 20, 1999 from Christopher I. Grimes of the NRC to Doug Walters of the NEI, Subject: *License Renewal Issue No. 98-012, Consumables*.

3. Information Bulletin 82-02, *Degradation of Threaded Fasteners in the Reactor Coolant Pressure Boundary of PWR Plants*, U.S. Nuclear Regulatory Commission, June 2, 1982.

4. Generic Letter 91-17, *Generic Safety Issue 29, "Bolting Degradation or Failure in Nuclear Power Plants"*, U.S. Nuclear Regulatory Commission, October 17, 1991.

5. NUREG-0933, *A Prioritization of Generic Safety Issues*, U.S. Nuclear Regulatory Commission, June 2000.

6. *Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants* (Draft for Public Comment), U.S. Nuclear Regulatory Commission, August 2000.

APPENDIX D

TECHNICAL SPECIFICATION CHANGES

APPENDIX D
Contents

D1.0 Technical Specification Changes - - -

D1.0 TECHNICAL SPECIFICATION CHANGES

10 CFR 54.22, requires that an application for license renewal include any Technical Specification changes, or additions that are necessary to manage the effects of aging during the period of extended operation. A review of the information provided in this License Renewal Application and the station's Technical Specifications confirms that no changes to the Technical Specifications are necessary.