FPL Energy

Duane Arnold Energy Center

License Renewal Application

September 2008

The following discussion describes the content of the Duane Arnold Energy Center (Duane Arnold) license renewal application.

Chapter 1.0 provides the administrative and general information required by 10 CFR 54.17 and 10 CFR 54.19.

Chapter 2.0 provides the scoping and screening methodology and identifies the systems, structures, and components within the scope of license renewal including intended functions. It also identifies the structures and components subject to an aging management review. Mechanical License Renewal drawings are listed that depict the components subject to Aging Management Review for mechanical systems. Civil License Renewal drawings are listed that depict plant layout. The system and structure groupings in Chapter 2.0 are organized to be consistent with NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," Revision 1, September 2005. Tables in this chapter list the plant systems and structures and identify whether systems and structures are in scope or out of scope for license renewal. This chapter provides descriptions of in-scope systems and structures and their intended functions. References are provided to the results of the aging management review in Chapter 3.0. The drawings are provided in a separate submittal.

Chapter 3.0 describes the results of the aging management reviews of mechanical, electrical/I&C, and structural components requiring aging management review. The tables in this chapter provide a summary of information concerning aging effects requiring management and applicable aging management programs for component and commodity groups subject to an aging management review. The information presented in the tables is based on the format and content of NUREG-1800. The tables include comparisons with the evaluations documented in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Revision 1, September 2005.

Chapter 4.0 provides the list of time-limited aging analyses defined by 10 CFR 54.3 and includes explanation of the time-dependent aspects of the calculation or analysis. This chapter demonstrates that the analyses remain valid for the period of extended operation, the analyses have been projected to the end of the period of extended operation, or the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. This chapter also confirms that no 10 CFR 50.12 exemptions based upon time-limited aging analyses as defined in 10 CFR 54.3 are required during the period of extended operation. The information in Chapter 4.0 fulfills the requirements of 10 CFR 54.21(c).

Appendix A, Updated Final Safety Analysis Report Supplement provides a summary description of the programs and activities that will manage the effects of aging for the period of extended operation. A summary description of the evaluation of the time-limited aging analyses for the period of extended operation is also included. Following issuance of the renewed license, the material contained in this appendix will be incorporated into the UFSAR. The information in Appendix A fulfills the requirements of 10 CFR 54.21(d).

Appendix B, Aging Management Programs, describes the aging management program and activities that will manage the effects of aging for the period of extended operation. Appendix B demonstrates that the aging effects on the components and structures within the scope of the License Renewal Rule will be managed such that they will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation. Where the Duane Arnold programs are consistent with corresponding programs in NUREG-1801, the appropriate NUREG-1801 program is referenced. The information in Chapters 2.0, 3.0 and Appendix B fulfills the requirements of 10 CFR 54.21(a).

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

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

Appendix E, Environmental Report, contains an environmental report analyzing the potential environmental impacts of license renewal and alternatives to license renewal, as provided in NRC regulations 10 CFR 51.53(c) and 10 CFR 54.23.

TECHNICAL AND ADMINISTRATIVE INFORMATION

Table of Contents

TECHNICAL AND ADMINISTRATIVE INFORMATION

Table of Contents

TECHNICAL AND ADMINISTRATIVE INFORMATION

Table of Contents

TECHNICAL AND ADMINISTRATIVE INFORMATION

Table of Contents

TECHNICAL AND ADMINISTRATIVE INFORMATION

Table of Contents

TECHNICAL AND ADMINISTRATIVE INFORMATION

Table of Contents

TECHNICAL AND ADMINISTRATIVE INFORMATION

Table of Contents

TECHNICAL AND ADMINISTRATIVE INFORMATION

Table of Contents

TECHNICAL AND ADMINISTRATIVE INFORMATION

Tables

TECHNICAL AND ADMINISTRATIVE INFORMATION

Tables

TECHNICAL AND ADMINISTRATIVE INFORMATION

Tables

TECHNICAL AND ADMINISTRATIVE INFORMATION

Tables

TECHNICAL AND ADMINISTRATIVE INFORMATION

Tables

TECHNICAL AND ADMINISTRATIVE INFORMATION

Tables

TECHNICAL AND ADMINISTRATIVE INFORMATION

Figures

1.0 ADMINISTRATIVE INFORMATION

Pursuant to Part 54 of Title 10 of the Code of Federal Regulations (10 CFR 54) [Reference 1.1-1], this application seeks renewal for an additional 20-year term of the facility operating license for Duane Arnold Energy Center (Duane Arnold). The facility operating license (DPR-49) currently expires at midnight, February 21, 2014. The application includes renewal of the source, special nuclear, and byproduct materials licenses that are combined in the facility operating license.

The application is based on the guidance provided by the U. S. Nuclear Regulatory Commission (NRC) in NUREG-1800,"Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," and Regulatory Guide 1.188, "Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses," which endorses the guidance provided by NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule" [References 1.1-2, 1.1-3, and1.1-4, respectively].

The license renewal application (LRA) is intended to provide sufficient information for the NRC to complete its technical and environmental reviews pursuant to 10 CFR Parts 54 and 51. The LRA is designed to allow the NRC to make the findings required by 10 CFR 54.29 in support of the issuance of a renewed operating license for Duane Arnold.

1.1 GENERAL INFORMATION

The following general information is required pursuant to 10 CFR 54.17 and 10 CFR 54.19.

1.1.1 NAME OF APPLICANTS

FPL Energy Duane Arnold, LLC (FPL Energy Duane Arnold)

FPL Energy Duane Arnold is the majority owner (70%) of the Duane Arnold Energy Center and is authorized to act as agent for Central Iowa Power Cooperative (20%) and Corn Belt Power Cooperative (10%) and has exclusive responsibility and control over the physical construction, operation, and maintenance of the facility.

1.1.2 ADDRESS OF APPLICANTS

FPL Energy Duane Arnold, LLC
700 Universe Boulevard
Juno Beach, FL 33408-0420

Other Owners and Addresses

Central Iowa Power Cooperative
1400 Highway 13 SE
Cedar Rapids, IA 52403

Corn Belt Power Cooperative
1300 13th Street North
Humboldt, IA 50548

Address of the site

Duane Arnold Energy Center
FPL Energy Duane Arnold, LLC
3277 DAEC Road
Palo, IA 52324

1.1.3 DESCRIPTION OF BUSINESS OF APPLICANTS

FPL Energy Duane Arnold, LLC

FPL Energy Duane Arnold is engaged in the business of acquiring generation assets and selling electricity at wholesale in the state of Iowa.

1.1.4 LEGAL STATUS AND ORGANIZATION

FPL Energy Duane Arnold, a Delaware limited liability company, is a direct, wholly-owned subsidiary of ESI Energy, LLC, which is a direct, wholly-owned subsidiary of FPL Energy, LLC. FPL Energy, LLC is in turn, a direct-wholly owned subsidiary of FPL Group Capital, Inc, which is a direct wholly-owned subsidiary of FPL Group. FPL Group is a public utility holding company incorporated in 1984 under the laws of the state of Florida.

FPL Energy, Duane Arnold is not owned, controlled, or dominated by any alien, a foreign corporation, or foreign government. FPL Energy Duane Arnold makes this application on their own behalf and on behalf of the other co-owners and is not acting as an agent or representative of any other person. All persons listed are United States citizens.

FPL Energy Duane Arnold does not have a Board of Directors.

FPL Energy Duane Arnold – Principal Officers

T. J. Tuscai
President
700 Universe Boulevard
Juno Beach, FL 33408-0420

Michael O'Sullivan
Senior Vice President
700 Universe Boulevard
Juno Beach, FL 33408-0420

John A. Stall
Senior Vice President and Chief Nuclear Officer
700 Universe Boulevard
Juno Beach, FL 33408-0420

Ronald L. Scheirer
Vice President
700 Universe Boulevard
Juno Beach, FL 33408-0420

Mark R. Sorensen
Treasurer
700 Universe Boulevard
Juno Beach, FL 33408-0420

Charles S. Schultz
Secretary
700 Universe Boulevard
Juno Beach, FL 33408-0420

Rita W. Costantino
Assistant Secretary
700 Universe Boulevard
Juno Beach, FL 33408-0420

Judith J. Kahn
Assistant Treasurer
700 Universe Boulevard
Juno Beach, FL 33408-0420

Central Iowa Power Cooperative – Executive Team and Officers

Dennis Murdock
Executive Vice President and Chief Executive Officer
1400 Highway 13 SE
Cedar Rapids, IA 52403

Craig Fricke
Chief Operating Officer/ Vice President Business Operations
1400 Highway 13 SE
Cedar Rapids, IA 52403

Richard Anderson
Vice President Utility Operations
1400 Highway 13 SE
Cedar Rapids, IA 52403

Central Iowa Power Cooperative –Officers

Patrick Murphy
Director Business Development, Assistant Vice President
1400 Highway 13 SE
Cedar Rapids, IA 52403

Terry Sullivan
Chief Financial Officer, Assistant Vice President
1400 Highway 13 SE
Cedar Rapids, IA 52403

Central Iowa Power Cooperative – Directors

Allen Albers
1400 Highway 13 SE
Cedar Rapids, IA 52403

Duane Armstead
1400 Highway 13 SE
Cedar Rapids, IA 52403

Tom Carson
1400 Highway 13 SE
Cedar Rapids, IA 52403

Robert Collins
1400 Highway 13 SE
Cedar Rapids, IA 52403

Allan Duffe
1400 Highway 13 SE
Cedar Rapids, IA 52403

Marcel Fett
400 Highway 13 SE
Cedar Rapids, IA 52403

Nicholas Hammes
1400 Highway 13 SE
Cedar Rapids, IA 52403

Ralph Lents
1400 Highway 13 SE
Cedar Rapids, IA 52403

Gene Manternach
1400 Highway 13 SE
Cedar Rapids, IA 52403

Gary Mount
1400 Highway 13 SE
Cedar Rapids, IA 52403

Sam Nichols
1400 Highway 13 SE
Cedar Rapids, IA 52403

Dale Walkup
1400 Highway 13 SE
Cedar Rapids, IA 52403

Donald Williams
1400 Highway 13 SE
Cedar Rapids, IA 52403

Corn Belt Power Cooperative – Principal Officers

Kenneth Kuyper
Executive Vice President and General Manager
1300 13th Street North
Humboldt, IA 50548

Karen Berte
Senior Vice President, Finance and Administration
1300 13th Street North
Humboldt, IA 50548

Kevin Bornhoft
Vice President, Engineering and Systems Operations
1300 13th Street North
Humboldt, IA 50548

Kathy Taylor
Vice President, Corporate Relations
1300 13th Street North
Humboldt, IA 50548

Mike Thatcher
Vice President, Generation
1300 13th Street North
Humboldt, IA 50548

Jim Vermeer
Vice President, Business Development
1300 13th Street North
Humboldt, IA 50548

Corn Belt Power Cooperative – Directors

Donald Feldman
1300 13th Street North
Humboldt, IA 50548

Ronald Deiber
1300 13th Street North
Humboldt, IA 50548

Scott Stecher
1300 13th Street North
Humboldt, IA 50548

Charles Gilbert
1300 13th Street North
Humboldt, IA 50548

Donald McLean
1300 13th Street North
Humboldt, IA 50548

William Courter
1300 13th Street North
Humboldt, IA 50548

Jeff Cranston
1300 13th Street North
Humboldt, IA 50548

David Onken
1300 13th Street North
Humboldt, IA 50548

L. Kirby Range
1300 13th Street North
Humboldt, IA 50548

Dale Schaefer
1300 13th Street North
Humboldt, IA 50548

Larry Tilton
1300 13th Street North
Humboldt, IA 50548

1.1.5 CLASS AND PERIOD OF LICENSE SOUGHT

FPL Energy Duane Arnold requests renewal of the Class 104b operating license for the Duane Arnold Energy Center (Facility Operating License DPR-49) for a period of 20 years beyond the expiration of the current license. This would extend the operating license from midnight February 21, 2014, to midnight February 21, 2034.

This application includes a request for renewal of those NRC source material, special nuclear material, and by-product material licenses included within the current operating licenses and issued pursuant to 10 CFR Parts 30, 40 and 70.

The facility will continue to be known as the Duane Arnold Energy Center.

1.1.6 ALTERATION SCHEDULE

FPL Energy Duane Arnold does not propose to construct or alter any production or utilization facility in connection with this renewal application. The current licensing basis (CLB) will be continued and maintained throughout the period of extended operation.

1.1.7 REGULATORY AGENCIES WITH JURISDICTION

In addition to the Nuclear Regulatory Commission, the following agencies have jurisdiction over Duane Arnold:

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

Securities and Exchange Commission
100 F Street NE
Washington, DC 20549

1.1.8 LOCAL NEWS PUBLICATIONS

Des Moines Register
715 Locust Street
Des Moines, IA 50309

Cedar Rapids Gazette
500 Third Avenue SE
Cedar Rapids, IA 52401

1.1.9 CONFORMING CHANGES TO STANDARD INDEMNITY AGREEMENT

The requirements of 10 CFR 54.19(b) state that license renewal applications include, "…conforming changes to the standard indemnity agreement, 10 CFR 140.92, Appendix B, to account for the expiration term of the proposed renewed license." The current indemnity agreement No. B-68 for the Duane Arnold Energy Center states that the agreement shall terminate at the time of expiration of the license.

The indemnity agreement lists DPR-49 as the applicable license number. Should the license number be changed upon issuance of the renewed license, FPL Energy Duane Arnold requests that conforming changes be made to the indemnity agreement as appropriate.

1.1.10 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, FPL Energy Duane Arnold, as a part of the application for a renewed operating license, 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.

1.2 PLANT DESCRIPTION

The Duane Arnold Energy Center plant site is adjacent to the Cedar River approximately 2.5 miles northeast of Palo, Iowa. The site contains approximately 500 acres. Distance from the reactor centerline to the site boundary is approximately 2000 feet.

The nuclear steam supply system and the turbine-generator were furnished by the General Electric Company. The balance of plant was designed and constructed by Bechtel Power Corporation as architect – engineer and constructor. The plant is licensed to operate at a core power level of 1912 megawatts thermal (MWt), approximately 629 megawatts electric (MWe). Duane Arnold was originally licensed to a core power level of 1658 MWt. However, the plant Technical Specifications restricted operation to 1593 MWt. In 1985, commencing with reload cycle 8, the Technical Specifications were amended to allow operation at the licensed rated thermal power. Two power uprates have been approved since the initial core thermal power was licensed. In 1985, License Amendment 115 increased the licensed core thermal power to 1658 MWt and in 2001, License Amendment 243 increased the licensed core thermal power to 1912 MWt.

The principal buildings and structures that comprise Duane Arnold are the reactor building, turbine building, control building, radwaste building, administration building, machine shop, offgas retention building, intake structure, pump house, cooling towers, training center, low level radwaste processing and storage facility, offgas stack, plant support center, and independent spent fuel storage installation. These buildings and structures are designed and constructed in accordance with codes applicable to the building's use and safety related functions.

The reactor building encloses the reactor, primary containment new and spent fuel storage pools, and other auxiliary systems associated with the nuclear steam supply system. The reactor building provides secondary containment for the reactor when in service and primary containment for the auxiliary systems and the reactor during periods when the primary containment is opened for refueling and servicing.

The turbine building houses the turbine generator and other components of the power conversion system. It houses two standby diesel generators and the plant heating boiler and associated auxiliaries. The structure is adjacent to, but physically separated from, the reactor building.

The control building houses the control room and associated auxiliaries, switchgear, battery rooms, and cable spreading room. The structure is adjacent to, but physically separated from, the reactor and turbine buildings.

The remaining buildings and structures provide for support and shelter for systems, components, and personnel necessary for the operation of the plant. Descriptions of the Duane Arnold systems and structures can be found in the Updated Final Safety Analysis Report (UFSAR) [Reference 1.2-1]. Additional descriptive information about Duane Arnold systems, structures, and components is provided in LRA Chapters 2.0, 3.0, and 4.0 and references to the UFSAR are provided where pertinent.

1.3 TECHNICAL INFORMATION REQUIRED FOR AN APPLICATION

In accordance with 10 CFR 54.21, four technical items are required to support an application for a renewed operating license. These are an integrated plant assessment (Chapters 2.0, 3.0 and Appendix B), an evaluation of time-limited aging analyses (Chapter 4.0), a supplement to the Duane Arnold UFSAR that contains a summary description of the programs and activities for managing the effects of aging and the evaluation of the time-limited aging analyses (Appendix A), and CLB changes during NRC review (Section 1.4).

In addition to the technical information, 10 CFR 54.22 requires applicants to submit any Technical Specification changes or additions necessary to manage the effects of aging during the period of extended operation (Appendix D). Also, 10 CFR 54.23 requires the application to include a supplement to the Environmental Report (Appendix E).

The integrated plant assessment, as defined by 10 CFR 54.3, is a licensee assessment that demonstrates that a nuclear power plant facility's structures and components requiring aging management review in accordance with 10 CFR 54.21(a) for license renewal have been identified. The integrated plant assessment also demonstrates that the effects of aging on the functionality of such structures and components will be managed to maintain the CLB during the period of extended operation. The Duane Arnold integrated plant assessment includes:

- identification of the structures and components within the scope of license renewal that are subject to an aging management review;
- identification of the aging effects applicable to these structures and components;
- identification of plant-specific programs and activities that will manage these identified aging effects; and
- a demonstration that these programs and activities will be effective in managing the effects of aging during the period of extended operation.

The Duane Arnold integrated plant assessment for license renewal, along with other information necessary to document compliance with 10 CFR 54, is maintained in an auditable and retrievable form in accordance with 10 CFR 54.37(a). The Duane Arnold integrated plant assessment is documented with site-specific reports and calculations that were generated in accordance with FPL Energy Duane Arnold Quality Assurance Program.

1.4 CURRENT LICENSING BASIS CHANGES DURING NRC REVIEW

Each year, following the submittal of the Duane Arnold LRA and at least three months before the scheduled completion of the NRC review, FPL Energy Duane Arnold will submit an amendment to the application pursuant to 10 CFR 54.21(b). This submittal will identify any changes to the CLB that materially affect the contents of the LRA, including the UFSAR supplement and any other aspects of the application.

1.5 COMMUNICATIONS

Written communications on this application should be directed to:

Mr. Richard Anderson
Vice President Duane Arnold Energy Center
FPL Energy Duane Arnold, LLC
Duane Arnold Energy Center
3277 DAEC Road
Palo, IA 52324

Dennis Murdock
Executive Vice President and Chief Executive Officer
Central Iowa Power Cooperative
P. O. Box 2517
Cedar Rapids, IA 52406-2517

Kenneth Kuyper
Executive Vice President and General Manager
Corn Belt Power Cooperative
P. O. Box 508
1300 13th Street North
Humboldt, IA 50548

1.6 REFERENCES

1.1-1 Title 10 Energy of the Code of Federal Regulations (10 CFR).

1.1-2 NUREG-1800, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, Revision 1, U.S. Nuclear Regulatory Commission, September 2005.

1.1-3 Regulatory Guide 1.188, Standard Format and Content for Applications to Renew Nuclear Power Plant Operating Licenses, Revision 1.

1.1-4 NEI 95-10, Industry Guideline for Implementing the Requirements of 10 CFR Part 54 -The License Renewal Rule, Revision 6, Nuclear Energy Institute, June 2005.

1.2-1 Duane Arnold Energy Center Updated Final Safety Analysis Report (UFSAR), Revision 19.

TABLE 1-1

ABBREVIATIONS AND ACRONYMS

AAC	All Aluminum Conductor
AAI	Applicant Action Item
AC	Alternating Current
ACI	American Concrete Institute
ACSR	Aluminum Conductor Steel Reinforced
ADS	Automatic Depressurization System
AMP	Aging Management Program
AMR	Aging Management Review
ANL	Argonne National Laboratory
ARI	Alternate Rod Insertion
ART	Adjusted Reference Temperature
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
B&W	Babcock & Wilcox
BWR	Boiling Water Reactor
BWROG	Boiling Water Reactor Owners Group
BWRVIP	Boiling Water Reactor Vessel and Internals Project
CASS	Cast Austenitic Stainless Steel
CB/SBGT	Control Building/Standby Gas Treatment
CCW	Closed Cooling Water
CE	Combustion Engineering
cfm	cubic feet per minute
CFR	Code of Federal Regulations
CLB	Current Licensing Basis
CMAA	Crane Manufacturers Association of America
CPVC	Chlorinated Poly-Vinyl Chloride
CRD	Control Rod Drive
CRD-HSR	Control Rod Drive – Hydraulic System Return
CRDRL	Control Rod Drive Return Line
CST	Condensate Storage Tank
CUF	Cumulative Usage Factor

TABLE 1-1

ABBREVIATIONS AND ACRONYMS

DAC	Data Acquisition Center
DAEC	Duane Arnold Energy Center
DBD	Design Basis Document
DBE	Design Basis Event
DC	Direct Current
DOR	Division of Operating Reactors
DP/SLC	Core Plate delta P/Standby Liquid Control
DZO	Depleted Zinc Oxide
EAF	Environmentally Assisted Fatigue
ECCS	Emergency Core Cooling System
EDB	Equipment Database
EFPY	Effective Full Power Years
EHS	Extra High Strength Steel
EIC	Electrical and Instrumentation and Control
EMA	Equivalent Margin Analysis
EPA	Electrical Penetration Assembly
EPRI	Electric Power Research Institute
EPRI-MRP	Electric Power Research Institute Materials Reliability Program
EPU	Extended Power Uprate
EQ	Environmental Qualification
EQR	Environmental Qualification Report
ESW	Emergency Service Water
FAC	Flow-Accelerated Corrosion
FEM	Finite Element Analysis
F_{EN}	Fatigue Life Correction Factor
FSAR	Final Safety Analysis Report
ft	Foot
ft-lb	Foot pounds
FW	Feedwater
GALL	Generic Aging Lessons Learned
GE	General Electric Company

TABLE 1-1

ABBREVIATIONS AND ACRONYMS

GL	Generic Letter
GSI	Generic Safety Issue
HVAC	Heating, Ventilation, and Air Conditioning
HCU	Hydraulic Control Unit
HELB	High Energy Line Break
HEPA	High Efficiency Particulate Absorber
hp	Horsepower
HPCI	High Pressure Coolant Injection
I&C	Instrumentation and Controls
IASCC	Irradiation Assisted Stress Corrosion Cracking
IBA	Intermediate Break Accident
IGSCC	Intergranular Stress Corrosion Cracking
INEL	Idaho National Engineering Laboratory
INPO	Institute of Nuclear Power Operations
IPA	Integrated Plant Assessment
IR	Insulation Resistance
ISG	Interim Staff Guidance
ISI	Inservice Inspection
ISP	Integrated Surveillance Program
kV	Kilovolts
kW	Kilowatts
Lbs	Pounds
LLC	Limited Liability Company
LOCA	Loss of Coolant Accident
LPCI	Low Pressure Coolant Injection
LRA	License Renewal Application
LTOP	Low Temperature Overpressure
MCM	1000 Circular Mils
MEB	Metal Enclosed Bus
MeV	Million Electron Volts
MIC	Microbiologically-Influenced Corrosion

TABLE 1-1

ABBREVIATIONS AND ACRONYMS

MMIS	Materials Management Information System
MSIV	Main Steam Isolation Valve
MWe	Megawatts Electric
MWt	Megawatts Thermal
n/cm^2	neutrons per square centimeter
NCV	Non-Cited Violation
NEDC	(GE) Nuclear Engineering Dept. (Contracted)
NEDO	(GE) Nuclear Engineering Dept. (Non-proprietary)
NEI	Nuclear Energy Institute
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NOC	Normal Operating Conditions
NOS	Nuclear Oversight
NPS	Nominal Pipe Size
NRC	Nuclear Regulatory Commission
NSAC	Nuclear Safety Analysis Center
NSSS	Nuclear Steam Supply System
NUMARC	Nuclear Utility Management and Resource Council
NUREG	Nuclear Regulation
OCCW	Open Cycle Cooling Water
OE	Operating Experience
P&ID	Piping and Instrument Drawing
P-T	Pressure – Temperature
PASS	Post-Accident Sampling System
pH	Concentration of Hydrogen Ions
Ppb	Parts per billion
ppm	Parts per million
PoF	Probability of Failure
psid	Pounds per square inch differential
psig	Pounds per square inch gauge
PUAR	Plant Unique Analysis Report

TABLE 1-1

ABBREVIATIONS AND ACRONYMS

PVC	Poly-vinyl Chloride
PWR	Pressurized Water Reactor
PWSCC	Primary Water Stress Corrosion Cracking
RBCCW	Reactor Building Closed Cooling Water
RCIC	Reactor Core Isolation Cooling
RCPB	Reactor Coolant Pressure Boundary
RFO	Refuel Outage
RG	Regulatory Guide
RHR	Residual Heat Removal
RPT	Recirculation Pump Trip
RPV	Reactor Pressure Vessel
RT_{NDT}	Reference Temperature – NIL Ductility Transition
RWCU	Reactor Water Clean-up
SBA	Small Break Accident
SBO	Station Black-out
SCCM	Standard Cubic Centimeters Per Minute
SCFM	Standard Cubic Feet Per Minute
SER	Safety Evaluation Report
SRP	Standard Review Plan
SRV	Safety-Relief Valve
SSC	Structures, Systems, and Components
SUS	Start-up System
TAP	Torus Attached Piping
TIP	Traversing Incore Probe
TLAA	Time Limited Aging Analysis
TMI	Three Mile Island
TS	Technical Specifications
UFSAR	Updated Final Safety Analysis Report
USAR	Updated Safety Analysis Report
USE	Upper Shelf Energy

TABLE 1-1

ABBREVIATIONS AND ACRONYMS

UV	Ultraviolet
VFLD	Vessel Flange Leak Detection
Zn	Zinc

2.0 STRUCTURES AND COMPONENTS SUBJECT TO AN AGING MANAGEMENT REVIEW

This chapter describes the process required by 10 CFR Part 54 [Reference 2.1-1] for the identification of structures and components subject to an aging management review in the Duane Arnold integrated plant assessment (IPA). For those systems, structures, and components within the scope of license renewal, §54.21(a)(1) requires a license renewal applicant to identify and list the structures and components subject to an aging management review. Furthermore, §54.21(a)(2) requires that methods used to identify and list these structures and components be described and justified. The technical information in this chapter serves to satisfy these requirements.

Duane Arnold's integrated plant assessment methodology follows the approach recommended in NEI 95-10 [Reference 2.1-2]. The methodology consists of scoping, screening, and aging management reviews. The methodology is implemented in accordance with FPL Energy Duane Arnold Quality Assurance Program.

The scoping and screening methodology is described in LRA Section 2.1. The results of the assessment to identify the systems and structures within the scope of license renewal (plant level scoping) are contained in LRA Section 2.2. The results of the identification of the components and structural components subject to an aging management review (screening) are contained in LRA Section 2.3 for mechanical systems, LRA Section 2.4 for structures, and LRA Section 2.5 for electrical/I&C systems.

2.1 SCOPING AND SCREENING METHODOLOGY

The Duane Arnold license renewal program consists of several distinct processes, specifically scoping, screening, aging management reviews, time limited aging analyses, and aging management programs. The purpose of this section is to describe the scoping and screening process used in the Duane Arnold license renewal program. Aging management reviews, time limited aging analyses, and aging management programs are discussed in LRA Chapters 3.0, 4.0, and Appendix B, respectively.

Duane Arnold license renewal project procedures provide detailed instructions for these processes. The procedures incorporate the guidance provided in NEI 95-10. In addition, Duane Arnold developed technical reports to provide additional guidance on specific topics associated with the criteria of 10 CFR Part 54.

The scoping process categorizes the entire plant in terms of major systems and structures and identifies system level functions. These systems and structures are then evaluated against the scoping criteria in §54.4(a)(1), §54.4(a)(2), and §54.4(a)(3). This process identifies the systems, structures, and components (SSCs) that perform or support an intended function for responding to a design basis event, are non-safety-related and whose failure could prevent accomplishment of a safety-related function, or support a specific requirement for one of the regulated events applicable to license renewal.

Each license renewal application must then provide an Integrated Plant Assessment that fulfills the requirements of §54.21. §54.3, “Definitions,” defines the Integrated Plant Assessment as:

> Integrated Plant Assessment (IPA) is a licensee assessment that demonstrates that a nuclear power plant facility's structures and components requiring aging management review in accordance with [10 CFR] 54.21(a) for license renewal have been identified and that the effects of aging on the functionality of such structures and components will be managed to maintain the CLB [Current Licensing Basis] such that there is an acceptable level of safety during the period of extended operation.

The integrated plant assessment, based on criteria in §54.21(a), includes:

- Identifying those in-scope components that are passive, long-lived, and serve an in-scope intended function,
- Providing a description and justification for the methods used to identify SSCs that are in-scope and subject to an aging management review, and
- Providing assurance that the effects of aging are adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

The screening process identifies in-scope, long-lived, passive system components and structural components that are subject to an aging management review. Commodity groups may be used to facilitate these reviews.

2.1.1 PLANT INFORMATION SOURCES

2.1.1.1 License Renewal Database

The Duane Arnold license renewal database served as an information repository for SSC evaluations. The license renewal database was designed to be consistent with the process requirements of 10 CFR Part 54 and the process guidance in NEI 95-10.

The population of the license renewal database used the assets of the Duane Arnold plant equipment database. The component data from the plant equipment database was used to electronically populate the license renewal database.

The plant equipment database does not uniquely identify all components installed in the plant. For example, the plant equipment database does not typically include items such as cables, raceways, piping, conduits, fireproofing, general construction items (e.g., nuts, bolts), or consumable materials (e.g., diesel fuel, resins, etc.). Components not uniquely identified in the plant equipment database that were in-scope for license renewal were identified as commodities or generic assets (e.g., pipe, structural steel) in their respective system or structure in the license renewal database to ensure proper coverage and evaluation.

In addition to the plant equipment database, controlled drawings, vendor information, and current licensing basis documentation were used to ensure a complete set of components were identified and evaluated.

2.1.1.2 Current Licensing Basis

The current licensing basis for Duane Arnold has been defined in accordance with §54.3.

The Duane Arnold CLB includes the NRC regulations contained in 10 CFR Parts 2, 19, 20, 21, 26, 30, 40, 50, 51, 54, 55, 70, 72, 73, 100 (including appendices); orders; license conditions; exemptions; and Duane Arnold Technical Specifications [Reference 2.1-3]. It also includes the plant-specific design-basis information documented in the Duane Arnold Updated Final Safety Analysis Report (UFSAR) [Reference 2.1-4], commitments remaining in effect that were made in docketed licensing correspondence such as licensee responses to NRC bulletins, generic letters, and enforcement actions, as well as licensee commitments documented in NRC safety evaluations or licensee event reports.

2.1.1.3 Design Basis Events

The functions performed by SSCs for Duane Arnold design basis events established the safety classification of SSCs. The design basis events are defined in the Duane Arnold CLB.

Chapter 15 of the Duane Arnold UFSAR provides the analyses of design basis events for Duane Arnold. These analyses include both design basis accidents and bounding transients. Chapter 2 of the Duane Arnold UFSAR contains evaluations of natural phenomena and external events applicable to the Duane Arnold. Structures designed to withstand DBE natural phenomena and external events are described in

UFSAR Chapter 3. Spent fuel events and hydrogen fires/explosions are described in UFSAR Chapter 9.

There are a number of supplemental information sources, including the Duane Arnold Design Basis Documents (DBDs). The DBDs cover a number of support and accident mitigation systems, selected licensing topical issues, and accident analyses. DBDs are a tool to help explain the requirements behind the design basis for selected systems and topics and complement information obtained from primary current licensing basis sources. DBDs are not current licensing basis documents, and serve strictly as an information resource.

2.1.1.4 Quality Classifications

For License Renewal, the NRC has defined the term “safety related” as follows:

SSCs and related activities relied upon to remain functional during and following design basis events to ensure:

a) The integrity of the reactor coolant boundary,

b) The capability to shut down the reactor and maintain it in a safe shutdown condition,

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

In recent years this, or very similar wording, has been introduced in NRC regulations and guidance documents. The design, construction and licensing of Duane Arnold predates this definition.

Site procedures define “safety related as:

“A term applied to plant structures, systems, components and related activities relied upon to remain functional during and following design basis events to ensure

a) the integrity of the reactor coolant pressure boundary,

b) the capability to shut down the reactor and maintain it in a safe shut down condition,

c) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the 10 CFR Part 100 guidelines.”

Part c) of the current NRC definition contains the words “comparable to §50.34(a)(1), §50.67, or §100.11 of this chapter, as applicable.” Duane Arnold’s definition contains the words “comparable to the 10 CFR Part 100 guidelines.” This difference in wording needs to be reconciled.

- §50.34(a)(1) points to §50.34(a)(1)(i) for a plant of Duane Arnold’s vintage. §50.34(a)(1)(i) points to 10CFR100 for potential offsite exposure limits. Therefore, the current Duane Arnold definition of safety related encompasses the NRC definition.

- §50.67 is part of Duane Arnold's current licensing basis and therefore, applicable to Duane Arnold. However, no equipment safety classification changes were necessary to implement §50.67. Therefore, the current Duane Arnold definition of safety related encompasses the NRC definition.
- §100.11 is included in Duane Arnold's definition.

Quality classifications for SSCs at Duane Arnold are defined in administrative control procedures. SSCs at Duane Arnold are classified into one of five quality levels. These Quality Levels are defined below:

<u>Quality Level I</u>

Applies to those structures, systems, components, and related activities that are relied upon to remain functional during and following design basis events to ensure:

- The integrity of the reactor coolant pressure boundary,
- The capability to shut down the reactor and maintain it in a safe shut down condition;
- The capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the 10 CFR Part 100 guidelines.

<u>Quality Level II</u>

Applies to those SSCs and related activities that are not Quality Level I (safety related), but are:

- Designated as other for which a Quality Assurance Program meeting 10 CFR 50 Appendix B has been applied in whole or in part;
- Designated as other for which a quality assurance requirements have been established, but 10 CFR 50 Appendix B program has not been specified;
- Commitments to regulatory agencies which include a documented position on applicability, exceptions and established quality assurance requirements; or
- Important to safety as defined by 10 CFR 72.140.

<u>Quality Level III</u>

Applies to selected SSCs and related activities that are not Quality Level I or II, but may be important for power generation and have established quality assurance requirements. Quality Level III SSCs are included in the Quality Assurance Program at the discretion of FPL Energy Duane Arnold.

<u>Quality Level IV</u>

Applies to permanent Duane Arnold SSCs and activities that do not require controls necessary for Quality Level I, II, or III.

<u>Quality Level V</u>

Applies to those equipment, hand tools, and other items that will not be made a permanent part of Duane Arnold operating equipment and are outside the scope of the Operational Quality Assurance Program.

Consequently, Quality Level I SSCs will be included in the scope of license renewal pursuant to the criterion stated in §54.4(a)(1) as safety related. Quality Level II through V SSCs will be evaluated for inclusion in the scope of license renewal pursuant to the criteria stated in §54.4(a)(2), or §54.4(a)(3).

2.1.1.5 Other Information Sources

Other information sources also assist in performing license renewal system and structure evaluations. These include:

- Controlled drawings
- Controlled databases
- Industry codes, standards, and regulations
- NRC docketed correspondence and documents
- Technical correspondence, analyses, and reports
- Calculations
- Design basis documents
- Plant modifications and alterations
- Nuclear steam supply system supplier, architect-engineer, vendor reports, specifications, and drawings

2.1.2 SCOPING METHODOLOGY

The scoping process categorizes the entire plant in terms of major systems and structures with respect to license renewal. System and structure functions are identified and evaluated against criteria provided in §54.4 (a)(1), §54.4(a)(2), and §54.4(a)(3) to determine whether the item should be considered within the scope of license renewal.

Even if only a portion of a system or structure fulfills a scoping criterion, the system or structure is in scope for license renewal. Eliminated are those systems and structures that do not satisfy any scoping criterion.

The scoping methodology utilized by Duane Arnold is consistent with the guidance provided by the NRC in NUREG 1800 [Reference 2.1-5], by the industry in NEI 95-10, [Reference 2.1-2] and by interim staff guidance as discussed in LRA Subsection 2.1.3.3.

This review uses existing plant documentation, including the Duane Arnold CLB documents, controlled drawings, and the plant equipment database. Once identified as being in-scope, the systems and structures move to component and commodity group level scoping and then to the next step in the integrated plant assessment process - screening.

2.1.2.1 System, Structure, and Commodity Group Identification

Systems

System identifier codes called Startup System Numbers (SUS numbers) are used to sort and track plant systems and components in the plant equipment database (EDB). This identification scheme supports plant needs with respect to maintenance work, but is not sufficient to identify license renewal system functional boundaries. For this reason, revision or the combination of some plant equipment database system identifiers was necessary for license renewal purposes.

License renewal systems were defined to account for all of the plant equipment database systems that contain permanently installed equipment. Redefining system boundaries for license renewal had no impact on whether or not a system, structure, or component performs a license renewal intended function.

Other information sources, such as the current licensing basis, were electronically searched using several keywords (e.g., system, new system, system modification) to ensure all plant systems were evaluated for license renewal intended functions regardless of their coverage in the plant equipment database.

Structures

The plant equipment database includes buildings and structures that comprises the Duane Arnold buildings and structures. The individual buildings were input into the license renewal database as individual or grouped license renewal structures.

Other information sources, such as CLB documentation, were electronically searched using several keywords (e.g., structure, new structure, building modification) to ensure all plant structures were evaluated for license renewal intended functions regardless of their coverage in the plant equipment database.

Commodity Groups

Use of commodity groups occurred when component evaluations were best performed by component type, rather than by system or structure. NEI 95-10 served as guidance for commodity groupings. Components constructed from similar materials, exposed to similar environments, and which perform similar intended functions form the commodity groups.

Commodity group components were not associated with a specific system or structure during the component's evaluation, but with their assigned commodity group. Evaluation of each commodity group took place as if it were a separate, individual system. Commodity groups accounted for all electrical aging management reviews.

2.1.2.2 Systems, Structures, Component and Commodity Group Functions

Numerous sources, including the Duane Arnold UFSAR, docketed correspondence with the NRC, Maintenance Rule documents, and design basis documents provided system and structure-level function information. Documentation of references used in this process was included for each system function as appropriate.

The process used at Duane Arnold identified all system-level and structure-level functions. If the functions met any of the criteria specified in §54.4(a)(1), §54.4(a)(2), or §54.4(a)(3), then the system or structure was in-scope for license renewal. Structures whose only function is to support or house in-scope systems were also in-scope for license renewal.

Once system and structure-level functions were identified, and their license renewal status determined, this information was used in combination with the plant equipment database and other information sources to identify component functions and determine if these functions are in-scope for license renewal. The same scoping criteria applied at the system and structure level was applied at the component level. For the mechanical systems and the civil structures and structural components, the component intended functions are defined in LRA Table 2.1-1. For the electrical and I&C components, the component commodity groups and associated intended functions are listed in LRA Table 2.1-2.

The critical element of scoping is to ensure that all SSCs that perform license renewal intended functions are identified and that the basis for this determination is clearly documented. The license renewal database provided assistance in documenting current licensing basis information used in the scoping process.

2.1.2.2.1 Safety Related SSCs Pursuant to 10 CFR 54.4(a)(1)

§54.4(a)(1) requires that safety-related SSCs that are relied upon to remain functional during and following design-basis events (as defined in §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 that could result in potential offsite exposure comparable to the guidelines in §50.34(a)(1), §50.67(b)(2), or § 100.11 of 10 CFR 50, as applicable.

This is the current NRC definition of "safety-related." In recent years this, or very similar wording, has been introduced in NRC regulations and guidance documents. The design, construction, and licensing of Duane Arnold predates this definition of safety-related.

The Duane Arnold Quality Levels were used to code items as safety-related in the Duane Arnold plant equipment database. The Duane Arnold plant equipment database served as one of the information sources used to identify systems, structures and components required by §54.4(a)(1).

The component functions were identified using a number of information sources, including the CLB. These functions were compared to §54.4(a)(1) to identify those that are in-scope for license renewal for Duane Arnold design basis events, regardless of their current classification in the plant equipment database or supporting Quality Level information sources.

In addition to the plant equipment database, the Duane Arnold P&IDs and other controlled drawings were used to identify components required to support in-scope system-level and structure-level functions. These components were included in-scope for license renewal and generally matched information contained in the plant equipment database. Where differences were noted, they were documented and resolved. Some of these differences resulted in the issuance of an action request for further evaluation within the site Corrective Action Program. Results were documented in the license renewal database and on the license renewal boundary drawings for mechanical components.

Therefore, the SSCs which perform any of functions identified in §54.4(a)(1) for Duane Arnold design basis events have been included in the scope of license renewal and the identification of these components and commodities was based on a variety of information sources.

2.1.2.2.2 Non-Safety Related Affecting Safety Related Pursuant to 10 CFR 54.4(a)(2)

§54.4(a)(2) requires that all non-safety-related systems, structures and components whose failure could prevent satisfactory accomplishment of any of the functions identified in §54.4(a)(1) be included within the scope of license renewal.

SSCs required by §54.4(a)(2) for Duane Arnold are included in one of the following three categories:

- Current Licensing Basis (CLB) Topics. The Duane Arnold CLB includes a number of topics that identify non-safety related SSCs credited for preventive or mitigative functions in support of safe shutdown for special events (e.g., external floods) or whose failure could prevent satisfactory accomplishment of a safety related function (e.g., seismic interactions),
- For the purpose of license renewal, non-safety related SSCs directly connected to safety related SSCs (typically piping systems), or
- For the purpose of license renewal, non-safety related SSCs that are not directly connected to safety related SSCs but whose failure due to spatial proximity could prevent the satisfactory accomplishment of a safety related function.

SSCs required by §54.4(a)(2) in the first two categories are typically identified during document reviews including the Duane Arnold UFSAR, plant drawings, design documents, piping analyses, the plant equipment database, and other CLB documents. SSCs required by §54.4(a)(2) in the third category are typically identified by both document reviews and plant walk downs to identify possible spatial interactions meeting the broader criteria established for license renewal.

a. Current Licensing Basis Review

Based on a review of the current licensing basis, those topics required by §54.4(a)(2) are:

- High Energy Line Break (HELB)

  The high energy piping systems were identified using the criteria that the service temperature is greater than 200°F and the design pressure is greater than 275 psig as defined in Section 3.6.1.2.2 of the Duane Arnold UFSAR. High energy line breaks outside containment were previously analyzed and discussed in Section 3.6 of the Duane Arnold UFSAR. All high-energy lines identified in Section 3.6 of the Duane Arnold UFSAR are included as in-scope of license renewal. High energy lines of one-inch diameter or smaller pipe size were excluded from the high energy line break analysis. These small lines were evaluated and placed in-scope for license renewal if their failure (spraying or leaking) could affect a safety related SSC located in the same room.

- Internal and External Flooding Events

  Flooding from various internal sources (e.g., pipe breaks) and external sources (e.g., river floods) were evaluated during the design of the plant. External flooding is discussed in Section 3.4 of the Duane Arnold UFSAR. A number of design features were installed in the plant to ensure safe shutdown as required by the CLB for the specific events evaluated. These features (e.g., level switches, flood barriers, drain systems, etc.) are in-scope for license renewal.

- Internal and External Missile Hazards

  Missiles that could be generated from internal sources or external sources such as rotating equipment and tornados were considered in the design of the plant. Both preventive (e.g., overspeed controls, seismic restraints) and mitigative (e.g., missile barriers) features were installed to ensure safe shutdown as required by the CLB for postulated missile hazards. These design features are in-scope for license renewal.

- Overhead Handling Systems

  Overhead handling systems associated with heavy loads as described in NUREG-0612 [Reference 2.1-6] are in-scope for license renewal. Additionally, the refueling platform and fuel prep machine are in-scope for license renewal.

b. Non-Safety Related SSCs Directly Connected to Safety Related SSCs

- SSCs Directly Connected To Safety Related SSCs

  For non-safety related SSCs directly connected to safety related SSCs, the in-scope boundary for license renewal extends into the non-safety related portion of the piping and supports up to and including the first equivalent anchor beyond the safety/non-safety interface. For Duane Arnold, the first equivalent anchor is that point beyond which failure of the piping system will not prevent the satisfactory accomplishment of the safety related function of the connected SSCs. Examples that constitute the first equivalent anchor include: a true anchor; a large piece of plant equipment; a building penetration; and, two levels of support in each orthogonal direction. In general, equivalent anchors were selected consistent with the pipe analyses of record that demonstrate seismic adequacy of the various configurations. The piping components and supports up to and including the first equivalent anchor are in-scope for license renewal. In addition, non-safety related piping components and supports attached to safety related piping were further evaluated under criterion §54.4(a)(3), Other Regulated Events and, in most cases, found to be in-scope for license renewal as a result of this evaluation.

Non-safety related structures attached to or next to safety related structures are in-scope for license renewal if their failure could prevent a safety related SSC from performing its intended function.

- Small Bore Lines Attached To Safety Related Large Bore Lines Or Equipment

  Small bore lines attached to the safety related portion of the large bore lines or safety related equipment are typically safety related to the first isolation valve and non-safety related thereafter. Most of these small bore lines are either drain or vent lines. In addition, many of these lines have no supports (i.e. cantilevers). In these instances, the entire line is in scope for license renewal. The drain and vent lines that do have supports generally run to a nearby drain. Again, the entire piping and supports are in scope for license renewal.

  In some instances, the small bore non-safety related piping has no seismic anchors. In those instances, the in scope portion was extended “sufficiently far” from the safety related portion such that the non-safety related piping beyond that point would not have a significant affect on the safety related portion. The definition of “sufficiently far” is the same as for large bore piping, i.e. a minimum of two levels of support in each orthogonal direction.

  Small bore lines often transition into tubing. Due to the relative flexibility between the piping and tubing, the non-safety related tubing was considered to have a negligible impact on the piping. Therefore, the non-safety related affecting safety related boundary for these lines is the tubing transition point.

  All tubing that is not air filled is in-scope for (a)(2) unless located in a room that does not contain safety-related components.

- Non-Safety Related Electrical Components Electrically Connected To Or In Close Proximity To Safety-Related Electrical Components

  In addition to mechanical and structural items, the potential exists by plant design and license for non-safety related electrical components to be electrically connected to or in close proximity to safety-related electrical components. Cable separation, electrical isolation (e.g., use of relays, optical isolators, etc.), breaker/fuse coordination, automatic load shedding, and other design features were implemented consistent with the Duane Arnold CLB to address such interfaces. Most electrical components are in-scope for license renewal and screen out due to the active nature of the device.

c. Non-Safety Related SSCs In Spatial Proximity Of Safety Related SSCs

For non-safety related SSCs that are not directly connected to safety related SSCs, the non-safety related SSCs is in-scope if their failure could prevent the performance of a safety related function.

- Steam and Water Systems

  For steam and water systems that could affect safety related SSCs due to spray and/or leaks, a list of safety related components and commodities, and location was assembled based on the plant equipment database. The non-safety related piping with potential to spray or leak that is located in close proximity to safety related and safety significant SSCs was considered in-scope for license renewal. If necessary, walkdowns were performed to identify non-safety related piping that is located such that it could impact safety related SSCs (spatial approach). For inaccessible areas during plant operation, a review was performed using mechanical, civil, and piping drawings to identify non-safety related piping for its impact on safety related SSCs.

- Air/Gas Systems

  Leakage of air/gas systems (non-liquid) is not a hazard to other plant equipment. A site-specific review was made of operating experience in regards to air/gas systems which verified that Duane Arnold air/gas systems have not negatively affected other plant equipment. Since none of the air/gas lines are considered high-energy lines and all supports in buildings with safety related SSCs are in-scope for license renewal, air/gas systems are not required by criterion §54.4(a)(2).

- Non-Safety Related Conduits, Trays, Junction Boxes, and Lighting Fixtures

  Non-safety related conduits, cable trays, junction boxes, lighting fixtures may contain or be routed near safety related cables or other components. To determine which of these commodities to consider in-scope for license renewal, a conservative simplified approach was used. All non-safety related conduits, trays, junction boxes and lighting fixtures and their supports located within structures housing safety related equipment are in-scope for license renewal. Additionally, conduits, trays, junction boxes and lighting fixtures and their supports required for regulated events that are located in structures not housing safety related SSCs are in-scope for license renewal.

- Non-Safety Related Heating, Ventilation, and Air Conditioning Ducts and Supports

  Though most heating, ventilation, and air conditioning ducts and their supports are non-safety related, they are located throughout the plant and typically run along ceilings and thus above many safety related SSCs. Similar to air/gas pipe systems, leakage from heating, ventilation, and air conditioning ducts is not a hazard to other plant equipment. The only spatial interaction concern is falling. Similar to conduit and cable trays, a conservative simplified approach is used. All heating, ventilation, and air conditioning ducts supports located within structures housing safety related SSCs are in-scope for license renewal.

- Steam Dryer Assembly

  Industry operating experience has shown that steam dryer assembly structural failures can occur. These structural failures have the potential to pass pieces down the main steam lines and potentially cause the main steam isolation valves (MSIVs) to fail to operate properly. These failures are directly attributable to implementation of an extended power uprate. In 1985, the thermal power of the plant was increased from 1593 MWt to 1658 MWt and has increased again in 2001 and is currently licensed at 1912 MWt. Duane Arnold has not experienced any steam dryer failures during the period of increased power operation and dryer failures in the industry have typically been attributed to design, not aging, concerns. During evaluation of the Dresden/Quad Cities Station license renewal application, the NRC recommended the steam dryers be considered pursuant to criterion §54.4(a)(2). Consistent with this recommendation, the Duane Arnold has included the steam dryer assembly as in-scope for license renewal.

- Seismic Interaction

  Within the Duane Arnold CLB, some lines and structures designed to ASME Class II seismic requirements were re-analyzed to more stringent requirements (seismic II/I) due to potential adverse interaction with safety-related SSCs. These lines (including supports) and structures are in-scope for license renewal.

- Main Steam Isolation Valve Leakage Treatment Path

  The Main Steam Isolation Valve Leakage Treatment Path is designed to mitigate the release of fission products following a LOCA. This is accomplished by directing main steam isolation valve leakage to the main condenser via the main steam drain line manifold connected downstream of the outboard main steam isolation valves. The volume and surface area of the condenser provides holdup time and plate-out surface for fission products. There is a primary leakage path to the main condenser, as well as an alternate path in the event that motor operated valves in the primary path fail to open. Other steam systems connected to Main Steam are isolated to ensure that leakage is processed through this path.

  SSCs that support the leakage treatment path (for example, reposition to establish a boundary) are in-scope for license renewal pursuant to criterion §54.4(a)(2).

2.1.2.2.3 Other Regulations Pursuant to 10 CFR Part 54

The third scoping category in 10 CFR 54.4 involves SSCs relied upon by licensees to address five regulated events. Specifically, §54.4(a)(3) defines SSCs as in-scope for license renewal, if relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with one or more of the regulated events:

- Fire Protection (10 CFR 50.48)
- Environmental Qualification (10 CFR 50.49)
- Pressurized Thermal Shock (10 CFR 50.61)
- Anticipated Transient Without Scram (10 CFR 50.62)
- Station Blackout (10 CFR 50.63)

Any SSC that is required to function in order to meet compliance requirements of one or more of these regulations was identified as required by §54.4(a)(3). All SSCs required by §54.4(a)(3) are in-scope for license renewal.

SSCs subject to these regulations are identified in the plant equipment database. In addition to this, a separate review was performed of the regulated events, to independently determine SSCs that would be in-scope for license renewal. The results of this review were documented in technical reports and incorporated into the license renewal database. The following discussion describes the methodology used in this review.

- Fire Protection (10 CFR 50.48)

  The design of the Duane Arnold Fire Protection Program is based upon the defense-in-depth concept. Multiple levels of protection are provided so that should a fire occur, it will not prevent safe plant shutdown and the risk of a radioactive release to the environment will be minimized. These levels of protection include fire prevention, fire detection and mitigation, and the capability to achieve safe shutdown should a fire occur. This protection is provided through commitments made to Branch Technical Position APCSB 9.5-1 Appendix A [Reference 2.1-7] and 10 CFR 50 Appendix R. The SSCs at Duane Arnold that support these multiple levels of protection are considered within the scope of license renewal.

  The Duane Arnold Fire Protection Program is contained in the Duane Arnold Fire Plan.

  The Site Fire Plan has been established to describe the overall Fire Protection Program for Duane Arnold. The Fire Plan identifies the various positions responsible for the implementation of the Fire Protection Program, and delineates responsibilities and authorities. It describes the operability requirements for fire protection equipment or features credited in the Appendix R Safe Shutdown Analysis.

  Identification of SSCs credited with fire prevention, detection, and mitigation was accomplished via review of Duane Arnold Fire Protection Program, Fire Plan, UFSAR, and applicable licensing correspondence. These SSCs are in-scope for license renewal pursuant to criterion §54.4(a)(3).

- Environmental Qualification (EQ) (10 CFR 50.49)

  Pursuant to §50.49(b), Duane Arnold electrical equipment important to safety covered by the Environmental Qualification rule was identified based on the following:

  (1) Safety related electric equipment that is relied upon to remain functional during and following design basis events to ensure:

  (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, and

  (iii) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the 10 CFR Part 100 guidelines.

  Design Basis Events are defined as conditions of normal operation, including anticipated operational occurrences, design basis accidents, external events, and natural phenomena for which the plant must be designed to ensure functions (i) through (iii) of this paragraph.

(2) Non safety electric equipment whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions specified in (i) through (iii) above.

(3) Certain post-accident monitoring equipment (refer to Regulatory Guide 1.97, [Reference 2.1-8].

Pursuant to the requirements of §50.49, Duane Arnold established a program for qualifying the electrical equipment defined in §50.49(b). For non-safety related electrical components whose failure under postulated environmental conditions could prevent satisfactory accomplishment of safety functions, Duane Arnold elected not to differentiate between safety related and non-safety related components. If failure of an electrical component can affect safety related functions, that electrical component is treated as if it were safety related for environmental qualification purposes and therefore are in-scope for license renewal pursuant to criterion §54.4(a)(3).

- Pressurized Thermal Shock (10 CFR 50.61)

  Pressurized thermal shock is not applicable to boiling water reactors. Duane Arnold is a boiling water reactor, therefore, pressurized thermal shock is not applicable to Duane Arnold.

- Anticipated Transients without Scram (10 CFR 50.62)

  §50.62 established a requirement for all light-water-cooled nuclear power plants for protection against anticipated transients without scram events. For boiling water reactors, including Duane Arnold, the final rule required:

  1. An alternate rod insertion system diverse from the reactor protection system, to vent the scram air header automatically under anticipated transient without scram conditions.
  2. A Recirculation Pump Trip System to trip the reactor recirculation pumps automatically under anticipated transient without scram conditions.
  3. A Standby Liquid Control System with the capability of injecting into the reactor pressure vessel, a borated water solution at a flow rate, level of boron concentration and boron-10 isotope enrichment, and accounting for volume of the reactor pressure vessel, that the resulting reactivity control is at least equivalent to that resulting from injection of 86 gpm of 13 weight percent sodium pentaborate decahydrate solution at a natural boron-10 isotope abundance into a 251-inch inside diameter reactor pressure vessel for a given core design.

  As stated in Section 15.3.1 of the Duane Arnold UFSAR, the systems required to meet the requirements of the anticipated transient without scram rule are the Standby Liquid Control System and the Alternate Rod Insertion – Recirculation Pump Trip System. Alternate Rod Insertion is part of the Control Rod Drive System. Recirculation Pump Trip System is part of the Reactor Vessel Recirculation System and the 460VAC Power System. Therefore, these systems are in scope for license renewal pursuant to criterion §54.4(a)(3).

- Station Blackout (SBO) (10 CFR 50.63)

  10 CFR Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, provides the requirements for renewal of a plant's operating license. §54.4(a)(3) requires that "All systems, structures, and components relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the Commission's regulations for station blackout (10 CFR 50.63)." be included within the scope of those SSCs addressed by the license renewal rule.

  NUREG-1800, Revision 1, contains additional considerations related to the determination of Station Blackout scoping boundaries for license renewal. The NUREG addresses the determination of boundaries of the plant system portion of the offsite power system relied upon to restore offsite power for license renewal considerations.

  Based on a review of the Duane Arnold CLB for license renewal, and the guidance in NUREG-1800, SSCs that perform an intended function for Station Blackout are in-scope for license renewal pursuant to criterion §54.4(a)(3).

2.1.2.3 Interim Staff Guidance

During license renewal application reviews, the staff identified issues for which additional NRC and industry clarification was necessary. The staff addressed these issues by issuing Interim Staff Guidance (ISG). Previously approved Interim Staff Guidance documents have been incorporated into the guidance of NUREG-1801, GALL Report [Reference 2.1-10] and NEI 95-10. Utilization of these guidance tools ensures that the ISGs are addressed in the Duane Arnold LRA. Since the latest revisions to NUREG-1801 and NEI 95-10, LR-ISG-23 - Replacement Parts Necessary To Meet 10 CFR 50.48 (Fire Protection) was closed by the NRC stating that no additional guidance is required [Reference 2.1-11].

The following Interim Staff Guidance issues are currently subject to discussion between the industry and the NRC staff. These currently unresolved Interim Staff Guidance issues (four that address concerns in the LRA and two that address concerns in the Environmental Report) are listed below.

License Renewal Application ISGs

- LR-ISG-19B - Cracking of nickel-alloy components in the reactor coolant pressure boundary - This LR-ISG is under development. NEI and Electric Power Research Institute Materials Reliability Program (EPRI-MRP) is to develop an augmented inspection program for GALL AMP XI.M11-B, "Nickel-Alloy Base-Metal Components and Welds in the Reactor Coolant Pressure Boundary." This AMP will not be completed until after the NRC approves an augmented inspection program for nickel-alloy base metal components and welds as proposed by the ERPI-MRP.
- LR-ISG-2006-01 - Corrosion of the Mark I Steel Containment Drywell Shell – The guidance in this ISG is incorporated into the Duane Arnold LRA.

License Renewal Application Environmental Report ISGs

- LR-ISG-2006-02 - Proposed staff guidance on acceptance review for environmental requirements. - The staff is in the process of evaluating this LR-ISG.
- LR-ISG-2006-03 - Staff Guidance for Preparing Severe Accident Mitigation Alternatives (SAMA) Analyses - The guidance in this ISG is incorporated into the Duane Arnold LRA.

In addition, the NRC is developing the following administrative guidance

- LR-ISG-2007-01 – Proposed Updating the LR-ISG Process to Include References to the Environmental Report Guidance Documents, References for the Recent Publication of Revision 1 of the License Renewal Guidance Documents, and Minor Revisions to be Consistent with Current Staff Practices – This ISG is under development by the NRC.

2.1.2.4 Generic Safety Issues

In accordance with the guidance in NEI 95-10 and Appendix A.3 of NUREG-1800, review of NRC Generic Safety Issues (GSIs) as part of the license renewal process is required to satisfy a finding per 10 CFR 54.29. GSIs that involve issues related to license renewal aging management reviews or time-limited aging analyses are addressed in the LRA. As a result of the review of NUREG-0933, Supplement 29 [Reference 2.1-12], the following GSI evaluations are provided:

- GSI-156.6.1 Pipe Break Effects on Systems and Components – This GSI addresses postulated high energy line breaks inside containment in which the effects of the resulting pipe break prevent the operation of systems required to mitigate the effects of the break. The GSI is related to aging of piping systems, because the probability of failure of a piping system is affected by degradation, including metal fatigue, that occurs over time. Age related piping degradation for high-energy piping is addressed in the aging management review for mechanical systems in Section 3 and in the TLAA evaluations of piping components in Section 4
- GSI 168, Environmental Qualification of Electrical Equipment – This GSI is related to aging concerns with respect to environmental qualification of electrical equipment. Environmental qualification evaluations of electrical equipment are identified as TLAAs for Duane Arnold. Accordingly, this GSI is addressed in LRA Subsection 4.3.1.
- GSI 190, Fatigue Evaluation of Metal Components for 60-year Plant Life – This GSI addresses fatigue life of metal components and was closed by the NRC [Reference 2.1-13]. However, the NRC concluded that license renewal applicants should address the effects of reactor coolant environment on component life. Accordingly, the issue of environmental effects on component life is addressed in LRA Section 4.3.5.

2.1.2.5 Evaluation Boundaries - License Renewal Boundary Drawings

Application of all three 10 CFR 54.4 criteria generated a listing of SSCs that are in-scope for license renewal. Not every component of a system may support the system intended functions, therefore some components within a system or structure are not subject to an aging management review.

Mechanical components and a site plan drawing that require Aging Management Review are depicted in the license renewal boundary drawings which accompany the Duane Arnold LRA, but are not considered part of the license renewal application. The drawings consist of simplified process and instrumentation drawings (for mechanical systems), and a site plan drawing (for major structures and buildings). The colored portions of the drawing identify the mechanical components (mechanical) and major structures and buildings (civil) that are subject to an aging management review. The mechanical components are color coded with two different colors to distinguish between §54.4(a)(1), §54.4(a)(3) and §54.4(a)(2) criteria. Red indicates criteria (a)(1) or (a)(3) and green indicates criterion (a)(2). The major structures and buildings are color coded with two different colors to distinguish between in-scope and non-safety that supports safety-related or equipment that supports a regulated event.

An Electrical License Renewal Boundary Drawing was not prepared. Figure 2.5-1 presents the Station Blackout Boundary/License Renewal Scope.

2.1.3 SCREENING PROCESS

2.1.3.1 License Renewal Screening

NUREG 1800 uses the term “screening” when referring to the application of §54.21(a)(1)(i) and (ii) criteria. These criteria are provided, in part, as follows:

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

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

2.1.3.2 General Screening Methodology

The screening process identifies the components from the systems, structures, and commodity groups within the scope of license renewal that are subject to an aging management review. These components are those that perform or support a component-level intended function without moving parts or change in configuration or properties and that are not subject to replacement based on a qualified life or specified time period.

A component-level intended function is one that supports the system-level intended function. The plant systems, structures, and commodity groups that are within the scope of license renewal and their system-level intended functions were previously identified during the scoping process.

The screening process consists of the following distinctive steps:

- Identification of the components that are subject to an aging management review (passive and long-lived) for each system, structure, or commodity in-scope for license renewal.
- Identification of the component-level intended functions for all components subject to an aging management review.
- Identification of the applicable references used to make these determinations.

2.1.3.3 Component Classification (Passive, Long-Lived)

As part of the screening process, components that were within the license renewal evaluation boundaries that functioned with moving parts or with a change in configuration or properties (i.e., active components) were identified. An aging management review was not required for these components. Appendix B to NEI 95-10 provides guidance regarding component types generally classified as passive or active.

Cables, connections, and electrical penetrations associated with the §50.49 environmental qualification program are defined as short lived (i.e., subject to replacement based on qualified life) and are addressed by time-limited aging analyses. Therefore, these cables, connections, and electrical penetrations are not included in the set of electrical components requiring aging management review.

The screening process identified those components classified as short-lived. If a work control document was found to provide for the periodic replacement of the component, or the component was found to have an established qualified life, the component has been identified as short-lived and an aging management review was not required for that component.

Consumables are a special class of short-lived items that can include packing, gaskets, component seals, O-rings, oil, grease, component filters, system filters, fire extinguishers, fire hoses, and air packs. Evaluation of items to determine whether or not they are consumables followed the guidance presented in Table 2.1-3 of NUREG-1800 as summarized below:

a. <u>Packing, Gaskets, Component Seals, and O-Rings</u>

Packing, gaskets, component mechanical seals, and O-rings 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 subcomponents of the identified components and, therefore, are not subject to their own condition or performance monitoring. Therefore, the aging management review for the component includes an evaluation of the sealing materials in those instances where none of the following applied:

1. The sealing materials are short-lived because they are replaced on a fixed frequency or have a qualified life established (e.g., for environmental qualification 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

b. <u>Oil, Grease, and Filters</u>

Oil, grease, and filters (both system and component filters) have been treated as consumables because either:

1. A program for periodic replacement exists, or
2. A monitoring program (e.g., predictive analysis activities, condition monitoring) exists that replaces these consumables, based on established performance criteria, when their condition begins to degrade, but before there is a loss of intended function.

c. <u>Fire Extinguishers, Fire Hoses, and Air Packs</u>

Components such as fire hoses, fire extinguishers, self-contained breathing apparatus, and self-contained breathing apparatus cylinders are consumables that are routinely tested or inspected. The Fire Protection Program complies with the applicable National Fire Protection Association (NFPA) safety standards, which specify performance and condition monitoring programs for these specific components. They are replaced as necessary. Therefore, while these consumables are in the scope of license renewal, they do not require an aging management review.

A component or component commodity group that was determined to be active or short-lived is not subject to an aging management review, and is screened out by the process.

A component or component commodity group that was determined to be passive and long-lived is subject to an aging management review, and is identified on license renewal boundary drawings.

2.1.3.4 Scoping and Screening of Electrical Equipment

All electrical systems were evaluated to determine if the system intended functions met the requirements of §54.4(a)(1), §54.4(a)(2) and §54.4(a)(3). Those SSCs which supported intended functions were considered within the scope of license renewal. Component level screening was performed for “in scope” components associated with electrical and mechanical systems. Most component level screening was performed and documented in the license renewal database on a commodity basis. Components identified as being within the scope of license renewal were evaluated per NEI 95-10 Appendix B criteria to determine if the component was considered “active.” Components were either screened out as active or were included in a commodity group. Long-lived, passive components were divided into commodity groups identified on LRA Table 2.1-2. Aging management was performed on these commodity groups. This process allowed for the quick removal of large numbers of out-of-scope and active components.

Mechanical systems contain some electrical only components (relays, power supplies, motors, etc.). Because electrical components are evaluated on a commodity basis or screen out due to active functions, it was not necessary to track each individual component (either in a mechanical document or in an electrical document). Existing electrical components in the equipment database were transferred to the license renewal database, but not evaluated on an individual basis.

2.1.3.5 Components Subject to Aging Management Review

A component-level intended function is one that is required for the system or structure to perform its system-level intended functions.

The components (or component commodity groups) that are subject to an aging management review are those in-scope components that perform a component-level intended function without moving parts or a change in configuration or properties and are not subject to replacement based on a qualified life or specified time period. Components may have more than one intended function. If a component did not have at least one component-level intended function, the component was not subject to an aging management review.

Detailed scoping and screening reports have been prepared which identify all structures and components subject to an aging management review. These reports have been prepared for all systems, structures, or commodity groups (except electrical commodities) in-scope for license renewal. Electrical commodities subject to an aging management review were identified using guidance in NEI 95-10 and the EPRI 1013475, EPRI License Renewal Electrical Handbook [Reference 2.1-14].

2.1.4 REFERENCES

2.1-1 10CFR, Code of Federal Regulations, Title 10 - Energy.

2.1-2 NEI 95-10, Industry Guideline for Implementing the Requirements of 10 CFR Part 54 -The License Renewal Rule, Revision 6, Nuclear Energy Institute, June 2005.

2.1-3 Duane Arnold Energy Center Technical Specifications.

2.1-4 Duane Arnold Updated Final Safety Analysis Report.

2.1-5 NUREG-1800, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, Revision 1, U.S. Nuclear Regulatory Commission, September 2005.

2.1-6 NUREG-0612, Control of Heavy Loads at Nuclear Power Plants, Resolution of Generic Activity A-36, U.S. Nuclear Regulatory Commission, July 1980.

2.1-7 NRC Branch Technical Position APCSB 9.5-1

2.1-8 Regulatory Guide 1.97, Instrumentation For Light-Water-Cooled Nuclear Power Plants To Assess Plant And Environs Conditions During And Following An Accident, U.S. Nuclear Regulatory Commission, May 1983.

2.1-9 Staff Guidance on Scoping of Equipment Relied on to meet the Requirements of the Station Blackout (SBO) Rule (10 CFR 50.63) for License Renewal, U.S. Nuclear Regulatory Commission, April 1, 2002.

2.1-10 NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Revision 1, U.S. Nuclear Regulatory Commission, September 2005.

2.1-11 Letter Pao-Tsin Kao, U.S. Nuclear Regulatory Commission to Alexander Marion, Nuclear Energy Institute, “Staff Resolution Associated with License Renewal Interim Staff guidance LR-ISG-23: Replacement Parts Necessary to Meet 10 CFR 50.48 (Fire Protection),” December 20, 2006.

2.1-12 NUREG-0933, A Prioritization of Generic Safety Issue, Supplement 29, U.S. Nuclear Regulatory Commission, November 2005.

2.1-13 Memorandum, Thadani, A. C., Director, Office of Nuclear Reactor Regulatory Research, to Travers, W. D., Executive Director of Operations – Closeout of Generic Safety Issue 190, “Fatigue Evaluation of Metal Components for 60-Year Plant Life,”. U.S. Nuclear Regulatory Commission, December 26, 1999.

2.1-14 EPRI 1013475, EPRI License Renewal Electrical Handbook., Revision 1 to EPRI Report 1003057.

TABLE 2.1-1
STRUCTURE / COMPONENT INTENDED FUNCTIONS

Intended Function	Description
Absorb neutrons	Absorb neutrons
Control building habitability	Provide an atmosphere suitable for personnel
Direct flow	Provide spray shield or curbs for directing flow
Electrical continuity	Provide electrical connections to specified sections of an electrical circuit to deliver voltage, current or signals
Expansion/separation	Provide for thermal expansion and/or seismic separation
Filter	Provide filtration
Fire barrier	Provide rated fire barrier to confine or retard a fire from spreading to and from adjacent areas of the plant
Flood barrier	Provide flood protection barrier (internal and external flooding event)
Gaseous release path	Provide path for release of filtered and unfiltered gaseous discharge
Heat sink	Provide heat sink during station blackout or design basis accidents
Heat transfer	Provide heat transfer
High energy line break (HELB) shielding	Provide shielding against high energy line breaks
Insulate (electrical)	Insulate and support an electrical conductor
Leakage boundary - spatial	Non-safety related component that maintains mechanical and structural integrity to prevent spatial interactions that could cause failure of safety related SSCs
Minimize inleakage	Minimize inleakage by maintaining/supporting positive pressure in the Control Building to ensure control room habitability
Missile barrier	Provide missile barrier (internally or externally generated)
Pipe whip restraint	Provide pipe whip restraint

TABLE 2.1-1 (continued)
STRUCTURE / COMPONENT INTENDED FUNCTIONS

Intended Function	Description
Pressure boundary	Provide pressure retaining boundary so that sufficient flow at adequate pressure is delivered, or provide fission product barrier for containment pressure boundary, or provide containment isolation for fission product retention
Pressure relief	Provide over pressure protection
Shelter, protection	Provide shelter/protection to safety-related components
Shielding	Provide shielding against radiation
Shutdown cooling water	Provide source of cooling water for plant shutdown
Spray	Convert fluid to spray
Structural integrity - attached	Non-safety related component that maintains mechanical and structural integrity to provide structural support to attached safety related piping and components
Structural pressure barrier	Provide pressure boundary or essentially leak tight barrier to protect public health and safety in the event of any postulated design basis events
Structural support	Provide structural and/or functional support to safety-related and/or non-safety-related components
Structure	Supports the mitigation of regulated events for components not specifically addressed by other component intended functions
Support/mitigate regulated events	Supports the mitigation of regulated events for components not specifically addressed by other component intended functions
Throttle	Provide flow restriction

TABLE 2.1-2
ELECTRICAL / I&C COMPONENT COMMODITY GROUPS

Commodity Group	Intended Function
Bare electrical wire	Electrically connect specified sections of an electrical circuit or deliver voltage, current or signal
Electrical cables	Electrically connect specified sections of an electrical circuit or deliver voltage, current or signal
Electrical connections (includes terminal boards/strips, bolted fuse holders, and splices)	Electrically connect specified sections of an electrical circuit or deliver voltage, current or signal
Electrical penetration assemblies	Electrically connect specified sections of an electrical circuit or deliver voltage, current or signal
Fuse holders (Clip type)	Disconnect an electrical circuit at a predetermined current and duration
High voltage electrical bus	Electrically connect specified sections of an electrical circuit to deliver voltage, current, or signal.
High voltage insulators	Insulate and support an electrical conductor
Metal enclosed bus	Electrically connect specified sections of an electrical circuit to deliver voltage, current, or signal.

2.2 PLANT LEVEL SCOPING RESULTS

Duane Arnold's integrated plant assessment methodology consists of scoping, screening, and aging management reviews. This section provides the plant level scoping results achieved when applying the scoping methodology described in LRA Subsection 2.1.1 to plant systems and structures. LRA Tables 2.2-1, 2.2-2, and 2.2-3 provide the plant level scoping results for mechanical systems, structures, and electrical / instrumentation and controls (I&C) systems, respectively. If a system or structure, in whole or in part, meets one or more of the license renewal scoping criteria, the system or structure is considered to be within the scope of license renewal. Included in the tables are references to the sections in this application that discuss screening results for in-scope systems and structures.

For License Renewal, some of the systems and structures were combined to provide a more logical method of evaluation. LRA Tables 2.2-1, 2.2-2, and 2.2-3 identify those systems that have been combined in the license renewal process.

TABLE 2.2-1
PLANT LEVEL SCOPING RESULTS – MECHANICAL SYSTEMS

System Name	In License Renewal Scope	Screening Results - LRA Subsection
Administration Building Heating, Ventilation, and Air Conditioning	No	
Auxiliary Heating Boiler	Yes	2.3.3.1
Badging Center Heating and Ventilation	No	
Building Sumps Administration Building Sumps Floor and Equipment Drains Offgas Building Sumps Radwaste Building Sumps Reactor Building Sumps (includes sanitary, floor & equipment drains) Turbine Building Sumps (includes floor & equipment drains)	Yes	2.3.3.2
Chlorination and Acid Feed System	Yes	2.3.3.3
Circulating Water System	Yes	2.3.3.4
Condensate and Demineralized Water System Condensate Demineralizer Makeup Water Treatment System	Yes	2.3.4.1
Condensate and Feedwater System Extraction Steam, Heaters, Vents and Drains Feedwater Control System	Yes	2.3.4.2
Condenser and Condenser Air Removal System	Yes	2.3.4.3
Containment Atmosphere Control System Containment Atmosphere Dilution System Containment Atmosphere Monitoring System Primary Containment Purge and Vent Nitrogen Inerting System Nitrogen Makeup System Nitrogen Compressor Containment Vacuum Breakers Containment Hardened Wetwell Vent	Yes	2.3.3.5
Control Building Heating, Ventilation, and Air Conditioning	Yes	2.3.3.6
Control Rod Drive System	Yes	2.3.3.7
Cooling Towers (basins in-scope for Fire Protection – See Table 2.2-2 Miscellaneous Yard Structures)	No	
Core Spray System	Yes	2.3.2.1
Data Acquisition Center Heating and Ventilation	No	

TABLE 2.2-1 (continued)
PLANT LEVEL SCOPING RESULTS – MECHANICAL SYSTEMS

System Name	In License Renewal Scope	Screening Results - LRA Subsection
Decontamination Facilities	No	
Drywell Sumps	Yes	2.3.3.8
Electrical Manhole Sump Pump	Yes	2.3.3.9
Emergency Service Water System	Yes	2.3.3.10
Fire Protection System	Yes	2.3.3.11
Fuel Pool Cooling and Cleanup System	Yes	2.3.3.12
General Service Water System	Yes	2.3.3.13
High Pressure Coolant Injection System	Yes	2.3.2.2
Hydrogen Water Chemistry System	Yes	2.3.3.14
Inactive Solid Waste (Refuse)	No	
Instrument Air System Service Air Breathing Air	Yes	2.3.3.15
Intake and Traveling Screens	Yes	2.3.3.16
Low Level Radwaste Processing and Storage Facility Area Heating, Ventilation, and Air Conditioning	No	
Low Level Radwaste Processing and Storage Facility Sumps	No	
Machine Shop and Offgas Building Heating, Ventilation, and Air Conditioning	No	
Main Steam Isolation and Automatic Depressurziation System Low-Low Set / Safety and Relief Valves Main Steam Downstream of Main Steam Isolation Valves Nuclear Steam Supply System Shutoff System	Yes	2.3.4.4
Main Steam Isolation Valve Leakage Control (system retired)	No	
Nuclear Boiler	Yes	2.3.1.1

TABLE 2.2-1 (continued)
PLANT LEVEL SCOPING RESULTS – MECHANICAL SYSTEMS

System Name	In License Renewal Scope	Screening Results - LRA Subsection
Offgas Exhaust System Area Radiation Monitor Control Building Ventilation Radiation Monitor Environmental Radiation Monitor Liquid Process Radiation Monitor Low Level Radwaste Processing and Storage Facility Kaman Radiation Monitor Main Steam Supply Line Radiation Monitor Offgas Radiation Monitor Offgas Recombiner Reactor Building Exhaust Radiation Monitor Reactor Building Kaman Radiation Monitor Stack Gas Radiation Monitor Turbine Building Kaman Radiation Monitor	Yes	2.3.3.17
Plant Ventilation Standby Diesel Generator Heating, Ventilation, and Air Conditioning Intake Structure Heating, Ventilation, and Air Conditioning Pump House Heating, Ventilation and Air Conditioning - Safety System Radwaste Building Heating, Ventilation, and Air Conditioning Turbine Building Heating, Ventilation and Air Conditioning	Yes	2.3.3.18
Pleasant Creek Pump Station and Valves	No	
Post Accident Sampling System	Yes	2.3.3.19
Primary Containment Drywell Access Control Drywell Radiation Monitors Traversing Incore Probe	Yes	2.3.2.3
Primary Containment Heating, Ventilation, and Air Conditioning	Yes	2.3.3.20
Pump House Heating Ventilation and Air Conditioning – Non Safety System	No	
Radwaste Sumps	No	
Reactor Building and Radwaste Building Sampling System	Yes	2.3.3.21
Reactor Building Closed Cooling Water System	Yes	2.3.3.22
Reactor Building Heating, Ventilation, and Air Conditioning (includes Reactor Recirculation Motor-Generator Set Room Heating, Ventilation and Air Conditioning)	Yes	2.3.3.23
Reactor Core Isolation Cooling System	Yes	2.3.2.4

TABLE 2.2-1 (continued)
PLANT LEVEL SCOPING RESULTS – MECHANICAL SYSTEMS

System Name	In License Renewal Scope	Screening Results - LRA Subsection
Reactor Vessel Recirculation System	Yes	2.3.1.2
Reactor Water Cleanup System	Yes	2.3.3.24
Residual Heat Removal System	Yes	2.3.2.5
RHR Service Water System	Yes	2.3.3.25
River Water Supply System	Yes	2.3.3.26
Safety Related Air System “A” and “B” Safety Related Air Systems	Yes	2.3.3.27
Security Building Heating Ventilation and Air Conditioning	No	
Smoke Detectors	No	
Solid Radwaste Liquid Radwaste Radwaste Evaporator (included floor & equipment drains)	Yes	2.3.3.28
Standby Diesel Generator Diesel Oil System Emergency Power	Yes	2.3.3.29
Standby Gas Treatment System	Yes	2.3.2.6
Standby Liquid Control System	Yes	2.3.3.30
Storm Drains	No	
Technical Support Center Heating, Ventilation, and Air Conditioning	No	
Turbine System Main Turbine Turbine Steam Seal System Lube Oil Transfer, Purification, and Storage System Hydrogen Seal Oil System Electro-Hydraulic Control System Stator Cooling System	Yes	2.3.4.5
Turbine Building Sampling System	Yes	2.3.3.31
Well Water System Domestic Water System (includes sanitary water supply)	Yes	2.3.3.32
Zinc Injection System	Yes	2.3.3.33

TABLE 2.2-2
PLANT LEVEL SCOPING RESULTS - BUILDINGS / STRUCTURES

Building / Structure Name	In License Renewal Scope	Screening Results LRA Subsection
Buildings, Structures not Affecting Safety Acid Tanks Administration Building Air Compressor Building (Instrument Air Building) Badging Center Barn Breathing Air Building CAD Charge House Construction Support Center Cooling Towers Data Acquisition Center East Warehouse Electrical Maintenance Shop Feedwater Heater Heat Exchanger Fabrication & Storage Building Fire Brigade Training Trailer HPCI/RCIC Room Cooling Unit Chill Water Heat Exchanger HVAC Cooling Units (Training Center) Hydrogen Storage Tanks ISFSI Storage Building Liquid Nitrogen Tank Low-Level Radwaste Storage Facility Mechanical Maintenance Shop Oil Barrier Storage Shed Plant Support Center Portable Shacks Safety & Human Performance Simulator Building Security Control Point (Guard Facility) Security Shack & Access Control Point Sewage Treatment Plant & Aerobic Digester Building Shooting Range & Building South Warehouse Technical Support Center (TSC) Technical Support Center Diesel Fuel Tank and Diesel Generator Trailers Training Center Training Center Annex	No	

TABLE 2.2-2 (continued)
PLANT LEVEL SCOPING RESULTS - BUILDINGS / STRUCTURES

Building / Structure Name	In License Renewal Scope	Screening Results LRA Subsection
Buildings, Structures not Affecting Safety (continued) Utility (Telephone) Shack Well Houses A, B, C and D West Warehouse		
Buildings, Structures Affecting Safety Low-Level Radwaste Processing Facility (partial) Machine Shop (partial) Offgas Retention Building (partial) Radwaste Building (partial) Railroad Airlock (partial)	Yes	2.4.1
Control Building	Yes	2.4.2
Cranes and Hoists	Yes	2.4.3
Doors Doors are in scope for LR, however, all components have been relocated to the appropriate building / structure commodity group.	No	
Dry Spent Fuel Storage System	No	
Fuel Handling Fuel Handling is in scope for LR, however, all components have been relocated to the appropriate building / structure commodity group.	No	
Intake Structure	Yes	2.4.4
Miscellaneous Yard Structures Yard and substation structures Condensate storage tank foundations Emergency diesel generator fuel oil tank anchors Underground duct banks and manholes containing safety related circuitry Circulating Water Dilution Structure	Yes	2.4.5
Offgas Stack	Yes	2.4.6
Primary Containment Structure	Yes	2.4.7
Pump House	Yes	2.4.8
Reactor Building	Yes	2.4.9
Supports	Yes	2.4.10

TABLE 2.2-2 (continued)
PLANT LEVEL SCOPING RESULTS - BUILDINGS / STRUCTURES

Building / Structure Name	In License Renewal Scope	Screening Results LRA Subsection
Tools Tools is in scope for LR, however, all components have been relocated to the appropriate building / structure commodity group	No	
Turbine Building	Yes	2.4.11

TABLE 2.2-3
PLANT LEVEL SCOPING RESULTS – ELECTRICAL / I&C SYSTEMS

System Name	In License Renewal Scope	Screening Results LRA Section
125 Volt DC System	Yes	2.5
161-345 kV Switchyard	Yes	2.5
24 Volt DC System	Yes	2.5
250 Volt DC Power System	Yes	2.5
4160 Volt AC System	Yes	2.5
480 Volt AC Motor Control Centers	Yes	2.5
480 Volt AC Switchgear	Yes	2.5
Alert Notification System	No	
Annunciator System (Except Fire Protection)	Yes	2.5
Annunciator System (Fire Protection)	Yes	2.5
Area Radiation Monitors	No	
Cathodic Protection System	Yes	2.5
Chemical Labs and Equipment	No	
Computers	Yes	2.5
Containment Isolation Monitoring System	Yes	2.5
External and Internal Telephones	Yes	2.5
Instrument AC Control Power System	Yes	2.5
Instrument Shop and Equipment	No	
Intrusion Alarms and Monitors	No	
Lighting Panel Power Supply System	Yes	2.5
Liquid Process Radiation Monitor	No	
Low Level Radwaste Processing and Storage Facility Kaman Radiation Monitor	No	
Main and Auxiliary Transformer and Isophase Bus	No	
Main Generator and Excitation	Yes	2.5
Meteorological System	No	
Neutron Monitoring System	Yes	2.5

TABLE 2.2-3 (continued)
PLANT LEVEL SCOPING RESULTS
– ELECTRICAL / I&C SYSTEMS

System Name	In License Renewal Scope	Screening Results LRA Section
Non-Safe Shutdown Emergency Lights in Lighting Panels	Yes	2.5
Offgas Radiation Monitor	No	
Panels (Structural functions included in Supports)(Internal components addressed as part of the associated system)	No	
Public Address System / Fire and Evacuation Alarm	Yes	2.5
Radio Communications	Yes	2.5
Reactor Building Kaman Radiation Monitor	No	
Reactor Manual Control System	No	
Reactor Non-Nuclear Instrumentation System	Yes	2.5
Reactor Protection System	Yes	2.5
Remote Shutdown System	Yes	2.5
Rod Worth Minimizer	No	
Safe Shutdown Pathway Emergency Lights in Lighting Panels	Yes	2.5
Safety Parameter Display System	Yes	2.5
Seismographic Monitors	No	
Sound Powered Phones	Yes	2.5
Smoke Detection	No	
Standby Transformer	Yes	2.5
Startup Transformer and Site Ground Nets	Yes	2.5
Steam Leak Detection System	Yes	2.5
Surveillance Equipment	No	
Turbine Building Kaman Radiation Monitor	No	
Uninterruptible AC Control Power System	Yes	2.5

2.3 SCOPING AND SCREENING RESULTS: MECHANICAL SYSTEMS

The determination of mechanical systems within the scope of license renewal is made by identifying Duane Arnold mechanical systems and then reviewing them to determine which ones satisfy one or more of the criteria in 10 CFR 54.4. This process is described in Section 2.1 and the results of the mechanical systems review are contained in Section 2.2.

LRA Section 2.1 also provides the methodology for determining the components within the scope of 10 CFR 54.4 that meet the requirements contained in 10 CFR 54.21(a)(1). The components that meet these screening criteria are identified in this section. These identified components subsequently require an aging management review for license renewal.

The screening results for mechanical systems are provided below in four subsections:

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

2.3.1 REACTOR COOLANT SYSTEMS

The Reactor Coolant Systems consist of the systems and components designed to contain and support the nuclear fuel, contain the reactor coolant, and transfer the heat produced in the reactor to the Steam and Power Conversion Systems for the production of electricity.

The following systems are addressed in this subsection:

- Nuclear Boiler
  - Reactor pressure vessel
  - Reactor pressure vessel internals
- Reactor Recirculation System

2.3.1.1 Nuclear Boiler

2.3.1.1.1 <u>System Description</u>

<u>Reactor Pressure Vessel</u>

The purpose of the reactor pressure vessel is to support and maintain proper alignment of the reactor core, control rods, and control rod drives during all modes of reactor operation. The reactor pressure vessel provides a high-integrity barrier to contain the reactor coolant and prevent leakage of radioactive materials. The reactor pressure vessel provides a volume in which the core can be submerged in coolant, thereby allowing power operation of the fuel.

The reactor pressure vessel is a vertical, cylindrical pressure vessel with hemispherical heads of welded construction. The cylindrical shell and bottom hemispherical head of the reactor pressure vessel are fabricated of low-alloy steel plate that is clad on the interior with stainless steel overlay. The stainless steel cladding provides the necessary corrosion resistance during reactor shutdown and also helps maintain water clarity during refueling operations.

The reactor pressure vessel top head is secured to the reactor pressure vessel by studs, nuts, and bushings. The reactor pressure vessel flanges are sealed by two concentric rings designed for no leakage through the inner or outer seal at any operating condition.

A connection is provided on the reactor pressure vessel flange annulus between the two metallic seal rings used to seal the reactor pressure vessel and the top head flanges. This connection permits the detection of leakage from the inside of the reactor pressure vessel past the inner seal ring. A pressure switch is provided to actuate the alarm in the main control room as pressure in the leakage collection pipe becomes abnormally high.

<u>Reactor Pressure Vessel Internals</u>

The purpose of the reactor vessel internals is to properly distribute the flow of coolant to the vessel, to locate and support the fuel assemblies, and to provide an inner volume containing the reactor core that can be flooded following a break in the nuclear system process barrier external to the reactor pressure vessel.

The reactor vessel internal components include the core (including the fuel, channels, control blades, incore flux monitor guide tubes, control rod guide tubes, and core instrumentation), core support structure (including the core shroud, top guide, fuel support pieces, and core plate), shroud head and steam separator assembly, steam dryer assembly, feedwater spargers, core spray spargers, differential pressure and liquid control line, surveillance sample holders, and jet pump assemblies.

The core structure surrounds the active core of the reactor and consists of the core shroud, shroud head and steam separator assembly, core support, and top guide. This structure is used to form partitions within the reactor pressure vessel to sustain pressure differentials across the partitions, to direct flow of the coolant water, and to locate laterally and support the fuel assemblies, control rod guide tubes, and steam separators.

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

The shroud head and steam separator assembly is bolted to the top of the upper shroud to form the top of the core discharge plenum. This plenum provides a mixing chamber for the steam water mixture before it enters the steam separators.

The core support plate (core plate) consists of a circular stainless steel plate stiffened with a rim and beam structure. Perforations in the plate provide lateral support and guidance for the control rod guide tubes, incore flux monitor guide tubes, peripheral fuel support pieces, and startup neutron sources. Vertical support is also provided for the peripheral fuel support pieces. The entire assembly is bolted to a support ledge between the central and lower portions of the core shroud. Alignment pins that bear against the shroud are used to correctly position the assembly before it is secured.

The top guide is formed by a series of stainless steel beams joined at right angles to the square openings. Each opening provides lateral support and guidance for four fuel assemblies. Holes are provided in the bottom of the beams to anchor the incore flux monitor guide tubes and startup neutron sources. The top guide is positioned with alignment pins that bear against the shroud.

The fuel support pieces are of two basic types: peripheral and four-lobed. The peripheral support pieces, which are welded to the core support assembly, are located at the outer edge of the active core and are not adjacent to control rods. Each peripheral fuel support piece will support one fuel assembly and contains an orifice assembly designed to ensure proper coolant flow to the fuel assembly. Each four-lobed support piece will support four fuel assemblies and is provided with orifice plates to ensure proper coolant flow distribution to each fuel assembly. The four-lobed support pieces rest on the top of the control rod guide tubes and are supported laterally by the core support. The control rods pass through slots in the center of the four-lobed fuel support pieces. A control rod and four fuel assemblies represents a core cell.

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

The jet pump assemblies are located in two semicircular groups in the downcomer annulus between the core shroud and the reactor pressure vessel wall. Each stainless steel jet pump consists of a driving nozzle, suction inlet, throat or mixing section, and diffuser. To monitor its flow, each jet pump has a sensing line.

The steam dryer removes moisture from the wet steam leaving the steam separators. A skirt extends from the top of the steam dryer to the steam separator standpipe, below the water level. This skirt forms a seal between the wet steam plenum and the dry steam flowing from the top of the steam dryer to the steam outlet nozzles. The steam dryer and shroud head are positioned in the reactor pressure vessel with the aid of vertical guide rods. The dryer assembly rests on the steam dryer support brackets attached to the reactor pressure vessel wall. Upward movement of the dryer assembly is restricted by the steam dryer holddown brackets attached to the reactor pressure vessel top head.

The feedwater spargers are perforated stainless steel headers located in the mixing plenum above the downcomer annulus. Sparger end brackets are attached to reactor pressure vessel brackets to support the weight of the spargers, and wedge blocks position the spargers away from the reactor pressure vessel wall.

Two 100% capacity core spray lines enter the reactor pressure vessel through two core spray nozzles. The lines divide immediately inside the reactor pressure vessel. The correct spray distribution pattern is provided by a combination of distribution nozzles pointed radially inward and downward from the headers.

The differential pressure and standby liquid control lines serve a dual function within the reactor pressure vessel – to inject liquid control solution into the coolant stream and to sense the differential pressure across the core support assembly.

The incore flux monitor guide tubes extend from the top of the incore flux monitor housings in the lower plenum to the top guide.

The surveillance sample holders are welded baskets containing impact and tensile specimen capsules.

2.3.1.1.2 System Functions

The Nuclear Boiler is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Environmental Qualification (10 CFR 50.49)
  - Anticipated Transients Without Scram (10 CFR 50.62)
  - Station Blackout (10 CFR 50.63)

2.3.1.1.3 UFSAR Reference

Additional Nuclear Boiler details are provided in Chapters 4 and 5 of the Duane Arnold UFSAR.

2.3.1.1.4 License Renewal Drawings

The license renewal drawings for the Nuclear Boiler are listed below:

BECH-M114-LR BECH-M115-LR BECH-M116-LR

BECH-M118-LR

2.3.1.1.5 Components Subject to an Aging Management Review

LRA Table 2.3.1-1 lists the component groups and intended functions of the Nuclear Boiler that require aging management review.

LRA Table 3.1.2-1 provides a summary of the results of the aging management review for the Nuclear Boiler.

2.3.1.2 Reactor Vessel Recirculation System

2.3.1.2.1 System Description

The purpose of the Reactor Vessel Recirculation System is to provide a variable rate of reactor coolant flow to the reactor core so that proper thermal margin is maintained during normal reactor operation. The Reactor Vessel Recirculation System consists of two recirculation loops external to the reactor vessel which provide the driving flow of water to sixteen reactor vessel jet pumps. Each external loop contains one variable speed, motor-driven recirculation pump and three motor operated gate valves for pump maintenance and isolation. Each pump discharge line contains a venturi-type flow meter nozzle. The recirculation loops are part of the reactor coolant pressure boundary and are located inside the drywell. The jet pumps are located inside the reactor vessel and are addressed with the reactor vessel internals.

The reactor coolant consists of saturated water from the steam separators and dryers that has been sub-cooled by mixing with incoming feedwater. The water passes down the annulus between the reactor vessel wall and the core shroud. A portion of the coolant exits from the reactor vessel and passes through the external reactor recirculation loops to become the driving force for the jet pumps. The two external recirculation loops each discharge high pressure flow into an external manifold from which individual recirculation inlet lines are routed to the jet pump risers within the reactor vessel. The remaining portion of the coolant mixture in the annulus becomes the driven flow for the jet pumps.

2.3.1.2.2 System Functions

The Reactor Vessel Recirculation System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Environmental Qualification (10 CFR 50.49)
  - Anticipated Transients Without Scram (10 CFR 50.62)
  - Station Blackout (10 CFR 50.63)

2.3.1.2.3 UFSAR Reference

Additional Reactor Vessel Recirculation System details are provided in Section 5.4 of the Duane Arnold UFSAR.

2.3.1.2.4 License Renewal Drawings

The license renewal drawings for Reactor Recirculation System are listed below:

BECH-M111-LR	BECH-M112-LR	BECH-M115-LR
BECH-M116-LR	BECH-M117-LR	

2.3.1.2.5 Components Subject to an Aging Management Review

LRA Table 2.3.1-2 lists the component groups and intended functions of the Reactor Vessel Recirculation System that require aging management review.

LRA Table 3.1.2-2 provides a summary of the results of the aging management review for the Reactor Vessel Recirculation System.

TABLE 2.3.1-1
NUCLEAR BOILER

Component Groups	Intended Function
Access hole covers	Structural support
Aligner	Structural support
Clamps, bracket, and jackbolt	Structural support
Control rod drive mechanism (CRD housing)	Pressure boundary
Control rod drive stub tubes	Structural Support
Control rod guide tube	Structural support
Core plate	Structural support
Core plate bolts	Structural support
Core shroud	Structural support
Core spray lines and spargers	Pressure boundary
Fasteners	Structural Support Pressure boundary
Feedwater sparger	Pressure boundary
Flow orifice Class 1	Pressure boundary Throttle
Fuel supports	Structural support
Incore housings	Pressure boundary Structural Boundary
Intermediate and source range monitor dry tubes	Pressure boundary
Jet pump assembly - casting, collar, flare	Pressure boundary
Jet pump assembly - diffuser	Pressure boundary
Jet pump assembly - elbow	Pressure boundary
Jet pump assembly - holddown beams	Structural support
Jet pump assembly - riser brace arm	Structural support
Jet pump assembly - riser pipe	Pressure boundary
Recirculation Inlet - thermal sleeves	Structural support
Jet pump restrainer	Structural support
Level elements	Pressure boundary
Nozzle – core differential pressure and standby liquid control	Pressure boundary

TABLE 2.3.1-1 (continued)
NUCLEAR BOILER

Component Groups	Intended Function
Nozzle - core spray	Pressure boundary
Nozzle – control rod drive return line	Pressure boundary
Nozzle - drain	Pressure boundary
Nozzle - feedwater	Pressure boundary
Nozzle – high pressure / low pressure seal leak detection	Pressure boundary
Nozzle - instrumentation	Pressure boundary
Nozzle - jet pump instrumentation	Pressure boundary
Nozzle - recirculation inlet & outlet	Pressure boundary
Nozzle - spare	Pressure boundary
Nozzle - steam outlet	Pressure boundary
Nozzle - vent	Pressure boundary
Orifice – fuel support	Structural support
Piping	Pressure boundary Structural integrity (attached)
Reactor pressure vessel intermediate shell and welds	Pressure boundary
Reactor pressure vessel lower shell and welds	Pressure boundary
Reactor pressure vessel shell flanges	Pressure boundary
Reactor pressure vessel shell ID attachment welds	Structural support
Reactor pressure vessel upper shell and welds	Pressure boundary
Reactor pressure vessel support skirt and welds	Structural support
Safe end - control rod drive	Pressure boundary
Safe end - core differential pressure and standby liquid control	Pressure boundary

TABLE 2.3.1-1 (continued)
NUCLEAR BOILER

Component Groups	Intended Function
Safe end - core spray	Pressure boundary
Safe end - feedwater	Pressure boundary
Safe end - feedwater extension	Pressure boundary
Safe end - instrumentation	Pressure boundary
Safe end - jet pump instrumentation	Pressure boundary
Safe end - recirculation inlet	Pressure boundary
Safe end – recirculation inlet extension	Structural support
Safe end – core spray extension	Structural support
Safe end - recirculation outlet	Pressure boundary
Safe end - steam outlet	Pressure boundary
Shroud support structure (shroud support cylinder)	Structural support
Steam dryer	Structural integrity (attached)
Thermal sleeve - control rod drive	Structural support
Thermal sleeve - core spray	Structural support
Thermal sleeve - feedwater	Structural support
Top guide	Structural support
Top head enclosure	Pressure boundary
Top head enclosure flange	Pressure boundary
Top head enclosure studs and nuts	Pressure boundary
Valve body	Pressure boundary

Table 2.3.1-2
REACTOR VESSEL RECIRCULATION SYSTEM

Component Groups	Intended Function
Fasteners	Leakage boundary (spatial) Pressure boundary
Filters	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Flow element, Class 1	Pressure boundary
Flow indicator	Leakage boundary (spatial)
Flow switches	Leakage boundary (spatial) Pressure boundary
Level gauges	Leakage boundary (spatial)
Piping	Leakage boundary (spatial) Pressure boundary Throttle
Pump casings	Leakage boundary (spatial) Pressure boundary
Valve body	Leakage boundary (spatial) Pressure boundary

2.3.2 ENGINEERED SAFETY FEATURES SYSTEMS

Engineered Safety Features Systems consist of systems and components designed to function under accident conditions to minimize the severity of an accident, or to mitigate the consequences of an accident. In the event of a loss of coolant accident (LOCA), the Engineered Safety Features Systems provide emergency coolant to assure structural integrity of the core, to maintain the integrity of the containment, and to reduce the concentration of fission products expelled from the drywell/containment atmosphere.

The following systems are addressed in this subsection:

- Core Spray System
- High Pressure Coolant Injection System
- Primary Containment
- Reactor Core Isolation Cooling System
- Residual Heat Removal System
- Standby Gas Treatment System

The Automatic Depressurization System is covered in LRA Section 2.3.4.4.

2.3.2.1 Core Spray System

2.3.2.1.1 System Description

The Core Spray System maintains core coolant inventory to prevent fuel damage, which limits, in conjunction with the primary and secondary containments, the release of radioactive materials to the environs following a design basis accident.

The two Core Spray System loops pump water into peripheral ring spray spargers mounted above the reactor core. The Core Spray System provides inventory makeup and spray cooling during a large break loss of coolant accident (LOCA) in which the core is uncovered. Following Automatic Depressurization System (ADS) initiation, the system provides inventory makeup following a small break LOCA.

The Core Spray System consists of two independent loops. Each loop includes one 100% capacity centrifugal pump driven by an electric motor, a spray sparger in the reactor vessel above the core, piping and valves that convey water from the suppression pool to the sparger, and associated controls and instrumentation. The core spray pumps receive power from the 4160 VAC emergency buses.

2.3.2.1.2 System Functions

The Core Spray System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Environmental Qualification (10 CFR 50.49)
  - Station Blackout (10 CFR 50.63)

2.3.2.1.3 UFSAR Reference

Additional Core Spray System details are provided in Sections 5.4 and 6.3 of the Duane Arnold UFSAR.

2.3.2.1.4 License Renewal Drawings

The license renewal drawings for the Core Spray System are listed below:

BECH-M114-LR	BECH-M119-LR	BECH-M120-LR
BECH-M121-LR		

2.3.2.1.5 Components Subject to an Aging Management Review

LRA Table 2.3.2-1 lists the component groups and intended functions of the Core Spray System that require aging management review.

LRA Table 3.2.2-1 provides a summary of the results of the aging management review for the Core Spray System.

2.3.2.2 High Pressure Coolant Injection System

2.3.2.2.1 System Description

High Pressure Coolant Injection (HPCI) is provided to maintain reactor vessel water inventory after small breaks that do not depressurize the reactor vessel. The Emergency Core Cooling System (ECCS) provides protection against the postulated LOCA caused by ruptures in the primary system piping. The purpose of High Pressure Coolant Injection is to limit, in conjunction with the primary and secondary containments, the release of radioactive materials to the environs following a LOCA. This system is normally aligned for standby operation, such that it is immediately available if required.

The High Pressure Coolant Injection System is designed to pump water into the reactor pressure vessel over a wide range of pressures. High Pressure Coolant Injection consists of a steam-driven turbine that drives constant flow pumps, and associated system piping, valves, controls and instrumentation. Steam is supplied to the turbine from a tap on the “B” main steam line. Steam from the turbine is exhausted to the suppression pool. The pump is designed to pump water at high pressure from the suppression pool or condensate storage tank to the reactor through a connection on the feedwater supply pipe. The coolant is distributed inside the reactor pressure vessel through the feedwater spargers, which causes mixing with the hot water or steam in the reactor pressure vessel. The normal suction for the High Pressure Coolant Injection pump is the condensate storage tank.

Steam from the reactor drives the High Pressure Coolant Injection turbine. Decay heat and residual heat generated steam which is extracted from a main steam header upstream of the main steam line isolation valves. The two High Pressure Coolant Injection isolation valves in the steam line to the High Pressure Coolant Injection turbine are normally open to keep piping to the turbine at elevated temperatures and to permit rapid startup of High Pressure Coolant Injection. To prevent the High Pressure Coolant Injection steam supply line from filling with water, a condensate drain pot is provided upstream of the turbine stop valve. The drain pot normally routes condensate to the main condenser, but on a receipt of a High Pressure Coolant Injection initiation signal or loss of control air pressure, isolation valves on the condensate line shut automatically.

The High Pressure Coolant Injection turbine gland seals are vented to the High Pressure Coolant Injection barometric condenser. Part of the water from the High Pressure Coolant Injection booster pump is routed through the condenser for cooling purposes. Non-condensable gases from the barometric condenser are exhausted through the Standby Gas Treatment System.

2.3.2.2.2 System Functions

The High Pressure Coolant Injection System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Environmental Qualification (10 CFR 50.49)
    - Station Blackout (10 CFR 50.63)

2.3.2.2.3 UFSAR Reference

Additional High Pressure Coolant Injection System details are provided in Sections 5.4 and 6.3 of the Duane Arnold UFSAR.

2.3.2.2.4 License Renewal Drawings

The license renewal drawings for the High Pressure Coolant Injection System are listed below:

BECH-M109-LR	BECH-M114-LR	BECH-M119-LR
BECH-M122-LR	BECH-M123-LR	BECH-M160(1)-LR

2.3.2.2.5 Components Subject to an Aging Management Review

LRA Table 2.3.2-2 lists the component groups and intended functions of the High Pressure Coolant Injection System that require aging management review.

LRA Table 3.2.2-2 provides a summary of the results of the aging management review for the High Pressure Coolant Injection System.

2.3.2.3 Primary Containment

2.3.2.3.1 System Description

The Primary Containment includes the following systems:

Primary Containment

The Primary Containment is a Mark I containment system, employing a drywell and a separate pressure suppression chamber. The drywell houses the reactor vessel, the reactor recirculation loops, and branch connections of the Reactor Coolant System that have isolation valves at the primary containment boundary. The pressure suppression chamber (torus) consists of an air volume and a suppression water volume. The drywell and torus are connected through a vent system which directs flow from the drywell into the suppression water of the torus through submerged downcomers. Primary Containment is in the scope of license renewal.

Drywell Radiation Monitors

This system monitors the radiation levels in the drywell and torus. The system consists of radioactive particulate, halogen, and noble gas monitors and provides indication in the control room. These analyzers are not designed for post-accident radioactivity levels, therefore, cannot be used for monitoring post-accident activity. However, grab samples can be obtained from sample points at the analyzers. The Drywell Radiation Monitors are not in the scope of license renewal.

High range containment radiation monitors have been installed in response to NUREG-0737, Section II.F.1.3. They consist of four physically separated monitors designed and qualified to function in an accident environment and with a maximum range of 10E7 rad/hr.

Traversing Incore Probe System

Traversing Incore Probe (TIP) system is a subsystem of the Nuclear Monitoring System. This system, which is not safety related, allows the calibration of the local power range monitors by correlating traversing incore probe signals to local power range monitor signals.

A drive mechanism uses an ion chamber (gamma flux detector) attached to a flexible cable, which is driven from outside the primary containment by a gearbox assembly. The flexible cable is contained by guide tubes that continue into the reactor core. The guide tubes are provided with an isolation valve that closes automatically on receipt of an isolation signal and after the cable and fission chamber have been retracted. In series with the isolation valve is a shear valve that ensures the integrity of the primary containment should the cable and probe fail to retract. The TIP system is in the scope of license renewal.

Drywell Access Control

One double door airlock is provided for access to the drywell and to provide containment isolation during the process of personnel entering and exiting the drywell. The airlock limits the release of radioactive material to the environment during normal operation, transients, and design basis accidents. Drywell Access Control is in the scope of license renewal.

2.3.2.3.2 System Functions

The Primary Containment is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Environmental Qualification (10 CFR 50.49)
  - Anticipated Transients Without Scram (10 CFR 50.62)
  - Station Blackout (10 CFR 50.63)

2.3.2.3.3 UFSAR Reference

Additional Primary Containment details are provided in Sections 6.2, 7.6, and 12.3 of the Duane Arnold UFSAR.

2.3.2.3.4 License Renewal Drawings

The license renewal drawings for the Primary Containment are listed below:

BECH-M115-LR　BECH-M143(2)-LR　BECH-M143(4)-LR

BECH-M181-LR　BECH-M186-LR

2.3.2.3.5 Components Subject to an Aging Management Review

LRA Table 2.3.2-3 lists the component groups and intended functions of the Primary Containment that require aging management review.

LRA Table 3.2.2-3 provides a summary of the results of the aging management review for the Primary Containment.

2.3.2.4 Reactor Core Isolation Cooling System

2.3.2.4.1 System Description

Reactor Core Isolation Cooling (RCIC) System provides core cooling during reactor isolation by pumping makeup water into the reactor vessel to prevent low water level.

Core cooling during reactor isolation is not a safety function for the Reactor Core Isolation Cooling System because the Emergency Core Cooling Systems provide the safety related means of cooling during design basis events.

Reactor Core Isolation Cooling consists of a steam turbine-driven pump unit and associated valves and piping capable of delivering makeup water to the reactor vessel. Steam from the main steam header powers the Reactor Core Isolation Cooling turbine-driven pump assembly. The Reactor Core Isolation Cooling turbine exhausts to the suppression pool.

The Reactor Core Isolation Cooling pump suction is normally aligned to the condensate storage tank. A backup supply is available from the suppression pool. The Reactor Core Isolation Cooling pump discharges to either the feedwater line for injection into the reactor vessel or a full-flow test line. The Reactor Core Isolation Cooling pump discharge also provides cooling water for the barometric condenser and to the Reactor Core Isolation Cooling turbine lube oil cooler.

2.3.2.4.2 System Functions

The Reactor Core Isolation Cooling System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)3)):
    - Fire Protection (10 CFR 50.48)
    - Environmental Qualification (10 CFR 50.49)
    - Station Blackout (10 CFR 50.63)

2.3.2.4.3 UFSAR Reference

Additional Reactor Core Isolation Cooling System details are provided in Section 5.4 of the UFSAR.

2.3.2.4.4 License Renewal Drawings

The license renewal drawings for Reactor Core Isolation Cooling System are listed below:

BECH-M109-LR	BECH-M114-LR	BECH-M122-LR
BECH-M123-LR	BECH-M124-LR	BECH-M125-LR

2.3.2.4.5 Components Subject to an Aging Management Review

LRA Table 2.3.2-4 lists the component groups and intended functions of the Reactor Core Isolation Cooling System that require aging management review.

LRA Table 3.2.2-4 provides a summary of the results of the aging management review for the Reactor Core Isolation Cooling System.

2.3.2.5 Residual Heat Removal System

2.3.2.5.1 System Description

The purpose of Residual Heat Removal System, in conjunction with Core Spray System and RHR Service Water System, is to restore and maintain the coolant inventory in the reactor vessel so that the core is adequately cooled after a loss of coolant accident (LOCA) and to provide core cooling during a normal shutdown. Residual Heat Removal provides spray cooling for the primary containment in the event of a LOCA to limit containment temperature and pressure by condensing steam released in the containment.

Residual Heat Removal is a two-loop system containing two heat exchangers and four residual heat removal pumps. The loops are physically separated from each other. A single header cross connects the two loops, making it possible to supply either loop from the pumps in the other loop. RHR Service Water provides cooling for the residual heat removal heat exchangers.

A spool piece is permanently installed on the shutdown cooling piping for making connection to the fuel pool system so that Residual Heat Removal can provide assistance to cooling the fuel pool. The boundary is maintained by two locked closed valves.

The system discharge piping is kept in a filled condition by its keep-fill pump to minimize time delay in Low Pressure Coolant Injection actuation and to avoid water hammer on pump starts.

The Residual Heat Removal System has four major modes of operation:

- Low Pressure Coolant Injection
- Containment spray
- Suppression pool cooling
- Shutdown cooling

The Residual Heat Removal System also has four minor modes of operation:

- Fuel pool cooling
- Reactor or containment flood with RHR Service Water
- Reactor vessel draining
- Suppression pool draining

Residual Heat Removal is normally lined up for automatic actuation in the low pressure coolant injection mode. The following describes each of the modes of operation of Residual Heat Removal.

<u>Low Pressure Coolant Injection</u>

In the Low Pressure Coolant Injection mode, Residual Heat Removal operates in combination with Core Spray, to restore and maintain the coolant inventory in the reactor vessel after a LOCA, so that the core is sufficiently cooled to preclude excessive fuel clad temperatures and subsequent release due to metal water reaction.

During Low Pressure Coolant Injection operation, Residual Heat Removal pumps take suction from the suppression pool and discharge into the reactor pressure vessel core region through either recirculation loop. A minimum flow bypass to the suppression pool is provided so that the pumps are not damaged if operating with the discharge valves shut. Flow through a break is contained by the drywell and returned to the suppression chamber via the pressure suppression vent lines.

Containment Spray (Drywell Spray and Suppression Pool Spray)

The containment spray mode is initiated manually after the reactor water level has been restored. In the containment spray mode of operation, the Residual Heat Removal pumps transfer water from the suppression chamber through the Residual Heat Removal heat exchangers and the corresponding heat exchanger bypass line, where the RHR Service Water removes heat. The cool water is diverted to two redundant spray headers in the drywell and one above the suppression pool to condense steam and cool non-condensable gases to prevent excessive containment temperature and pressure.

Suppression Pool Cooling

The suppression pool cooling mode takes suction from the suppression pool, passes it through the Residual Heat Removal heat exchangers, and returns flow to the suppression pool through the full flow test line. This mode is manually initiated to limit the water temperature in the suppression pool, so that immediately following a LOCA, the temperature does not exceed 170^{o}F.

Shutdown Cooling

The shutdown cooling mode is used during normal shutdown and cooldown. The initial phase of Reactor Coolant System cooldown is accomplished by dumping steam from the reactor pressure vessel to the main condenser, with the main condenser acting as the heat sink. When insufficient steam is available to maintain a vacuum in the condenser, reactor cooldown is completed by pumping reactor coolant with the Residual Heat Removal pumps from one of the recirculation loops through the Residual Heat Removal heat exchangers, which transfer heat to RHR Service Water. The cooled reactor coolant is returned to the reactor vessel through the recirculation loop discharge piping. While the reactor is shutdown, the shutdown cooling mode is used to remove decay heat.

Fuel Pool Cooling

If additional or backup fuel pool cooling is needed, Residual Heat Removal may be cross-connected with Fuel Pool Cooling and Cleanup. This may be required to maintain fuel storage temperature below the design limit of 150^{o}F after a full core off-load of fuel from the reactor. The fuel pool cooling mode takes suction from Fuel Pool Cooling and Cleanup, flows through the Residual Heat Removal heat exchangers, and discharges back to Fuel Pool Cooling and Cleanup.

Reactor or Containment Flood with RHR Service Water

The emergency reactor vessel fill mode of Residual Heat Removal provides a cross-tie between the RHR Service Water and Residual Heat Removal piping. The RHR Service Water pumps take suction from the RHR Service Water / Emergency Service Water pits and inject into the reactor pressure vessel through the Residual Heat Removal piping. This mode of operation provides a source of water to maintain the reactor core covered (and fill containment) in the event that emergency core cooling systems pumps are unavailable.

Reactor Vessel Draining and Suppression Pool Draining

These modes of operation are used to facilitate maintenance and have no design basis safety function.

2.3.2.5.2 System Functions

The Residual Heat Removal System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Environmental Qualification (10 CFR 50.49)
  - Anticipated Transients Without Scram (10 CFR 50.62)
  - Station Blackout (10 CFR 50.63)

2.3.2.5.3 UFSAR Reference

Additional Residual Heat Removal System details are provided in Section 6.3 of the Duane Arnold UFSAR.

2.3.2.5.4 License Renewal Drawings

The license renewal drawings for the Residual Heat Removal System are listed below:

BECH-M113-LR BECH-M119-LR BECH-M120-LR
BECH-M122-LR BECH-M143<3>-LR

2.3.2.5.5 Components Subject to an Aging Management Review

LRA Table 2.3.2-5 lists the component groups and intended functions of the Residual Heat Removal System that require aging management review.

LRA Table 3.2.2-5 provides a summary of the results of the aging management review for the Residual Heat Removal System.

2.3.2.6 Standby Gas Treatment System

2.3.2.6.1 System Description

The Standby Gas Treatment System is a subsystem of the secondary containment and consists of two identical parallel air filtration assemblies. With the reactor building isolated, each train can hold the building at a sub-atmospheric pressure of 0.25 in. of water.

The Standby Gas Treatment System limits the release of airborne radioactivity to the environs so that offsite doses from a postulated design basis accident will be below the guideline values of 10 CFR 50.67 and RG 1.183 [References 2.3-1 and 2.3-2, respectively]. The Standby Gas Treatment System operates in conjunction with the reactor building, (secondary containment); the Reactor Building Ventilation System (isolation of ventilation penetrations); and the Offgas Exhaust System (airborne activity release at an elevated point). The Standby Gas Treatment System is comprised of redundant filter trains, with common suction ductwork and a common discharge pipe to the offgas vent stack.

2.3.2.6.2 System Functions

The Standby Gas Treatment System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Environmental Qualification (10 CFR 50.49)

2.3.2.6.3 UFSAR Reference

Additional Standby Gas Treatment System details are provided in Subsection 6.5.3 of the Duane Arnold UFSAR.

2.3.2.6.4 License Renewal Drawings

The license renewal drawings for the Standby Gas Treatment System are listed below:

BECH-M122-LR	BECH-M124-LR	BECH-M143(1)-LR
BECH-M158-LR	BECH-M164-LR	BECH-M165-LR
BECH-M172-LR	BECH-M176(1)-LR	BECH-M176(2)-LR
BECH-M182-LR		

2.3.2.6.5 Components Subject to an Aging Management Review

LRA Table 2.3.2-6 lists the component groups and intended functions of the Standby Gas Treatment System that require aging management review.

LRA Table 3.2.2-6 provides a summary of the results of the aging management review for the Standby Gas Treatment System.

Table 2.3.2-1
Core Spray System

Component Groups	Intended Function
Fasteners	Pressure boundary
Filters	Filter
Flow element	Pressure boundary Throttle
Flow orifice	Pressure boundary Throttle
Pressure vessel	Pressure boundary
Piping	Leakage boundary (spatial) Pressure boundary Structural integrity (attached) Throttle
Pump casings	Pressure boundary
Valve body	Pressure boundary Structural integrity (attached)

Table 2.3.2-2
High Pressure Coolant Injection System

Component Groups	Intended Function
Blower	Structural integrity (attached)
Fasteners	Pressure boundary
Filters	Filter Pressure boundary
Flow gauge (sightglass)	Pressure boundary
Heat exchanger	Pressure boundary Heat transfer
Level gauge	Leakage boundary (spatial)
Piping	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)
Pump casings	Pressure boundary
Thermowell	Pressure boundary
Turbine	Pressure boundary
Valve body	Pressure boundary Structural integrity (attached)

Table 2.3.2-3
Primary Containment

Component Groups	Intended Function
Fasteners	Pressure boundary
Instrumentation (Level element)	Pressure boundary
Piping	Pressure boundary Structural integrity (attached)
Valve body	Pressure boundary

Table 2.3.2-4
Reactor Core Isolation Cooling System

Component Groups	Intended Function
Blower	Structural integrity (attached)
Fasteners	Pressure boundary
Filters	Filter Pressure boundary
Heat exchanger	Heat transfer Leakage boundary (spatial) Pressure boundary
Flow gauge	Pressure boundary
Piping	Pressure boundary Structural integrity (attached) Throttle
Pump casings	Pressure boundary
Turbine	Pressure boundary
Valve body	Pressure boundary Structural integrity (attached)

Table 2.3.2-5
Residual Heat Removal System

Component Groups	Intended Function
Fasteners	Pressure boundary
Filters	Filter
Heat exchanger	Heat transfer Pressure boundary
Pressure vessel	Pressure boundary
Piping	Leakage boundary (spatial) Pressure boundary
Pump casings	Pressure boundary
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.2-6
Standby Gas Treatment System

Component Groups	Intended Function
Drip pans	Leakage boundary (spatial)
Ductwork	Pressure boundary
Fasteners	Pressure boundary
Filters	Filter
Instrumentation (Flow element)	Pressure boundary
Piping	Leakage boundary (spatial) Pressure boundary
Valve body	Pressure boundary

2.3.3 AUXILIARY SYSTEMS

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

The following systems are addressed in this subsection:

- Auxiliary Heating Boiler
- Building Sumps
- Chlorination and Acid Feed System
- Circulating Water System
- Containment Atmospheric Control System
- Control Building Heating, Ventilation, and Air Conditioning
- Control Rod Drive System
- Drywell Sumps
- Electrical Manhole Sump Pump
- Emergency Service Water System
- Fire Protection System
- Fuel Pool Cooling and Cleanup System
- General Service Water System
- Hydrogen Water Chemistry System
- Instrument Air System
- Intake and Traveling Screens
- Offgas Exhaust System
- Plant Ventilation
- Post Accident Sampling System
- Primary Containment Heating, Ventilation, and Air Conditioning
- Reactor Building and Radwaste Building Sampling System
- Reactor Building Closed Cooling Water System
- Reactor Building Heating, Ventilation, and Air Conditioning
- Reactor Water Cleanup System
- RHR Service Water System
- River Water Supply System
- Safety Related Air System
- Solid Radwaste

- Standby Diesel Generators
- Standby Liquid Control System
- Turbine Building Sampling System
- Well Water System
- Zinc Injection System

2.3.3.1 Auxiliary Heating Boiler

2.3.3.1.1 System Description

The plant heating boiler system operates as a standby for the plant heating system when the plant is operating and the feedwater heater drains are used as the primary heat source. The system is used to provide heat whenever the plant is shut down during cold weather.

Removable spool pieces are provided for temporary connection of the plant heating steam to the High Pressure Coolant Injection and Reactor Core Isolation Cooling Systems. Blind flanges are provided to isolate the systems when the spool pieces are not in use. There is no permanent connection from the plant heating boiler system to any safety-related equipment.

2.3.3.1.2 System Functions

The Auxiliary Heating Boiler is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

2.3.3.1.3 UFSAR Reference

Additional Auxiliary Heating Boiler details are provided in Section 9.5.9 of the Duane Arnold UFSAR.

2.3.3.1.4 License Renewal Drawings

The license renewal drawings for the Auxiliary Heating Boiler are listed below:

BECH-M104(1)-LR	BECH-M110-LR	BECH-M124-LR
BECH-M143(4)-LR	BECH-M160(1)-LR	

2.3.3.1.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-1 lists the components and commodity groups of the Auxiliary Heating Boiler that require aging management review, including their intended function(s).

LRA Table 3.3.2-1 provides a summary of the results of the Aging Management Review for the Auxiliary Heating Boiler.

2.3.3.2 Building Sumps

2.3.3.2.1 System Description

Administration Building Sumps

The administration building chemical drain sump pumps discharge to the chemical waste tank located in the reactor building. The administration building detergent drain sump pumps discharge to the detergent drain tank located in the radwaste building.

Floor and Equipment Drains

The floor and equipment drain piping and components have been evaluated with their associated building sumps.

Offgas Building Sumps

The offgas retention building equipment drain sump and the offgas floor drain sump collect water from sources within the offgas retention building and the sump pumps transfer the water to the radwaste system. The offgas stack sump collects water from the offgas stack and the sump pumps transfer the water to the radwaste system.

Radwaste Building Sumps

The radwaste building radioactive equipment and floor drainage system begins with funnel drains and floor drains. Drainage collects in branch lines, and drains by gravity to the radwaste building equipment and floor drain sumps. Sump pumps transfer wastes from the pumps to the Radwaste System.

Reactor Building Sumps

The reactor building radioactive equipment and floor drains are collected in two separate systems. One handles drainage from equipment and floor drains located in the primary containment, and the other handles drainage from equipment and floor drains located in the secondary containment. Sump pumps transfer wastes from the sumps to the Radwaste System.

Leakage from the spent fuel pool is channeled into one or more drain pipe lines to monitor leakage. The drains are routed to the reactor building floor drain sump through a common trough.

Turbine Building Sumps

The turbine building radioactive equipment and floor drains are collected in the turbine building equipment and floor drain sumps. Sump pumps transfer the waste to the Radwaste System.

The turbine building non-radioactive equipment and floor drains are collected in the non-radioactive waste water sump. The waste water is pumped to the storm drains.

Diesel generator floor drains are isolated by manual valves from the turbine building non-radwaste sumps to prevent water backup into the diesel generator rooms from site flooding conditions.

2.3.3.2.2 System Functions

The Building Sumps are in scope for license renewal because they contain:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)

2.3.3.2.3 UFSAR Reference

Additional Building Sumps details are provided in Section 9.3.3 of the Duane Arnold UFSAR.

2.3.3.2.4 License Renewal Drawings

The license renewal drawings for the Building Sumps are listed below:

BECH-M-110-LR	BECH-M112-LR	BECH-M119-LR
BECH-M137(1)-LR	BECH-M137(2)-LR	BECH-M138(1)-LR
BECH-M139-LR	BECH-M141-LR	

2.3.3.2.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-2 lists the components and commodity groups of the Building Sumps that require aging management review, including their intended function(s).

LRA Table 3.3.2-2 provides a summary of the results of the aging management review for the Building Sumps.

2.3.3.3 Chlorination and Acid Feed System

2.3.3.3.1 System Description

The Chlorination and Acid Feed System provides the means to add chemicals to Circulating Water. Sulfuric acid, corrosion inhibitor, surfactant, and silt dispersant are added to the circulating water pit. Sodium hypochlorite is added to the discharge of the circulating water and general service water pumps.

The chlorination system is also used to treat the RHR Service Water and Emergency Service Water Systems to prevent biological growth, corrosion, and fouling.

The copper ion injection system is included in the Chlorination and Acid Feed System. The copper ion injection system is installed at the intake structure and prevents growth of Bryozoa in underground piping and downstream components. The copper is toxic to Bryozoa and other marine organisms, such as algae and mussels.

2.3.3.3.2 System Functions

The Chlorination and Acid Feed System is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

2.3.3.3.3 UFSAR Reference

The Chlorination and Acid Feed System is discussed in Sections 9.2.4.2 and 10.4.5.2 of the Duane Arnold UFSAR.

2.3.3.3.4 License Renewal Drawings

The license renewal drawings for the Chlorination and Acid Feed System are listed below:

BECH-M129-LR	BECH-M142-LR	BECH-M144(1)-LR
BECH-M146-LR	BECH-M180-LR	

2.3.3.3.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-3 lists the components and commodity groups of the Chlorination and Acid Feed System that require aging management review, including their intended function(s).

LRA Table 3.3.2-3 provides a summary of the results of the aging management review for the Chlorination and Acid Feed System.

2.3.3.4 Circulating Water System

2.3.3.4.1 System Description

The Circulating Water System provides water from the circulating water pump pit to the main condenser to absorb heat from the main turbine exhaust. The Circulating Water System is a closed loop system with two motor-driven pumps circulating water through the main condenser and two induced-draft cooling towers. The pumps take suction from a sump which is gravity-fed from the cooling tower basins. The flowpaths through the low pressure and high pressure condensers are designated the inner loop and the outer loop. The heated water leaves the condenser and moves to the cooling towers to transfer heat to the environment. The tower-cooled water is gravity fed to the circulating water pump pit. During normal operation, both circulating water pumps and both cooling towers are in service.

2.3.3.4.2 System Functions

The Circulating Water System is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)

2.3.3.4.3 UFSAR Reference

Additional Circulating Water System details are provided in Section 10.4.5 of the Duane Arnold UFSAR.

2.3.3.4.4 License Renewal Drawings

The license renewal drawings for the Circulating Water System are listed below:

BECH-M142-LR BECH-M180-LR

2.3.3.4.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-4 lists the components and commodity groups of the Circulating Water System that require aging management review, including their intended function(s).

LRA Table 3.3.2-4 provides a summary of the results of the aging management review for the Circulating Water System.

2.3.3.5 Containment Atmosphere Control System

2.3.3.5.1 System Description

The Containment Atmosphere Control System consists of the following subsystems:

Containment Atmosphere Dilution System

Containment Atmosphere Dilution is the principal combustible gas control system. It consists of ten nitrogen cylinders and associated valves, instrumentation, and piping. The cylinders contain sufficient volume to ensure that following a LOCA, Containment Atmosphere Dilution can supply nitrogen for seven days, after which offsite nitrogen would be available. Following a LOCA, system operation is manually initiated when containment oxygen level approaches 5% by volume. Nitrogen is purged through the containment spray headers to dilute oxygen concentration to less than 4% by volume. Containment Atmosphere Dilution System is in the scope of license renewal.

Containment Atmosphere Monitoring System

Containment Atmosphere Monitoring consists of two separate redundant systems or loops which each contain a hydrogen-oxygen analyzer, a radioactivity monitor, and associated valves and piping. Each loop is capable of sampling from one of three locations, two drywell points and one torus point. The system analyzer panels are located in the Reactor Building with remote indication and control provided in the Control Room. During normal operation, both hydrogen and oxygen monitor loops are in standby subject to monthly testing. A separate oxygen monitor provides continuous monitoring of containment oxygen concentrations. Hydrogen and oxygen concentrations are recorded and displayed on dual scale meters. Containment Atmosphere Monitoring System is in the scope of license renewal.

Primary Containment Purge and Vent

Primary Containment Purge and Vent provides the means to introduce air to and exhaust from the drywell and suppression chamber. Reactor Building air is supplied to the containment from a 6000 scfm fan for purge purposes and to permit personnel access and occupancy. The exhaust is routed to Standby Gas Treatment. The containment can also be vented during heatup or following a LOCA to keep pressure within limits. Venting also provides a backup means of combustible gas control. The system has quick acting, butterfly type isolation valves with inflatable T-ring seals to minimize leakage. A hardened wetwell vent is provided to control containment pressure during a sustained loss of decay heat removal. Primary Containment Purge and Vent components are in the scope of license renewal.

Nitrogen Inerting System

The Nitrogen Inerting System provides the ability to introduce gaseous nitrogen into the containment to reduce oxygen concentration to less than 4% prior to normal operation. Nitrogen from the liquid nitrogen storage tank is vaporized in a purge vaporizer using the Auxiliary Boiler System. The gaseous nitrogen is supplied to the containment through the Containment Purge System. The Nitrogen Inerting System is in the scope of license renewal.

Nitrogen Makeup System

The Nitrogen Makeup receives nitrogen from the liquid nitrogen tank. The nitrogen is vaporized by a self-contained vaporizer that is supplied with the storage tank. The system supplies 90 psig nitrogen to operate the outboard main steam isolation valves, to the auxiliary boiler deareator, and as a backup supply to the nitrogen compressor system. The system supplies 1.75 psig nitrogen to the containment purge line to makeup for containment losses and maintain the inert atmosphere during normal operation. The Nitrogen Makeup System is in the scope of license renewal.

Nitrogen Compressor

The Nitrogen Compressor is used to supply an operating medium to pneumatic valves within the primary containment. The compressor takes a suction on the drywell atmosphere and discharges through a cooler and filters to a 250 gallon accumulator. The accumulator supplies nitrogen for operation of pneumatic valves inside the primary containment. If accumulator pressure decreases to less than 90 psig, backup nitrogen is supplied from the Nitrogen Makeup System. The Nitrogen Compressor is in the scope of license renewal.

Containment Vacuum Breakers

The primary containment is designed for an internal / external differential pressure not to exceed two psid. To ensure that this pressure is not exceeded, there are two groups of vacuum breakers. The torus to drywell group prevents drywell pressure from being significantly less than torus pressure and the reactor building to torus group prevents the torus from being significantly lower than reactor building pressure.

The torus to drywell group consists of seven check valves which are located on the vent header in the suppression chamber air space. These valves are equipped with pneumatic operators to allow for remote testing, and have a counter balance and magnet to assure closure after operation.

The reactor building to torus group consists of two vacuum breaker check valves and two air-operated butterfly valves in series with the check valves. The air-operated valves each have their own accumulator and open on a differential pressure signal. Each vacuum breaker is of adequate size to prevent the containment from exceeding its negative design pressure. The Containment Vacuum Breakers are in the scope of license renewal.

Containment Hardened Wetwell Vent

The Containment Hardened Wetwell Vent is an 8-inch line that connects the torus vent line to the Offgas Exhaust System downstream of the steam packing exhauster that will facilitate the venting of the primary containment when primary containment pressure limit is threatened. The system vents directly to the offgas stack, bypassing Standby Gas Treatment.

The hardpipe vent taps off between the inboard and outboard Containment Vent isolation valves. A rupture disk is installed in-line with the hardened wetwell vent piping. The disk serves two specific purposes: (1) the rupture disk will prevent the opening of a vent path from a primary containment directly to the environment unless the primary containment pressure limit is threatened, and (2) during a design basis accident, the rupture disk will provide a zero leakage barrier between the primary containment and the environment to prevent leakage from bypassing the secondary containment. The Containment Hardened Wetwell Vent is in the scope of license renewal.

2.3.3.5.2 System Functions

The Containment Atmosphere Control System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Environmental Qualification (10 CFR 50.49)
    - Anticipated Transients Without Scram (10 CFR 50.62)
    - Station Blackout (10 CFR 50.63)

2.3.3.5.3 UFSAR Reference

Additional Containment Atmosphere Control System details are provided in Sections 1.8.7, 6.2.1, and 6.2.5 of the Duane Arnold UFSAR.

2.3.3.5.4 License Renewal Drawings

The license renewal drawings for the Containment Atmosphere Control System are listed below:

BECH-M104(1)-LR	BECH-M143(1)-LR	BECH-M143(2)-LR
BECH-M143(3)-LR	BECH-M143(4)-LR	
BECH-M181-LR		

2.3.3.5.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-5 lists the components and commodity groups of the Containment Atmosphere Control System that require aging management review, including their intended function(s).

LRA Table 3.3.2-5 provides a summary of the results of the aging management review for the Containment Atmosphere Control System.

2.3.3.6 Control Building Heating, Ventilation, and Air Conditioning

2.3.3.6.1 System Description

Control Building Heating, Ventilation, and Air Conditioning services the control room, heating, ventilation, and air conditioning equipment room, computer room, cable spreading room, battery room, and the switchgear rooms.

The control room is served by an air conditioning system that also serves the cable spreading room, battery rooms, and essential switchgear rooms. This system normally provides a mixture of outdoor air and recirculated air that is filtered by roughing and medium efficiency filters and is either heated or cooled. During an emergency condition involving the contamination of the outdoor air, the ventilation supply of outside air is drawn through one of two single pass high efficiency filter trains consisting of heating coils, high efficiency particulate absorber (HEPA) filters, charcoal filters, and fans. The control room outside air high efficiency filter trains are Seismic Category I and meet the single failure criterion. This specially filtered air is then mixed with the recirculated air to provide control room ventilation.

The control room air conditioning system has two normal modes of operation controlled from Panel 1C 26. The system can operate in a recirculation mode which will provide 1.2 air changes per hour. The system also has a fresh air (purge) mode which will provide six air changes per hour. The source of intake air is remote from potential contamination.

Fresh air makeup is filtered during normal operation by main inlet filters. Should fission products leaving the main stack reach ground level during a brief atmospheric fumigation, air radiation monitors will isolate the normal ventilation path and initiate high efficiency filtration of incoming outside air.

Two 1000 cfm single pass high efficiency filter trains are provided in parallel with the normal outside air inlet duct. The filter trains each consist of inlet and outlet isolation dampers, a heating coil, high efficiency particulate absorber charcoal filter (2 in. bed, tray type), and final high efficiency particulate absorber filter.

Control room air is recirculated through dust filters and heated or cooled as necessary to maintain comfortable working conditions. Power for the filtration recirculation system may be supplied from the emergency bus. The filtration recirculation system is Seismic Category I and is located in a Seismic Category I structure.

Two types of ductwork systems distribute air from the filter trains. One supply system is connected to the cable spreading room below the control room floor and supplies cooling air directly to the space. The other supply system is for general space cooling and consists of ductwork supplying ceiling diffusers and air flows upward through the central panels, out to the return ductwork system, and back to the filter train. Space air returns to the filter train through a return air system.

When normal plant and offsite power is unavailable, the emergency diesel generators will power system fans and will allow the water chillers to operate so they can maintain the control room at its design temperature described above.

Airborne contamination is monitored to detect gross gamma radiation using a scintillation detector located just inside the inlet plenum. If high radiation is detected, automatic changeover takes place, causing the control room outside air supply to be passed through one of the high efficiency filter trains.

2.3.3.6.2 System Functions

Control Building Heating, Ventilation, and Air Conditioning is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)

2.3.3.6.3 UFSAR Reference

Additional Control Building Heating, Ventilation, and Air Conditioning details are provided in Sections 6.4, 6.5, and 9.4 of the Duane Arnold UFSAR.

2.3.3.6.4 License Renewal Drawings

The license renewal drawings for the Control Building Heating, Ventilation, and Air Conditioning are listed below:

BECH-M161-LR	BECH-M169(1)-LR	BECH-M169(2)-LR
BECH-M169(3)-LR	BECH-M170-LR	BECH-M173-LR

2.3.3.6.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-6 lists the components and commodity groups of Control Building Heating, Ventilation, and Air Conditioning System require aging management review, including their intended function(s).

LRA Table 3.3.2-6 provides a summary of the results of the aging management review for Control Building Heating, Ventilation, and Air Conditioning.

2.3.3.7 Control Rod Drive System

2.3.3.7.1 System Description

The Control Rod Drive mechanical system design provides for a sufficiently rapid control rod insertion so that no fuel damage results from any abnormal operating transient.

Control Rod Drive controls gross changes in core reactivity by incrementally positioning neutron-absorbing control rods within the reactor core, in response to manual control signals. The Control Rod Drive System is also designed to quickly shut down the reactor (scram) in emergency situations by rapidly inserting withdrawn control rods into the core in response to a manual or automatic signal. The Control Rod Drive System consists of locking piston control rod drive mechanisms and the control rod drive hydraulic system (including power supply and regulation, hydraulic control units, interconnecting piping, instrumentation and electrical controls).

The control rod drive mechanism (drive) used for positioning the control rod in the reactor core is a double-acting, mechanically latched, hydraulic cylinder using demineralized water as its operating fluid. The individual drives are mounted on the bottom head of the reactor pressure vessel. The drives are capable of inserting or withdrawing a control rod at a slow, controlled rate, in addition to providing rapid insertion when required.

The control rod drive hydraulic system supplies and controls the pressure and flow to and from the drives. One supply subsystem supplies water to the hydraulic control units (HCU) at the correct flow. Each hydraulic control unit controls the flow to and from a drive. The water discharged from the drives during a scram flows through the hydraulic control units to the scram discharge volume. The water discharged from a drive during a normal control rod positioning operation returns to the reactor vessel through a reverse flow path involving the insert exhaust directional control valves of non-actuated control rod drive hydraulic control units.

The Control Rod Drive System supplies water to the reactor vessel instrumentation reference leg backfill subsystem. This subsystem provides a constant backfill of water from the Control Rod Drive System's drive water header to instrument reference legs to prevent the entrainment of non-condensable gases in the water, which might evolve from solution during a depressurization of the reactor vessel, causing an erroneous reactor vessel level indication.

Should the reactor protection system fail to scram the reactor, an alternate rod injection (ARI) system would actuate. The Alternate Rod Injection System responds to reactor high pressure and reactor low-low water level signals by energizing

SV1863 and SV1864 and venting the scram air header which provides an alternate means of scramming the reactor using the existing Control Rod Drive System.

The Control Rod Drive System is relied upon to rapidly shutdown the reactor in support of the Fire Protection Program and in response to a Station Blackout condition.

The control rods are designed with a velocity limiter as an integral part of the bottom assembly of each control rod. This engineered safeguard protects against a high reactivity insertion rate by limiting the control rod velocity in the event of a control rod drop accident.

2.3.3.7.2 System Functions

The Control Rod Drive System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Anticipated Transients Without Scram (10 CFR 50.62)
    - Station Blackout (10 CFR 50.63)

2.3.3.7.3 UFSAR Reference

Additional Control Rod Drive System details are provided in Sections 3.9.4, 4.6.1, 7.2.3, and 15.3.1 of the Duane Arnold UFSAR.

2.3.3.7.4 License Renewal Drawings

The license renewal drawings for the Control Rod Drive System are listed below:

BECH-M109-LR	BECH-M114-LR	BECH-M115-LR
BECH-M117-LR	BECH-M118-LR	

2.3.3.7.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-7 lists the components and commodity groups of the Control Rod Drive System that require aging management review, including their intended function(s).

LRA Table 3.3.2-7 provides a summary of the results of the aging management review for the Control Rod Drive System.

2.3.3.8 Drywell Sumps

2.3.3.8.1 System Description

The Drywell Sump System monitors leakage collected in the floor drain and equipment drain sumps. Unidentified leakage is collected in the floor drain sump and consists of leakage from control rod drives, valve flanges or packing, floor drains, closed cooling water system, drywell air cooling unit condensate drains, and any leakage not collected in the drywell equipment drain sump. Identified leakage is collected in the equipment drain sump and consists of leakage from various expected leakage sources.

2.3.3.8.2 System Functions

The Drywell Sumps are in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Environmental Qualification (10 CFR 50.49)
  - Anticipated Transients Without Scram (10 CFR 50.62)
  - Station Blackout (10 CFR 50.63)

2.3.3.8.3 UFSAR Reference

Additional Drywell Sumps details are provided in Section 9.2.1.3 of the Duane Arnold UFSAR.

2.3.3.8.4 License Renewal Drawings

The license renewal drawings for the Drywell Sumps are listed below:

BECH-M112-LR BECH-M137(1)-LR BECH-M138(1)-LR
BECH-M139(1)-LR

2.3.3.8.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-8 lists the components and commodity groups of the Drywell Sumps that require aging management review, including their intended function(s).

LRA Table 3.3.2-8 provides a summary of the results of the aging management review for the Drywell Sumps.

2.3.3.9 Electrical Manhole Sump Pump

2.3.3.9.1 System Description

The electrical manhole sump pumps remove excess water from the manhole sumps. Water is pumped from each manhole to the ground outside the manhole.

2.3.3.9.2 System Functions

The Electrical Manhole Sump Pump is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2)).

2.3.3.9.3 UFSAR Reference

The Electrical Manhole Sump Pump is not included in the Duane Arnold UFSAR.

2.3.3.9.4 License Renewal Drawings

There are no license renewal drawings for the Electrical Manhole Sump Pump.

2.3.3.9.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-9 lists the components and commodity groups of the Electrical Manhole Sump Pump that require aging management review, including their intended function(s).

LRA Table 3.3.2-9 provides a summary of the results of the aging management review for the Electrical Manhole Sump Pump.

2.3.3.10 Emergency Service Water System

2.3.3.10.1 System Description

Emergency Service Water System uses Cedar River water to provide coolant for all emergency equipment except the residual heat removal heat exchangers. The system consists of two independent and redundant trains, each supplied by one emergency service water pump taking suction from the RHR service water/emergency service water pits. Except for the emergency diesel generators, the emergency service water trains discharge to Circulating Water. Emergency service water to the emergency diesel generators is discharged directly to the river through the storm sewers.

Emergency Service Water supplies the following components: emergency diesel generators, residual heat removal pump seal coolers, residual heat removal and core spray pump room cooling units, high pressure coolant injection room cooling units, reactor core isolation cooling room cooling units, control building chillers, core spray pump motor bearing coolers, RHR service water pump motor coolers, and heating and ventilation instrument air compressors.

2.3.3.10.2 System Functions

The Emergency Service Water System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)).
    - Fire Protection (10 CFR 50.48)
    - Anticipated Transients Without Scram (10 CFR 50.62)
    - Station Blackout (10 CFR 50.63)

2.3.3.10.3 UFSAR Reference

Additional Emergency Service Water System details are provided in Section 9.2.3 of the Duane Arnold UFSAR.

2.3.3.10.4 License Renewal Drawings

The license renewal drawings for the Emergency Service Water System are listed below:

BECH-M113-LR	BECH-M119-LR	BECH-M120-LR
BECH-M121-LR	BECH-M146-LR	BECH-M169(2)-LR
BECH-M169(3)-LR	BECH-M171-LR	BECH-M173-LR

2.3.3.10.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-10 lists the components and commodity groups of the Emergency Service Water System that require aging management review, including their intended function(s).

LRA Table 3.3.2-10 provides a summary of the results of the aging management review for the Emergency Service Water System.

2.3.3.11 Fire Protection System

2.3.3.11.1 System Description

The Fire Protection System includes a fire loop header underground and distribution piping supplied by water from one diesel-driven and one motor-driven fire pump. The system has pressure maintained by a jockey pump.

Fire protection water is normally taken from the circulating water pit. The fire protection water and well water systems are cross connected so that when the circulating water pit is drained for maintenance, the fire protection system can be supplied water from the well water system. The general service water system can be cross connected to the fire protection system when the circulating water pit is in service. The jockey pump is supplied water from the well water system. Well water and general service water can be used as a compensatory measure for an inoperable fire suppression water supply and is not designed to automatically supply the required flow of water to the fire suppression system. An underground ring header, around the entire plant, supplies water to yard fire hydrants, hose standpipe stations in the buildings, and sprinkler and deluge systems. An interior fire main is routed through the low level radwaste processing and storage facility.

Manually operated fire protection equipment in the plant consists of fire hose stations and portable fire extinguishers.

Sprinkler, deluge and preaction systems have been provided to cover specific and area hazards.

An automatic total flooding low-pressure carbon dioxide system protects the cable spreading room. Automatic actuation of the system is by rate compensating detectors; the storage tank has sufficient capacity to inject additional carbon dioxide into the room. The actuation of the second discharge is by manual means. The power for the system is an uninterruptible 48-VDC system.

Several fire detection and signaling systems are provided that transmit alarm and supervisory signals to the control room or at a security alarm station. Supervisory signals are provided to indicate the locations of the affected areas or units. Fire and smoke detection systems generally do have backup power supplies. Fire detection systems for the charcoal filters and safety related areas are equipped with backup power supplies.

Fire detectors installed include fixed temperature, thermistor sensor, infrared, rate compensating, smoke, line type, and rate-of-rise.

The main control unit of the Pyr-A-Larm fire detection system is a Pyr-A-Larm Fire Indicating Unit module connected to a non-essential AC power source. A Pyr-A-Larm emergency power supply module has been added to the system to provide continued detection capability following a loss of offsite power. The Pyr-A-Larm system is installed in most areas of the reactor and control buildings and other selected areas of the plant.

A Pyrotronics MXL system is installed in the plant. The MXL system covers the low level radwaste processing and storage facility building, some office areas, the control room ceiling, control room panels, control room computer room, control building heating, ventilation, and air conditioning room, and other selected areas of the plant.

Fire areas are generally enclosed by floors, walls, and ceilings that have a 3-hour rating. Areas not having a 3-hour rating are acceptable on the basis of evaluation of the barrier. Structural steel supporting or forming area fire barriers that is expected to exceed 1100°F in a design-basis fire has been fireproofed. Fire barriers such as walls, floors, and ceilings are penetrated by ventilation ducts, electrical raceways, mechanical piping systems, and doors. Fire barrier penetration assemblies are designed to be sufficient for the hazard.

A Halon suppression system is provided in the plant computer room for property protection.

2.3.3.11.2 System Functions

The Fire Protection System is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Station Blackout (10 CFR 50.63)

2.3.3.11.3 UFSAR Reference

Additional Fire Protection System details are provided in Section 9.5.1 of the Duane Arnold UFSAR.

2.3.3.11.4 License Renewal Drawings

The license renewal drawings for the Fire Protection System are listed below:

BECH-M133(1)-LR	BECH-M133(2)-LR	BECH-M133(3)-LR
BECH-M133(4)-LR	BECH-M133(5)-LR	BECH-M151-LR
BECH-M152-LR	BECH-M153-LR	BECH-M155-LR
BECH-M159-LR	BECH-M161-LR	BECH-M175-LR
BECH-M177-LR	BECH-M185-LR	

2.3.3.11.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-11 lists the components and commodity groups of the Fire Protection System that require aging management review, including their intended function(s).

LRA Table 3.3.2-11 provides a summary of the results of the aging management review for the Fire Protection System.

2.3.3.12 Fuel Pool Cooling and Cleanup System

2.3.3.12.1 System Description

The Fuel Pool Cooling and Cleanup System maintains fuel pool water temperature at a level that will prevent damage to the fuel elements. The system removes the decay heat from the fuel assemblies and maintains fuel pool water temperature for spent fuel storage and refueling operations and prevents damage to the fuel elements caused by overheating.

Fuel Pool Cooling And Cleanup minimizes corrosion product buildup and controls water clarity, minimizes fission product concentration in the water that could be released from the pool to the reactor building environment, and monitors fuel pool water level and maintains a water level above the fuel sufficient to provide shielding for normal building occupancy.

Fuel Pool Cooling And Cleanup cools the fuel storage pool by transferring the spent fuel decay heat through a heat exchanger to Reactor Building Closed Cooling Water. A system cross-tie allows well water to augment the general service water cooling for the Reactor Building Closed Cooling Water system during General Service Water out-of-service windows during refuel outages. Water purity and clarity in the storage pool, reactor well, and dryer-separator storage pit are maintained by filtering and demineralizing the pool water through a filter-demineralizer.

2.3.3.12.2 System Functions

The Fuel Pool Cooling and Cleanup System is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)

2.3.3.12.3 UFSAR Reference

Additional Fuel Pool Cooling and Cleanup System details are provided in Section 9.1.3 of the Duane Arnold UFSAR.

2.3.3.12.4 License Renewal Drawings

The license renewal drawings for the Fuel Pool Cooling and Cleanup System are listed below:

BECH-M109-LR	BECH-M119-LR	BECH-M128-LR
BECH-M134-LR	BECH-M135-LR	BECH-M136-LR
BECH-M137(1)-LR	BECH-M138(1)-LR	BECH-M139-LR
BECH-M140-LR		

2.3.3.12.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-12 lists the components and commodity groups of the Fuel Pool Cooling and Cleanup System that require aging management review, including their intended function(s).

LRA Table 3.3.2-12 provides a summary of the results of the aging management review for the Fuel Pool Cooling and Cleanup System.

2.3.3.13 General Service Water System

2.3.3.13.1 System Description

The General Service Water System provides water to meet cooling requirements of the Reactor Building Closed Cooling Water and equipment in the turbine building. General Service Water is supplied from circulating water system pit.

Three general service water pumps are located in the service water system pumphouse take suction from the same wet-pit as the circulating water pumps. Normally, two pumps are operating with the third pump in standby. The pumps discharge to a common header for distribution to plant equipment. The outlets of the plant equipment is combined and returned to the circulating water wet-pit after being cooled by passage through the cooling towers.

General Service Water provides cooling to the following equipment: isophase bus duct cooler, generator hydrogen coolers, stator winding liquid coolers, condensate pump motor coolers, exciter air cooler, turbine lube oil coolers, oil and motor coolers for reactor feed pumps, electro-hydraulic control system coolers, recirc pump motor-generator set coolers, reactor building closed cooling water heat exchangers, chlorination system, circulating water pump motor coolers, and the steam tunnel cooling units.

2.3.3.13.2 System Functions

The General Service Water System is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

2.3.3.13.3 UFSAR Reference

Additional General Service Water System details are provided in Section 9.2.4 of the Duane Arnold UFSAR.

2.3.3.13.4 License Renewal Drawings

The license renewal drawings for the General Service Water System are listed below:

BECH-M111-LR	BECH-M112-LR	BECH-M142-LR
BECH-M146-LR	BECH-M160(1)-LR	BECH-M180-LR

2.3.3.13.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-13 lists the components and commodity groups of the General Service Water System that require aging management review, including their intended function(s).

LRA Table 3.3.2-13 provides a summary of the results of the aging management review for the General Service Water System.

2.3.3.14 Hydrogen Water Chemistry System

2.3.3.14.1 System Description

The Hydrogen Water Chemistry System supplies hydrogen for injection into the feedpump suction and for main generator makeup and purge requirements. The system supplies the Offgas Exhaust System with air or oxygen to ensure a stoichiometric mixture for recombination of hydrogen and oxygen, and injects oxygen into the suction of the condensate pumps to maintain oxygen levels sufficiently high to minimize corrosion.

The Hydrogen Water Chemistry System includes the Crack Arrest Verification System. This system takes a sample from the reactor recirculation sample line. The system provides online monitoring (crack growth) of pre-cracked, stressed, fractured mechanics test specimens made from boiling water reactor structural materials. Other components at the Crack Arrest Verification System location measure the chemical and electrochemical properties of the reactor coolant.

2.3.3.14.2 System Functions

The Hydrogen Water Chemistry System is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SC's that are relied upon to demonstrate compliance with the following NRC Regulations (10 CFR 54.4(a)(3)):
  - Fire Protection

2.3.3.14.3 UFSAR Reference

Additional Hydrogen Water Chemistry System details are provided in Section 9.3.5 of the Duane Arnold UFSAR.

2.3.3.14.4 License Renewal Drawings

The license renewal drawings for the Hydrogen Water Chemistry System are listed below:

BECH-M105(1)-LR	BECH-M106-LR	BECH-M127-LR
BECH-M189(1)-LR	BECH-M189(2)-LR	BECH-M189(3)-LR

2.3.3.14.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-14 lists the components and commodity groups of the Hydrogen Water Chemistry System that require aging management review, including their intended function(s).

LRA Table 3.3.2-14 provides a summary of the results of the aging management review for the Hydrogen Water Chemistry System.

2.3.3.15 Instrument Air System

2.3.3.15.1 System Description

The Instrument Air System includes the Service Air System and Breathing Air System.

Instrument and service air is provided by three motor-driven, oil-free compressors located in the air compressor building. A fourth oil-free compressor located in the turbine building basement is used as a standby compressor. Each compressor discharges through an integral aftercooler into a common discharge header, and then into either or both of two air receivers. Instrument air then passes through an air dryer and a filter before entering the instrument air header that feeds the instrument components. There is a standby air dryer and filter which can be used for maintenance purposes. Service air is supplied directly from the receivers to the service air components. The service air system is automatically isolated from the instrument air system on low header pressure.

Provisions within the air systems are made to mitigate the effects of system piping breaks. Should loss of air system header pressure occur, successive header isolations will result. Also air accumulators or high pressure storage bottles have been provided locally for critical components of the Condensate and Feedwater System. This backup air system will allow the feedwater system to control reactor water level for a brief period after a loss of instrument air.

Instrument and Service Air Systems are not safety-related. The Service Air System does not supply any safety-related equipment. Although the normal Instrument Air System supplies some safety-related equipment, total failure of the system will not adversely affect the operation of the plant. The Safety-Related Air System can supply air to support the operation of safety-related equipment if the instrument air system becomes unavailable.

Breathing Air contains six man stations located throughout the power block. Breathing Air is cross-tied to the Instrument Air. When necessary, breathing air for personnel use can be obtained from the instrument air mains or service air mains. Breathing Air inside the drywell has been abandoned in place. The breathing air connection to the drywell has a removable spool piece inside the drywell, a blank flange which is installed on the air supply line in the drywell and an isolation valve outside the containment. The breathing air system is not itself a safety-related system. Any interaction of the breathing air system with safety-related systems is kept to a minimum.

2.3.3.15.2 System Functions

The Instrument Air System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SC's that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2)).

2.3.3.15.3 UFSAR Reference

Additional Instrument Air System details are provided in Section 9.3.1 of the Duane Arnold UFSAR.

2.3.3.15.4 License Renewal Drawings

The license renewal drawings for the Instrument Air System are listed below:

BECH-M111-LR BECH-M130(3)-LR BECH-M130(9)-LR

2.3.3.15.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-15 lists the components and commodity groups of the Instrument Air System that require aging management review, including their intended function(s).

LRA Table 3.3.2-15 provides a summary of the results of the aging management review for the Instrument Air System.

2.3.3.16 Intake and Traveling Screens

2.3.3.16.1 System Description

The intake structure for the safety related water supply systems (River Water Supply, RHR Service Water, and Emergency Service Water Systems) is located on the west bank of the Cedar River. Water diverted to the intake structure passes through bar racks to two parallel intake channels . At the inlet end of each channel, water passes through traveling screens into two separate pump wet pits. Each pit contains two vertical river water pumps.

A trash rack is provided on the outdoor deck of the intake structure to remove any debris accumulated on the bar racks. The traveling screen in each pump wet well pit channel is operated individually. Each screen is supplied with wash water by a screen wash pump that takes its supply from the main header.

2.3.3.16.2 System Functions

The Intake and Traveling Screens are in scope for license renewal because they contain:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)

2.3.3.16.3 UFSAR Reference

Additional Intake and Traveling Screens details are provided in Section 9.2.2 of the Duane Arnold UFSAR.

2.3.3.16.4 License Renewal Drawings

The license renewal drawings for the Intake and Traveling Screens are listed below:

BECH-M129-LR

2.3.3.16.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-16 lists the components and commodity groups of the Intake and Traveling Screens that require aging management review, including their intended function(s).

LRA Table 3.3.2-16 provides a summary of the results of the aging management review for the Intake and Traveling Screens.

2.3.3.17 Offgas Exhaust System

2.3.3.17.1 System Description

The Offgas Exhaust System includes the Offgas Recombiner, Offgas Exhaust and the Radiation Monitoring System.

The Offgas Exhaust System collects gaseous discharges from the main condenser air ejectors and gland seal condenser. The system processes and delivers the gases to the main stack for elevated releases to the atmosphere. The system is designed so that any quantities of gaseous radioactivity inadvertently released will not exceed the exposure limits of 10 CFR 20.

The Offgas Recombiner System uses a high temperature catalytic recombiner to recombine radiolytically dissociated hydrogen and oxygen from the air ejectors. After chilling to strip the condensibles and reduce the volume, the remaining non-condensibles are delayed in a 30-minute holdup system, cooled with a chilled glycol cooler, passed through a de-entrainer, heated, and passed through a high efficiency particulate absorber (HEPA) filter before reaching the adsorption bed. The charcoal adsorption bed selectively adsorbs and delays xenon and krypton from the bulk carrier gas. The delay on the charcoal allows the xenon and krypton to decay in place. The gas effluent passes through a high efficiency after-filter and proceeds to the elevated release point.

The Radiation Monitoring System consists of several subsystems which provide continuous monitoring of area radiation levels, and radiation levels of liquid and gaseous processes throughout the plant which can release activity directly to the environment. The Radiation Monitoring System consists of the following subsystems:

Stack Gas Radiation Monitoring

The system monitors and samples the radioactivity in the offgas stack, indicates the rate of radioactive material relapsed, and provides indication, alarm, and control of release when limits on the release of radioactive material to the environs are reached or exceeded. The system is comprised of an isokinetic probe located at a height in the stack to ensure a representative sample, a filter sample point adjacent to the probe external to the stack for calibration purposes, and appropriate instrumentation. The Stack Gas Radiation Monitors are not in-scope of license renewal.

Offgas Radiation Monitoring

The system monitors the radioactivity level in the air ejector offgas discharge line, pre-treatment and post-treatment. The pre-treatment system consists of one gamma radiation detector positioned adjacent to an offgas sample chamber. The post-treatment systems consist of two gamma scintillation detectors. Both systems provide indication and alarms. The post-treatment system will automatically place the offgas charcoal adsorbers in service and close the adsorber bypass valve when the high radiation trip level is reached. A gamma radiation detector monitors the radioactivity level in the charcoal bed vault to provide indication and alarm. The Offgas Radiation Monitors are not in-scope of license renewal.

Liquid Process Radiation Monitoring

This system monitors the radioactivity of selected process streams. Four systems (general service water effluent, emergency service water effluent, RHR service water effluent, and reactor building closed cooling water) monitor normally uncontaminated streams and are used to indicate possible process system malfunctions. Three of these four streams discharge to the environs. A fifth stream monitors liquid effluents being discharged to the environs via the radwaste floor drains system. The Liquid Process Radiation Monitors are not in-scope of license renewal.

Main Steam Supply Line Radiation Monitoring

This system monitors the radiation level in the main steamlines for gross release of fission products from the fuel. The system consists of four gamma radiation detectors mounted in the steam tunnel to provide indications, alarms, and input to the Nuclear Steam Supply Shutoff System. The Main Steam Supply Line Radiation Monitors are in the scope of license renewal.

Reactor Building, Low Level Radwaste Processing and Storage Facility, and Turbine Building Kaman Radiation Monitoring

This computer based system was installed to meet the requirements of NUREG-0737, Item II.F.1 and Regulatory Guide 1.21 [References 2.3-3 and 2.3-4, respectively]. Dual range systems that monitor normal and accident range are installed in the turbine building roof vents and the reactor building main exhaust stacks. A single normal range system is installed in the low level radwaste storage and processing facility ventilation exhaust. The Kaman Radiation Monitors are not in-scope of license renewal.

Area Radiation Monitoring

Area radiation monitors are located in appropriate areas within the reactor building, turbine building, control building, radwaste building, low level radwaste processing and storage facility and administration building. Alarm and indication are provided in the main control room for all but the low level radwaste processing and storage facility. The Area Radiation Monitors are not in-scope of license renewal.

Environmental Radiation Monitoring

The site environmental radiation monitoring system consists of monitors within 16 standard meteorological sectors, both at and beyond the boundary of the unrestricted area. The Environmental Radiation Monitors are not in-scope of license renewal.

Reactor Building Exhaust Radiation Monitoring

This system consists of the reactor building ventilation exhaust plenum radiation monitors and the refuel pool ventilation exhaust radiation monitors. Both systems initiate control action to prevent release of radioactive material to the environs. The Reactor Building Exhaust Radiation Monitors are in-scope of license renewal.

Control Building Ventilation Radiation Monitoring

This system monitors the radioactivity level of the outside air being drawn into the control building, indicates whenever abnormal amounts of radiation are present, and initiates control action to limit the amount of radioactive material drawn into the control building. The Control Building Ventilation Radiation Monitors are in the scope of license renewal.

2.3.3.17.2 System Functions

The Offgas Exhaust System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

2.3.3.17.3 UFSAR Reference

Additional Offgas Exhaust System details are provided in Sections 1.2, 1.2.5.4.3, 11.3, and 11.5 of the Duane Arnold UFSAR.

2.3.3.17.4 License Renewal Drawings

The license renewal drawings for the Offgas Exhaust System are listed below:

BECH-M105-(1)-LR	BECH-M105(2)-LR	BECH-M141-LR
BECH-M149-LR	BECH-M176(1)-LR	

2.3.3.17.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-17 lists the components and commodity groups of the Offgas Exhaust System that require aging management review, including their intended function(s).

LRA Table 3.3.2-17 provides a summary of the results of the aging management review for the Offgas Exhaust System.

2.3.3.18 Plant Ventilation

2.3.3.18.1 System Description

Plant ventilation includes the following: Intake Structure Heating, Ventilation and Air Conditioning, Pump House Structure Heating, Ventilation, and Air Conditioning, Standby Diesel Generator Rooms Heating, Ventilation, and Air Conditioning, Turbine Building Heating, Ventilation, and Air Conditioning, and Radwaste Building Heating, Ventilation, and Air Conditioning.

Intake Structure Heating, Ventilation and Air Conditioning

This system provides heating and forced air ventilation to the intake structure to maintain acceptable environmental conditions to support fire protection. This system is in the scope of license renewal.

Pump House Structure Heating, Ventilation, and Air Conditioning

The pump rooms housing the RHR service water pumps and the emergency service water pumps are provided with ventilation supply and exhaust systems. Heating is provided for equipment and piping freeze protection. Supply fans introduce filtered air through roughing and medium efficiency filters to remove excessive heat generated by equipment. The air is mostly recirculated and is tempered by mixing return air with outdoor air to maintain design temperature.

Two physically separated seismic category I supply fans supply cooling air to the RHR service water pump and emergency service water pump area. One supply fan provides cooling air to each division of RHR service water pumps and emergency service water pumps. The fans are connected to the emergency buses. When a supply fan operates, the exhaust louvers automatically open. This system is in the scope of license renewal.

Standby Diesel Generator Rooms Heating, Ventilation, and Air Conditioning

Each standby diesel generator room is provided with a ventilation air supply fan and a suitable means of exhaust. Heating is provided for equipment freeze protection. The ventilation system is supplied with standby power during a loss of offsite power. This system is in the scope of license renewal.

Turbine Building Heating, Ventilation, and Air Conditioning

The turbine building is ventilated by a once-through systems consisting of one supply subsystem and three distinct exhaust subsystems. Supply air is drawn through the main plant intake coils by three supply fans located in the reactor building equipment room. Each of the three fans supplies air to a common mixing header from which air is distributed to various areas of the turbine building.

Air is exhausted from the operating floor by way of eight roof exhaust ducts which are connected to three exhaust fans via a common header. The three exhaust fans discharge to the environs by way of a monitored release point. Air is exhausted from the general area of the condenser and heater bays by way of a duct to the main exhaust plenum. Turbine building exhaust is mixed with air from other plant areas and then discharged to the environs via the main plant ventilation stack by three exhaust fans. The turbine area of the highest potential contamination (air ejector room, condensate backwash room, etc.) are exhausted via a special exhaust system which directs its flow to the offgas stack during normal operation. This system is in the scope of license renewal.

Radwaste Building Heating, Ventilation, and Air Conditioning

The Radwaste Building is served by ventilating systems, one for the radwaste control room and one for the radwaste area and equipment room. The radwaste control room unit supplies the room with a mixture of outdoor air and recirculated air. Air passes through medium efficiency air filters and can by heated or cooled as required.

The radwaste area and equipment room ventilating system is a once-through system. The supply air unit has roughing and medium efficiency filters, heating and cooling coils, and two fans. The radwaste area is exhausted by two redundant exhaust fan units, each of which consists of a fan, prefilters, high efficiency particulate absorbers (HEPA) filters to the space surrounding the torus, which is used as the reactor building exhaust plenum. This system is in the scope of license renewal.

2.3.3.18.2 System Functions

Plant Ventilation is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Anticipated Transients Without Scram (10 CFR 50.62)
  - Station Blackout (10 CFR 50.63)

2.3.3.18.3 UFSAR Reference

Additional Plant Ventilation details are provided in Section 9.4 of the Duane Arnold UFSAR.

2.3.3.18.4 License Renewal Drawings

The license renewal drawings for Plant Ventilation are listed below:

BECH-M159-LR	BECH-M160(1)-LR	BECH-M163-LR
BECH-M164-LR	BECH-M170-LR	BECH-M175-LR
BECH-M177-LR		

2.3.3.18.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-18 lists the components and commodity groups of the Plant Ventilation that require aging management review, including their intended function(s).

LRA Table 3.3.2-18 provides a summary of the results of the aging management review for the Plant Ventilation.

2.3.3.19 Post Accident Sampling System

2.3.3.19.1 System Description

The Post Accident Sampling System (PASS) is designed to enable an operator to obtain representative grab samples of reactor coolant, suppression pool liquid, and containment atmosphere for radiological and chemical analyses in association with a postulated loss-of-coolant accident. The system consists of a sample station, sample control panels, a sample piping station, a sample station exhaust fan, a cyclone separator rack, a refrigeration unit, and demineralized water, nitrogen, and tracer gas supplies.

The Post Accident Sampling System equipment is located in two areas of the plant. The sample piping station, cyclone separator rack, and the sample station exhaust fan are located in the northwest corner room inside the reactor building. The sample station, sample control panels, refrigeration unit, and demineralized water, nitrogen, and tracer gas supplies are located in the administration building access control area. Isolation valves for liquid and gas sample lines, sample return lines, and the sample station exhaust duct isolation dampers are operated from the control room. The sample station and components located inside the reactor building but not operated from the control room are remotely operated from the sample control panels in the access control area.

The sample station consists of a liquid sampling unit, gas sampling unit, sampler mounting frame, and associated lead brick shielding. The liquid and gas sampling units each contain a compact, removable equipment tray designed to provide easy access to individual components for maintenance. Special sample handling tools are provided for installing and removing sample bottles from the sample station. Shielded sample casks are provided for transporting samples from the sample station to the laboratory areas.

2.3.3.19.2 System Functions

The Post Accident Sampling System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Environmental Qualification (10 CFR 50.49)
  - Anticipated Transients Without Scram (10 CFR 50.62)
  - Station Blackout (10 CFR 50.63)

2.3.3.19.3 UFSAR Reference

Additional Post Accident Sampling System details are provided in Section 12.3.4 of the Duane Arnold UFSAR.

2.3.3.19.4 License Renewal Drawings

The license renewal drawings for the Post Accident Sampling System are listed below:

BECH-M115-LR	BECH-M119-LR	BECH-M120-LR
BECH-M181-LR	BECH-M187-LR	

2.3.3.19.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-19 lists the components and commodity groups of Post Accident Sampling System that require aging management review, including their intended function(s).

LRA Table 3.3.2-19 provides a summary of the results of the aging management review for the Post Accident Sampling System.

2.3.3.20 Primary Containment Heating, Ventilation, and Air Conditioning

2.3.3.20.1 System Description

The Primary Containment Ventilation (Drywell Cooling) System maintains ambient temperatures in various areas of the drywell within the ranges dictated by equipment requirements during normal plant operation. It provides air mixing and comfortable working conditions for maintenance and inspection personnel during plant shutdown.

The drywell ventilation system is a water-cooled, forced-air system, using well water as the cooling medium. In this system, the temperature of the gas entering and leaving the cooler and the outlet temperature of the well water are monitored. Once steady-state operation is established, variations of these parameters can indicate possible leaks. Since the inlet water has an essentially constant temperature, a rise in outlet temperature indicates additional heat load on the cooling coils and could be indicative of a leak. With the exception of the single fan units, high air or water outlet temperature will actuate an alarm.

2.3.3.20.2 System Functions

Primary Containment Heating, Ventilation, and Air Conditioning is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Environmental Qualification (10 CFR 50.49)
    - Anticipated Transients Without Scram (10 CFR 50.62)
    - Station Blackout (10 CFR 50.63)

2.3.3.20.3 UFSAR Reference

Additional Primary Containment Heating, Ventilation, and Air Conditioning details are provided in Section 5.2.5.2.3.2 of the Duane Arnold UFSAR.

2.3.3.20.4 License Renewal Drawings

The license renewal drawings for the Primary Containment Heating, Ventilation, and Air Conditioning are listed below:

BECH-M144(1)-LR BECH-M157(1)-LR BECH-M157(2)-LR

2.3.3.20.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-20 lists the components and commodity groups of Post Primary Containment Heating, Ventilation, and Air Conditioning that require aging management review, including their intended function(s).

LRA Table 3.3.2-20 provides a summary of the results of the aging management review for Primary Containment Heating, Ventilation, and Air Conditioning.

2.3.3.21 Reactor Building and Radwaste Building Sampling System

2.3.3.21.1 System Description

The Reactor Building and Radwaste Building Sampling System provides the ability to obtain samples from various plant equipment located in these buildings. Samples are used to monitor the operation of plant equipment and provide information for making operational decisions.

The Reactor Building and Radwaste Building Sampling System aids in monitoring the operation of plant equipment, along with providing information for making operational decisions with regard to effectiveness and proper performance.

The Reactor Recirculation System process sample line has post accident sample capabilities that can be used as a backup to the post accident sampling system.

Radioactive liquid waste sampling and activity analyses are performed in accordance with the Technical Specifications. Liquid releases are sampled before release. Other samples are taken before and after processing. Maximum tank activity and sampling frequency are in accordance with the plant Technical Specifications.

The radwaste sample station provides the ability to sample collector tanks for gross concentrations to determine the necessary batch process. Sample tanks are sampled for gross activity to determine the effectiveness of the process and to determine if further processing is necessary.

2.3.3.21.2 System Functions

The Reactor Building and Radwaste Building Sampling System is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

2.3.3.21.3 UFSAR Reference

Additional Reactor Building and Radwaste Building Sampling System details are provided in Section 9.3.2 of the Duane Arnold UFSAR.

2.3.3.21.4 License Renewal Drawings

The license renewal drawings for the Reactor Building and Radwaste Building Sampling System are listed below:

BECH-M127-LR	BECH-M134-LR	BECH-M135-LR
BECH-M136-LR	BECH-M138(1)-LR	BECH-M139-LR
BECH-M182-LR	BECH-M183-LR	BECH-M189(1)-LR
BECH-M189(2)-LR	BECH-M189(3)-LR	

2.3.3.21.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-21 lists the components and commodity groups of the Reactor Building and Radwaste Building Sampling System that require aging management review, including their intended function(s).

LRA Table 3.3.2-21 provides a summary of the results of the aging management review for the Reactor Building and Radwaste Building Sampling System.

2.3.3.22 Reactor Building Closed Cooling Water System

2.3.3.22.1 System Description

The purpose of the Reactor Building Closed Cooling Water (RBCCW) System is to provide required cooling to the equipment located in the reactor building which may contain or have the potential to contain radioactive fluids.

The Reactor Building Closed Cooling Water System is a closed cooling water system using inhibited demineralized water to cool reactor auxiliaries, rejecting heat to

General Service Water. Reactor Building Closed Cooling Water contains three heat exchangers and three pumps. Normally two pumps and two heat exchangers are inservice. An expansion tank is provided to accommodate system volume expansion and contraction.

Reactor Building Closed Cooling Water provides cooling for the following equipment: drywell equipment drain sump cooler, reactor water cleanup non-regenerative heat exchangers, reactor building sample cooler, turbine building sample cooler, radwaste building sample coolers, fuel pool heat exchangers, control rod drive pump coolers, reactor cleanup recirculating pump seal coolers, reactor recirc pump heat exchangers, reactor building equipment drain sump heat exchanger, and post accident sampling system cooler.

2.3.3.22.2 System Functions

The Reactor Building Closed Cooling Water System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

2.3.3.22.3 UFSAR Reference

Additional Reactor Building Closed Cooling Water System details are provided in Section 9.2.5 of the Duane Arnold UFSAR.

2.3.3.22.4 License Renewal Drawings

The license renewal drawings for the Reactor Building Closed Cooling Water System are listed below:

BECH-M112-LR	BECH-M116-LR	BECH-M117-LR
BECH-M127-LR	BECH-M147-LR	BECH-M187-LR
BECH-M189(1)-LR	BECH-M189(2)-LR	

2.3.3.22.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-22 lists the components and commodity groups of the Reactor Building Closed Cooling Water System that require aging management review, including their intended function(s).

LRA Table 3.3.2-22 provides a summary of the results of the aging management review for the Reactor Building Closed Cooling Water System.

2.3.3.23 Reactor Building Heating, Ventilation, and Air Conditioning

2.3.3.23.1 System Description

Reactor Building Heating, Ventilation, and Air-Conditioning controls the plant air temperatures and the flow of airborne radioactive contaminants to ensure the operability of plant equipment and the accessibility and habitability of plant buildings and compartments.

Included in the Reactor Building Heating, Ventilation, and Air-Conditioning are the safety related cooling coils for the residual heat removal and core spray rooms, high pressure coolant injection room, and reactor core isolation cooling room. Cooling water for these coils is provided by the Emergency Service Water System.

Reactor Building Heating, Ventilation, and Air-Conditioning supplies filtered air and is divided into two subsystems. One supplies air at the refueling floor level, and the other below the refueling floor level. Air is exhausted through hoods located at the perimeter of the dryer-separator storage pool, reactor well, fuel storage pool, and refueling floor. The exhaust ventilation system serving areas below the refueling floor maintains negative pressures with respect to reactor building interior ambient pressure for various areas.

2.3.3.23.2 System Functions

Reactor Building Heating, Ventilation, and Air Conditioning is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Environmental Qualification (10 CFR 50.49)

2.3.3.23.3 UFSAR Reference

Additional Reactor Building Heating, Ventilation, and Air Conditioning details are provided in Section 9.4 of the Duane Arnold UFSAR.

2.3.3.23.4 License Renewal Drawings

The license renewal drawings for the Reactor Building Heating, Ventilation, and Air Conditioning are listed below:

BECH-M111-LR	BECH-M152-LR	BECH-M160(1)-LR
BECH-M162-LR	BECH-M165-LR	BECH-M166-LR
BECH-M170-LR	BECH-M171-LR	

2.3.3.23.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-23 lists the components and commodity groups of the Reactor Building Heating, Ventilation, and Air Conditioning that require aging management review, including their intended function(s).

LRA Table 3.3.2-23 provides a summary of the results of the aging management review for the Reactor Building Heating, Ventilation, and Air Conditioning.

2.3.3.24 Reactor Water Cleanup System

2.3.3.24.1 System Description

The Reactor Water Cleanup System maintains high reactor water purity to limit chemical and corrosive action, thereby limiting fouling and deposition on heat-transfer surfaces. Reactor Water Cleanup removes corrosion products to limit impurities available for activation by neutron flux and resultant radiation from the deposition of corrosion products. Provisions are made for the discharge of reactor water in order to control reactor water level during startup and shutdown, and to limit the heat loss and the fluid loss from the nuclear system.

Reactor Water Cleanup provides continuous purification of a portion of the recirculation flow. The processed fluid is returned to the reactor via the feedwater line or to storage. Regenerative heat exchangers are provided to limit heat loss from the nuclear system.

The Reactor Water Cleanup System consists of two pumps, regenerative and nonregenerative heat exchangers and two filter-demineralizers with supporting equipment. Reactor coolant is removed from the reactor coolant recirculation system, cooled in the regenerative and non-regenerative heat exchangers, filtered and demineralized, and returned to the feedwater system through the shell side of the regenerative heat exchanger.

During emergency conditions, the Duane Arnold emergency operating procedures permit the use of Reactor Water Cleanup as an alternate means of injecting boron solution into the reactor vessel to shutdown the reactor. This method would be utilized if an anticipated transient without scram (ATWS) condition exists and Standby Liquid Control failed to operate as designed. Reactor Water Cleanup can also be used for decay heat removal per the emergency operating procedures.

2.3.3.24.2 System Functions

The Reactor Water Cleanup System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Environmental Qualification (10 CFR 50.49)
    - Anticipated Transients Without Scram (10 CFR 50.62)
    - Station Blackout (10 CFR 50.63)

2.3.3.24.3 UFSAR Reference

Additional Reactor Water Cleanup System details are provided in Section 5.4.8 of the Duane Arnold UFSAR.

2.3.3.24.4 License Renewal Drawings

The license renewal drawings for the Reactor Water Cleanup System are listed below:

BECH-M106-LR	BECH-M112-LR	BECH-M116-LR
BECH-M119-LR	BECH-M127-LR	BECH-M128-LR
BECH-M138<1>-LR		

2.3.3.24.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-24 lists the components and commodity groups of the Reactor Water Cleanup System that require aging management review, including their intended function(s).

LRA Table 3.3.2-24 provides a summary of the results of the aging management review for the Reactor Water Cleanup System.

2.3.3.25 RHR Service Water System

2.3.3.25.1 System Description

The RHR Service Water System provides a reliable supply of cooling water for heat removal from the Residual Heat Removal System under post accident conditions and supplies a source of water if post accident flooding of the core or primary containment is required. RHR Service Water provides cooling water to the residual heat removal heat exchangers during conditions of normal shutdown and cooldown. The system consists of two independent and redundant trains each containing one residual heat removal heat exchanger and two 50% residual heat removal service water pumps.

RHR Service Water uses river water to remove heat from the primary containment under post accident conditions. RHR Service Water has the capability to return the water either to the cooling towers or directly to the river (if necessary) via Circulating Water.

RHR Service Water System pressure is maintained a minimum of 20 psi greater than the fluid on the shell side of the residual heat removal heat exchanger to prevent the release of radioactive material.

A cross connect to Residual Heat Removal provides the capability for core or containment flooding.

2.3.3.25.2 System Functions

The RHR Service Water System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Environmental Qualification (10 CFR 50.49)
    - Anticipated Transients Without Scram (10 CFR 50.62)

2.3.3.25.3 UFSAR Reference

Additional RHR Service Water System details are provided in Section 9.2.3 of the Duane Arnold UFSAR.

2.3.3.25.4 License Renewal Drawings

The license renewal drawings for the RHR Service Water System are listed below:

BECH-M113-LR	BECH-M119-LR	BECH-M120-LR
BECH-M142-LR	BECH-M146-LR	

2.3.3.25.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-25 lists the components and commodity groups of the RHR Service Water System that require aging management review, including their intended function(s).

LRA Table 3.3.2-25 provides a summary of the results of the aging management review for the RHR Service Water System.

2.3.3.26 River Water Supply System

2.3.3.26.1 System Description

Four river water pumps are located in two separate wet pits in the intake structure. The wet pits are supplied from the Cedar River through two channels that contain bar racks and traveling screens to prevent debris from entering the pits. The four river water pumps deliver water through two lines to a stilling basin. The basin supplies

RHR Service Water and Emergency Service Water wet-pit pump sumps to maintain these sumps at a safe operating level. An overflow weir in the stilling basis makes the excess flow available to Circulating Water and General Service Water. Water for one method of radwaste dilution is available by branch connections from each of the main headers upstream of the flow control valves at the entrance to the stilling basin. An alternate method of radwaste dilution is provided by the return flow from RHR Service Water and Emergency Service Water.

2.3.3.26.2 System Functions

The River Water Supply System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)

2.3.3.26.3 UFSAR Reference

Additional River Water Supply System details are provided in Section 9.2.2 of the Duane Arnold UFSAR.

2.3.3.26.4 License Renewal Drawings

The license renewal drawings for the River Water Supply are listed below:

BECH-M129-LR BECH-M142-LR BECH-M146-LR

2.3.3.26.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-26 lists the components and commodity groups of the River Water Supply System that require aging management review, including their intended function(s).

LRA Table 3.3.2-26 provides a summary of the results of the aging management review for the River Water Supply System.

2.3.3.27 Safety Related Air System

2.3.3.27.1 System Description

The Safety Related Air System includes both the “A” and “B” Safety Related Air Systems. The Safety Related Air System is designed to provide compressed air to support certain systems and components that function to limit fission to limit fission product release and control the environment from which the unit can be operated following a design basis accident.

The Safety Related Air System consists of two independent and redundant subsystems. Each of the two subsystems is made up of a compressor, air receiver, associated instrumentation, and piping. The air receivers are normally supplied by the plant instrument air system. If the pressure in the air receivers decreases below a specified limit, then the safety related air system instrument air compressor will automatically start. With the air receiver pressure higher than the plant instrument air system, check valves will close to provide isolation of each of the subsystems.

The safety related air compressors are normally cooled by Well Water, but can be cooled by Emergency Service Water to ensure post accident cooling.

2.3.3.27.2 System Functions

The Safety Related Air System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SC's that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2)).
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Environmental Qualification (10 CFR 50.49)

2.3.3.27.3 UFSAR Reference

Additional Safety Related Air System details are provided in Section 9.3.1 of the Duane Arnold UFSAR.

2.3.3.27.4 License Renewal Drawings

The license renewal drawings for the Safety Related Air System are listed below:

BECH-M113-LR	BECH-M157(1)-LR	BECH-M158-LR
BECH-M161-LR	BECH-M173-LR	BECH-M176(2)-LR

2.3.3.27.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-27 lists the components and commodity groups of the Safety Related Air System that require aging management review, including their intended function(s).

LRA Table 3.3.2-27 provides a summary of the results of the aging management review for the Safety Related Air System.

2.3.3.28 Solid Radwaste

2.3.3.28.1 System Description

The Solid Radwaste System includes liquid radwaste system and the evaporator.

The solid radwaste areas are located in the radwaste building, the low level radwaste processing and storage facility, and the offgas retention building. The system processes wet and dry solid radwaste. The wet solid wastes are spent demineralizer resins and filter sludge. The dry solid radwaste consist of miscellaneous radioactive and contaminated solid wastes.

The liquid radwaste system collects, monitors, processes, stores, and disposes of radioactive liquid wastes. The liquid radwaste system is divided into several subsystems so that liquid wastes from various sources can be kept segregated and processed separately. The liquid radwaste is classified, collected, and treated as high purity, low purity, chemical detergent, sludge, or spent resins. The liquid radwaste system provides for filtration and demineralization of both waste collector (high purity) and floor drain (low purity) effluents. Radioactive liquids are recycled within the plant to the extent practicable.

An evaporator provides treatment capability for those waste liquids whose chemical composition is such that demineralization is not possible.

2.3.3.28.2 System Functions

Solid Radwaste is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

2.3.3.28.3 UFSAR Reference

Additional Solid Radwaste details are provided in Sections 11.2 and 11.4 of the Duane Arnold UFSAR.

2.3.3.28.4 License Renewal Drawings

The license renewal drawings for the Solid Radwaste are listed below:

BECH-M109-LR	BECH-M138(1)-LR	BECH-M139-LR
BECH-M140-LR	BECH-M182-LR	

2.3.3.28.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-28 lists the components and commodity groups of the Solid Radwaste that require aging management review, including their intended function(s).

LRA Table 3.3.2-28 provides a summary of the results of the aging management review for the Solid Radwaste.

2.3.3.29 Standby Diesel Generators

2.3.3.29.1 System Description

The Standby Diesel Generator System includes the Diesel Oil System and the Emergency Power System. Also included are the air start and fuel supply subsystems.

The standby diesel generator system is composed of two electrically and physically separated diesel generator subsystems, each capable of independently supplying emergency power to its associated 4160 Volt bus. Each diesel has the following ratings:

- Continuous - 2850 KW (3956 hp)
- 2000 hour- 3000 KW (4160 hp)
- 300 hour- 3250 KW (4507 hp)

The standby diesel generator system does not rely upon any system or function not expected to be available during or following a design basis accident.

The two auxiliary buses supplying power to the auxiliaries and engineered safety features required for safe shutdown are designated essential buses. Each essential bus is capable of receiving power from reliable offsite sources through either the startup or standby transformers and from one of two standby diesel generators. The standby diesel generators are physically and electrically separated from the offsite power source.

The standby diesel generators are the emergency sources of auxiliary AC power. These generators start automatically on LOCA and loss of AC power signals. Each diesel generator has the capacity to operate all systems required to achieve and maintain safe shutdown.

A 40,000 gallon safety-related underground diesel oil storage tank contains fuel for both fuel supply trains.

2.3.3.29.2 System Functions

The Standby Diesel Generators are in scope for license renewal because they contain:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Anticipated Transients Without Scram (10 CFR 50.62)
  - Station Blackout (10 CFR 50.63)

2.3.3.29.3 UFSAR Reference

Additional Standby Diesel Generators details are provided in Sections 8.3.1 and 9.5.4 of the Duane Arnold UFSAR.

2.3.3.29.4 License Renewal Drawings

The license renewal drawings for the Standby Diesel Generators are listed below:

BECH-M113-LR BECH-M132(1)-LR BECH-M132(2)-LR
BECH-M132(3)-LR

2.3.3.29.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-29 lists the components and commodity groups of the Standby Diesel Generators that require aging management review, including their intended function(s).

LRA Table 3.3.2-29 provides a summary of the results of the aging management review for the Standby Diesel Generators.

2.3.3.30 Standby Liquid Control System

2.3.3.30.1 System Description

The Standby Liquid Control System provides a backup method, independent of control rods, to bring and maintain the reactor subcritical as the nuclear system cools. This is accomplished by pumping a neutron absorbing solution (sodium pentaborate) into the reactor in sufficient quantity and concentration to overcome the maximum positive reactivity resulting from cooldown and xenon decay after a complete shutdown and to provide the required shutdown margin. The system is designed to bring the reactor from rated power to a cold shutdown at anytime in core life. Maintaining subcriticality ensures that the fuel barrier is not threatened by overheating in the improbable event that not enough of the control rods can be inserted to counteract the positive reactivity effects of a colder moderator.

Standby Liquid Control is manually initiated from the main control room to pump a boron neutron-absorber (sodium pentaborate) solution into the reactor if the operator believes the reactor cannot be shut down or kept shut down with the control rods. Standby Liquid Control consists of a boron solution tank, a test water tank, two positive-displacement pumps, two explosive valves, and associated local valves and controls mounted in the reactor building outside primary containment. The liquid is piped into the reactor vessel and discharged near the bottom of the core shroud so that it mixes with the cooling water rising through the core.

2.3.3.30.2 System Functions

The Standby Liquid Control System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Anticipated Transients Without Scram (10 CFR 50.62)

2.3.3.30.3 UFSAR Reference

Additional Standby Liquid Control System details are provided in Section 9.3.4 of the Duane Arnold UFSAR.

2.3.3.30.4 License Renewal Drawings

The license renewal drawings for the Standby Liquid Control System are listed below:

BECH-M115-LR   BECH-M126-LR

2.3.3.30.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-30 lists the components and commodity groups of the Standby Liquid Control System that require aging management review, including their intended function(s).

LRA Table 3.3.2-30 provides a summary of the results of the aging management review for the Standby Liquid Control System.

2.3.3.31 Turbine Building Sampling System

2.3.3.31.1 System Description

The Turbine Building Sampling System is designed to obtain representative samples in forms that can be used in radiochemical laboratory analysis. The process sampling systems allow monitoring of plant equipment operation and provide information for making operational decisions with regard to effectiveness and proper performance. Turbine Building Sampling includes sampling for main steam, condensate pumps, steam packing exhauster, feedwater heaters, condensate lines to and from the demineralizers, and the condensate demineralizer tanks.

2.3.3.31.2 System Functions

The Turbine Building Sampling System is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

2.3.3.31.3 UFSAR Reference

Additional Turbine Building Sampling System details are provided in Sections 6.7 and 9.3.2 of the Duane Arnold UFSAR.

2.3.3.31.4 License Renewal Drawings

The license renewal drawings for the Turbine Building Sampling System are listed below:

BECH-M103(1)-LR	BECH-M105(2)-LR	BECH-M106-LR
BECH-M107-LR	BECH-M108-LR	BECH-M147-LR

2.3.3.31.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-31 lists the components and commodity groups of the Turbine Building Sampling System that require aging management review, including their intended function(s).

LRA Table 3.3.2-31 provides a summary of the results of the aging management review for the Turbine Building Sampling System.

2.3.3.32 Well Water System

2.3.3.32.1 System Description

The Well Water System removes heat from components during startup, normal operation, shutdown, and cooldown. The Well Water System discharges to Circulating Water System. Well Water provides cooling water for all the plant ventilation cooling units, supplies potable water, and supplies water for demineralizer makeup. Well Water has a normally closed crosstie that can provide a backup supply of water to Fire Protection during conditions where the circulating pit is drained. The system consists of four independent wells. The wells are sealed to prevent the collection of less desirable ground water from shallower aquifers.

The Domestic Water System consists of potable water and sanitary water. Domestic Water is supplied from Well Water. The system provides water for drinking and sanitary purposes. The water is filtered and purified as necessary to meet applicable drinking water standards.

2.3.3.32.2 System Functions

The Well Water System is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

2.3.3.32.3 UFSAR Reference

Additional Well Water System details are provided in Section 9.2.1 of the Duane Arnold UFSAR.

2.3.3.32.4 License Renewal Drawings

The license renewal drawings for the Well Water System are listed below:

BECH-M110-LR	BECH-M111-LR	BECH-M113-LR
BECH-M133(2)-LR	BECH-M142-LR	BECH-M144(1)-LR
BECH-M146-LR	BECH-M149-LR	BECH-M157(1)-LR
BECH-M161-LR	BECH-M164-LR	BECH-M166-LR
BECH-M180-LR		

2.3.3.32.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-32 lists the components and commodity groups of the Well Water System that require aging management review, including their intended function(s).

LRA Table 3.3.2-32 provides a summary of the results of the aging management review for the Well Water System.

2.3.3.33 Zinc Injection System

2.3.3.33.1 System Description

The Zinc Injection System consists of a zinc addition skid that injects trace amounts of depleted zinc oxide (DZO) into the feedwater during normal plant operation. Maintaining trace quantities of ionic zinc in the reactor water reduces radiation levels by maintaining/reducing cobalt 60 buildup on primary system surfaces.

The system consists of a recirculation loop off of the Feedwater System. A stream of feedwater from the feed pump discharge header is passed through the dissolution vessel containing depleted zinc oxide pellets, dissolving the pellets, and returned to the feed pump suction header.

2.3.3.33.2 System Functions

The Zinc Injection System is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

2.3.3.33.3 UFSAR Reference

Additional Zinc Injection System details are provided in Section 9.3.6 of the Duane Arnold UFSAR.

2.3.3.33.4 License Renewal Drawings

The license renewal drawings for the Zinc Injection System are listed below:

BECH-M107-LR	BECH-M189(3)-LR

2.3.3.33.5 Components Subject to an Aging Management Review

LRA Table 2.3.3-33 lists the components and commodity groups of the Zinc Injection System that require aging management review, including their intended function(s).

LRA Table 3.3.2-33 provides a summary of the results of the aging management review for the Zinc Injection System.

Table 2.3.3-1
Auxiliary Heating Boiler

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial)
Fasteners	Leakage boundary (spatial)
Filters	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Instrumentation (Level Gauge, Flow Element)	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Separators	Leakage boundary (spatial)
Thermowell	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-2
Building Sumps

Component Groups	Intended Function
Fasteners	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-3
Chlorination and Acid Feed System

Component Groups	Intended Function
Fasteners	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Pressure vessels	Leakage boundary (spatial)
Pump casings	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-4
Circulating Water System

Component Groups	Intended Function
Fasteners	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Pump casings	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-5
Containment Atmosphere Control System

Component Groups	Intended Function
Pressure vessel	Pressure boundary Structural Integrity
Fasteners	Pressure boundary
Filters	Filter Pressure boundary
Flow orifice	Pressure boundary
Heat exchanger	Leakage boundary (spatial)
Piping	Leakage boundary (spatial) Pressure boundary Structural Integrity
Valve body	Leakage boundary (spatial) Pressure boundary Structural Integrity

Table 2.3.3-6
Control Building Heating, Ventilation, and Air Conditioning

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial) Pressure boundary
Blower	Pressure boundary
Drip pans	Leakage boundary (spatial)
Ductwork	Pressure boundary
Elastomer	Pressure boundary
Heater housing	Leakage boundary (spatial)
Fasteners	Pressure boundary
Filters	Leakage boundary (spatial) Pressure boundary
Flow element	Pressure boundary
Flow gauge	Pressure boundary
Heat exchanger	Heat transfer Leakage boundary (spatial) Pressure boundary
Instrumentation (Pressure Transducer)	Leakage boundary (spatial) Pressure boundary
Level gauge	Leakage boundary (spatial)
Piping	Leakage boundary (spatial) Pressure boundary
Pump casings	Leakage boundary (spatial) Pressure boundary
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.3-7
Control Rod Drive System

Component Groups	Intended Function
Pressure vessel	Pressure boundary
Control rod drive mechanism	Pressure boundary
Elastomers	Pressure boundary
Fasteners	Leakage boundary (spatial) Pressure boundary
Filters	Filter Leakage boundary (spatial) Pressure boundary
Flow elements	Leakage boundary (spatial) Pressure boundary
Level elements	Pressure boundary
Level switches	Pressure boundary
Piping	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)
Pump casings	Leakage boundary (spatial)
Thermowell	Pressure boundary
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.3-8
Drywell Sumps

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial)
Fasteners	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Instrumentation (Flow Element)	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-9
Electrical Manhole Sump Pumps

Component Groups	Intended Function
Fasteners	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Pump casings	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-10
Emergency Service Water System

Component Groups	Intended Function
Fasteners	Pressure boundary
Filters	Filter Pressure boundary
Instrumentation (Flow Gauges, Flow Elements)	Pressure boundary
Piping	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)
Pump casings	Pressure boundary
Valve body	Pressure boundary

Table 2.3.3-11
Fire Protection System

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial) Pressure boundary
Fasteners	Pressure boundary
Filters	Filter Leakage boundary (spatial) Pressure boundary
Heat exchanger	Heat transfer Pressure boundary
Instrumentation (Flow Alarms, Flow Gauges, Flow Element)	Leakage boundary (spatial) Pressure boundary
Piping	Leakage boundary (spatial) Pressure boundary Spray
Pump casings	Leakage boundary (spatial) Pressure boundary
Valve body	Fire barrier Leakage boundary (spatial) Pressure boundary

Table 2.3.3-12
Fuel Pool Cooling and Cleanup System

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial)
Fasteners	Pressure boundary
Piping	Leakage boundary (spatial) Pressure boundary
Pump casings	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.3-13
General Service Water System

Component Groups	Intended Function
Fasteners	Leakage boundary (spatial)
Filters	Leakage boundary (spatial)
Instrumentation (Flow Indicator, Flow Gauges)	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Pump casings	Leakage boundary (spatial)
Thermowell	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-14
Hydrogen Water Chemistry System

Component Groups	Intended Function
Fasteners	Leakage boundary (spatial)
Filters	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Instrumentation (Electrodes, Flow Elements, Temperature Elements, Sensing Elements)	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Pressure vessels	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-15
Instrument Air System

Component Groups	Intended Function
Blower	Leakage boundary (spatial)
Fasteners	Pressure boundary
Piping	Leakage boundary (spatial) Pressure boundary
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.3-16
Intake and Traveling Screens

Component Groups	Intended Function
Fasteners	Pressure boundary
Filters	Filter Pressure boundary
Instrumentation (Flow Element)	Leakage boundary (spatial)
Piping	Leakage boundary (spatial) Pressure boundary Spray
Pump casings	Pressure boundary
Structures, buildings	Structural support
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.3-17
Offgas Exhaust System

Component Groups	Intended Function
Ductwork	Pressure boundary
Fasteners	Leakage boundary (spatial) Pressure boundary
Sample Point	Pressure boundary
Piping	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-18
Plant Ventilation

Component Groups	Intended Function
Blower	Pressure boundary
Damper casings	Pressure boundary Structural Support
Drip pans	Leakage boundary (spatial)
Ductwork	Pressure Boundary
Fasteners	Pressure boundary
Filters	Filter Leakage boundary (spatial)
Flow elements	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Piping	Leakage boundary (spatial) Pressure boundary
Pump casings	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-19
Post Accident Sampling System

Component Groups	Intended Function
Fasteners	Pressure boundary
Heat exchanger	Leakage boundary (spatial)
Piping	Pressure boundary Leakage boundary (spatial)
Separators	Leakage boundary (spatial)
Valve body	Pressure boundary Leakage boundary (spatial) Structural integrity (attached)

Table 2.3.3-20
Primary Containment Heating, Ventilation, and Air Conditioning

Component Groups	Intended Function
Fasteners	Leakage boundary (spatial) Pressure boundary
Filters	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Instrumentation (Flow Gauge)	Leakage boundary (spatial)
Piping	Leakage boundary (spatial) Pressure boundary
Pump casings	Leakage boundary (spatial)
Thermowell	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.3-21
Reactor Building and Radwaste Building Sampling System

Component Groups	Intended Function
Fasteners	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Flow controller	Leakage boundary (spatial)
Instrumentation (Level Gauge, Flow Gauge)	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Pump casings	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-22
Reactor Building Closed Cooling Water System

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial)
Fasteners	Pressure boundary
Heat exchanger	Leakage boundary (spatial)
Instrumentation (Flow Gauges, Level Gauge)	Leakage boundary (spatial)
Piping	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)
Pump casings	Leakage boundary (spatial)
Thermowell	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.3-23
Reactor Building Heating, Ventilation, and Air Conditioning

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial)
Drip pans	Pressure boundary
Ductwork	Pressure boundary
Fasteners	Pressure boundary
Heat exchanger	Heat transfer Leakage boundary (spatial) Pressure boundary
Piping	Leakage boundary (spatial)
Pump casings	Leakage boundary (spatial)
Separators	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-24
Reactor Water Cleanup System

Component Groups	Intended Function
Fasteners	Leakage boundary (spatial) Pressure boundary
Filters	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Flow element	Leakage boundary (spatial) Pressure boundary Throttle
Flow orifice	Leakage boundary (spatial)
Manifold	Leakage boundary (spatial)
Piping	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)
Pump casings	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.3-25
RHR Service Water System

Component Groups	Intended Function
Fasteners	Pressure boundary
Filters	Pressure boundary
Instrumentation (Flow Element)	Leakage boundary (spatial) Pressure boundary
Piping	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)
Pump casings	Pressure boundary
Thermowell	Pressure boundary
Valve body	Leakage boundary (spatial) Pressure boundary Pressure relief Structural integrity (attached)

Table 2.3.3-26
River Water Supply System

Component Groups	Intended Function
Fasteners	Pressure boundary
Instrumentation (Flow Element)	Pressure boundary Structural integrity (attached) Throttle
Piping	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)
Pump casings	Pressure boundary
Valve body	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)

Table 2.3.3-27
Safety Related Air System

Component Groups	Intended Function
Pressure vessel	Pressure boundary
Fasteners	Pressure boundary
Filters	Pressure boundary
Heat exchanger	Heat transfer Pressure boundary
Piping	Pressure boundary
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.3-28
Solid Radwaste

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial)
Fasteners	Leakage boundary (spatial)
Filters	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Pump casings	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-29
Standby Diesel Generators

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)
Heater housing	Pressure boundary
Fasteners	Pressure boundary
Filters	Filter Leakage boundary (spatial) Pressure boundary Structural integrity (attached)
Heat exchanger	Heat transfer Pressure boundary
Instrumentation (Level Indicators)	Pressure boundary Structural integrity (attached)
Piping	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)
Pump casings	Pressure boundary
Valve body	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)

Table 2.3.3-30
Standby Liquid Control System

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial) Pressure boundary
Fasteners	Pressure boundary
Instrumentation (Level Gauge)	Leakage boundary (spatial)
Piping	Leakage boundary (spatial) Pressure boundary
Pump casings	Pressure boundary
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.3-31
Turbine Building Sampling System

Component Groups	Intended Function
Fasteners	Leakage boundary (spatial)
Filters	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Instrumentation (Flow Indicator, Level Gauge)	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Pump casings	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-32
Well Water System

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial)
Fasteners	Leakage boundary (spatial)
Filters	Leakage boundary (spatial)
Instrumentation (Flow Indicators, Flow Elements)	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Pump casings	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.3-33
Zinc Injection System

Component Groups	Intended Function
Fasteners	Leakage boundary (spatial)
Filters	Leakage boundary (spatial)
Instrumentation (Flow Element)	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Pressure vessels	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

2.3.4 STEAM AND POWER CONVERSION SYSTEMS

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

The following systems are addressed in this subsection:

- Condensate and Demineralized Water System
- Condensate and Feedwater System
- Condenser and Condenser Air Removal System
- Main Steam Isolation and Automatic Depressurization System
- Turbine

2.3.4.1 Condensate and Demineralized Water System

2.3.4.1.1 <u>System Description</u>

The Condensate and Demineralized Water System includes the Condensate Storage and Transfer System, Condensate Demineralizer System and the Makeup Water Treatment System.

The Condensate Storage and Transfer System stores the condensate required for the operation and servicing of the nuclear power plant and transfers this condensate for various uses. The system includes two 200,000-gal condensate storage tanks which provide sufficient capacity for refueling, normal service, and emergency demand and two 100% capacity pumps and one jockey pump.

The storage tanks have an approximate 75,000-gallon total reserve for Reactor Core Isolation Cooling and High Pressure Coolant Injection. The condensate storage tank requirements are physically isolated from the emergency volume by suction lines raised to an elevation above the approximate 75,000-gallon reserve.

The condensate storage tanks overflow to the reactor building equipment drain sump by way of a 1000-gallon overflow tank. In an emergency, this tank will overflow to the area around the tanks. The tanks are enclosed by a dike with a concrete pad preventing the entry of condensate into the ground. The diked area has sufficient capacity to contain the volume of water stored in one condensate storage tank and has a sump to collect rainwater and permit sampling to determine disposal. The disposal, through normally locked closed valves under administrative control will be to the discharge canal or to the radwaste disposal system depending on the concentration of radioactivity.

The Condensate Demineralizer System ensures that water of the required purity is supplied to the reactor. The Condensate Demineralizer System consists of five filter-demineralizer vessels and the associated piping, instrumentation, and controls to facilitate continuous processing of the design condensate flow.

The Makeup Water Treatment System processes and stores demineralized water for use in the plant. The system is supplied from the Well Water System and processes the well water using portable demineralizers. The demineralized water is stored in an 50,000 gallon lined carbon steel tank. Two transfer pumps are used to supply plant requirements for demineralized water or to supply makeup to the condensate storage tank.

2.3.4.1.2 System Functions

The Condensate and Demineralized Water System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Station Blackout (10 CFR 50.63)

2.3.4.1.3 UFSAR Reference

Additional Condensate and Demineralized Water System details are provided in Section 9.2.6 of the Duane Arnold UFSAR.

2.3.4.1.4 License Renewal Drawings

The license renewal drawings for the Condensate and Demineralized Water System are listed below:

BECH-M106-LR	BECH-M108-LR	BECH-M109-LR
BECH-M110-LR	BECH-M112-LR	BECH-M113-LR
BECH-M119-LR	BECH-M120-LR	BECH-M121-LR
BECH-M126-LR	BECH-M128-LR	BECH-M132(1)-LR
BECH-M134-LR	BECH-M136-LR	BECH-M138(1)-LR
BECH-M138(1A)-LR	BECH-M139-LR	BECH-M140-LR
BECH-M141-LR	BECH-M144(1)-LR	BECH-M145(2)-LR
BECH-M147-LR	BECH-M149-LR	BECH-M160(1)-LR
BECH-M161-LR	BECH-M169(1)-LR	BECH-M169(2)-LR
BECH-M182-LR	BECH-M183-LR	

2.3.4.1.5 Components Subject to an Aging Management Review

LRA Table 2.3.4-1 lists the components and commodity groups of the Condensate and Demineralized Water System that require aging management review, including their intended function(s).

LRA Table 3.4.2-1 provides a summary of the results of the aging management review for the Condensate and Demineralized Water System.

2.3.4.2 Condensate and Feedwater System

2.3.4.2.1 System Description

The Condensate and Feedwater Systems includes the Feedwater Control System and the Extraction Steam, Heaters, Vents, and Drains System. The Condensate and Feedwater System provides a dependable supply of feedwater to the reactor, provides feedwater heating, and minimizes water-quality problems.

Two motor-driven, vertical, centrifugal condensate pumps deliver water through the steam packing exhauster condenser, air ejector, condensate demineralizer, and low-pressure feedwater heaters to the suction of the reactor feedwater pumps, with sufficient pressure to satisfy the net positive suction head requirements of the feed pumps.

Two motor-driven centrifugal feedwater pumps deliver water through the high-pressure heaters and the feedwater control valves to the reactor. During normal operation, the Feedwater Control System automatically regulates feedwater flow into the reactor vessel to control water level in the reactor vessel.

The feedwater heaters consist of two parallel strings of heaters, each containing five low pressure heaters and one high pressure heater. All heater vents are individually aligned to the main condenser. Heater drains are cascaded through the heaters to the main condenser.

The hotwell transfer system provides a means of transferring condensate from the condenser hotwell through the condensate demineralizers to the condensate storage tanks without the use of the condensate pumps. The hotwell is used during outages to store condensate from the torus, reactor vessel and other demineralized water systems.

2.3.4.2.2 System Function Listing

The Condensate and Feedwater System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Station Blackout (10 CFR 50.63)

2.3.4.2.3 UFSAR Reference

Additional Condensate and Feedwater System details are provided in Sections 7.7, 10.2, and 10.4 of the Duane Arnold UFSAR.

2.3.4.2.4 License Renewal Drawings

The license renewal drawings for the Condensate and Feedwater System are listed below:

BECH-M103(2)-LR	BECH-M103(3)-LR	BECH-M104(2)-LR
BECH-M104(3)-LR	BECH-M105(2)-LR	BECH-M105(3)-LR
BECH-M106-LR	BECH-M107-LR	BECH-M108-LR
BECH-M114-LR	BECH-M117-LR	BECH-M125-LR
BECH-M127-LR	BECH-M160(1)-LR	BECH-M189(1)-LR

2.3.4.2.5 Components Subject to an Aging Management Review

LRA Table 2.3.4-2 lists the components and commodity groups of the Condensate and Feedwater System that require aging management review, including their intended function(s).

LRA Table 3.4.2-2 provides a summary of the results of the aging management review for the Condensate and Feedwater System.

2.3.4.3 Condenser and Condenser Air Removal System

2.3.4.3.1 System Description

The main condenser provides a heat sink for the turbine exhaust steam and turbine bypass steam. It also dearates and stores the condensate for reuse after a period of radioactive decay. The Condenser Air Removal System removes all non-condensibles from the condenser.

The main condenser is a two pass, divided water box type of dual pressure, deaerating design. The condenser removes non-condensible gases from the condensate. The hotwell contains baffling to provide two minutes of radioactive decay time for short-lived isotopes. Two full capacity steam jet air ejectors, with inter and after-condensers are provided to remove the air and non-condensibles from the main condenser and direct it to the offgas system. A mechanical vacuum pump is provided to evacuate the turbine and condenser during startup and shutdown. The mechanical vacuum pump discharge is directed though the same delay line as the turbine gland seal exhaust to the offgas stack for elevated release.

The main steam line drains and the main condenser provide a main steam isolation valve leakage path designed to mitigate the release of fission products following a LOCA. This is accomplished by directing main steam isolation valve leakage to the main condenser via the outboard main steam line drain line. Other systems connected to main steam are isolated to ensure that leakage is processed through this path.

2.3.4.3.2 System Function Listing

The Condenser and Condenser Air Removal System is in scope for license renewal because it contains:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Environmental Qualification (10 CFR 50.49)

2.3.4.3.3 UFSAR Reference

Additional Condenser and Condenser Air Removal System details are provided in Sections 6.7, 10.4.1, and 10.4.2 of the Duane Arnold UFSAR.

2.3.4.3.4 License Renewal Drawings

The license renewal drawings for the Condenser and Condenser Air Removal System are listed below:

BECH-M103(1)-LR	BECH-M103(2)-LR	BECH-M103(3)-LR
BECH-M104(1)-LR	BECH-M104(2)-LR	BECH-M104(3)-LR
BECH-M105(1)-LR	BECH-M105(2)-LR	BECH-M105(3)-LR
BECH-M106-LR	BECH-M109-LR	BECH-M114-LR
BECH-M122-LR	BECH-M124-LR	BECH-M134-LR
BECH-M136-LR	BECH-M141-LR	BECH-M142-LR

2.3.4.3.5 Components Subject to an Aging Management Review

LRA Table 2.3.4-3 lists the components and commodity groups of the Condenser and Condenser Air Removal System that require aging management review, including their intended function(s).

LRA Table 3.4.2-3 provides a summary of the results of the aging management review for the Condenser and Condenser Air Removal System.

2.3.4.4 Main Steam Isolation and Automatic Depressurization System

2.3.4.4.1 System Description

The Main Steam Isolation and Automatic Depressurization System (ADS) includes the Nuclear Steam Supply Shutoff System, Main Steam Downstream of the Main Steam Isolation Valves, and Low-Low Set Safety and Relief Valves.

The Main Steam System transports steam from the reactor vessel through the primary containment to the main turbine. The system supplies the high pressure coolant injection and the reactor core isolation cooling turbines and provides overpressure protection for the reactor vessel. The system maintains the integrity of the reactor coolant pressure boundary.

The system consists of four main steamlines between the reactor vessel and the main turbine. Two automatic isolation valves are provide in each main steamline. A venturi-type flow restrictor is installed in each steamline close to the reactor vessel. The Main Steam System is in the scope of license renewal.

The Automatic Depressurization System provides nuclear system depressurization for small breaks assuming failure of the High Pressure Cooling Injection System, so that the Low Pressure Coolant Injection and the Core Spray Systems can inject water into the reactor vessel. The system uses four of the nuclear system pressure relief valves to relieve the high pressure steam to the suppression pool. The Automatic Depressurization System is in the scope of license renewal.

The Nuclear Steam Supply System Shutoff Valves provides for automatic actuation of the valves necessary to close to isolate the primary containment and/or the reactor vessel. The Nuclear Steam Supply Shutoff Valves are in the scope of license renewal.

Main Steam Downstream of the Main Steam Isolation Valves includes the main steamlines up to the turbine inlets, the reheat steamlines, and the turbine bypass lines. Main Steam Downstream of the Main Steam Isolation Valves are in the scope of license renewal.

The Low-Low Set Safety Relief Valve logic causes the low-low set relief valves to be opened at a lower pressure after reactor pressure has exceeded the scram setpoint and any safety-relief valve has opened at its normal steam setpoint, and stays open longer, due to expanded open and reclose setpoints for subsequent actuations. This mitigates the induced loads on the containment and the thrust loads on the safety relief valve discharge lines by increasing the time between subsequent safety relief valve actuations. The Low-Low Set Safety Relief Valve logic is in the scope of license renewal.

2.3.4.4.2 System Function Listing

The Main Steam Isolation and Automatic Depressurization System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)1)

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)2)
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Environmental Qualification (10 CFR 50.49)
  - Anticipated Transients Without Scram (10 CFR 50.62)
  - Station Blackout (10 CFR 50.63)

2.3.4.4.3 UFSAR Reference

Additional Main Steam Isolation and Automatic Depressurization System details are provided in Sections 5.4, 7.3.1, 10.2, and 10.3 of the Duane Arnold UFSAR.

2.3.4.4.4 License Renewal Drawings

The license renewal drawings for the Main Steam Isolation and Automatic Depressurization System are listed below:

BECH-M103(1)-LR	BECH-M104(1)-LR	BECH-M105(1)-LR
BECH-M106-LR	BECH-M114-LR	BECH-M184-LR

2.3.4.4.5 Components Subject to an Aging Management Review

LRA Table 2.3.4-4 lists the components and commodity groups of the Main Steam Isolation and Automatic Depressurization System that require aging management review, including their intended function(s).

LRA Table 3.4.2-4 provides a summary of the results of the aging management review for the Main Steam Isolation and Automatic Depressurization System.

2.3.4.5 Turbine

2.3.4.5.1 System Description

The Turbine System includes the following systems: Main Turbine, Turbine Steam Seal System, Turbine Lube Oil System, Lube Oil Transfer, Purification, and Storage System, Hydrogen Seal Oil System, Main Generator Gas Control System, Electro-Hydraulic Control System, and Stator Cooling System.

The turbine is a General Electric 1800 rpm, tandem-compound, four flow, three casing, condensing, two stage reheat unit. The turbine consist of one high pressure shell plus two double flow low pressure shells. Steam from the high pressure shell is reheated with extraction steam and main steam in two stages prior to entering the low pressure sections.

Turbine controls include an electro-hydraulic control system, control valves, main stop valves, combined intercept valves, initial pressure regulator and backup controller, steam bypass system, and emergency mechanical overspeed trip. There is a stop valve and a turbine control valve in each of the four main steam lines.

The Turbine Steam Seal System provides steam to the turbine seals and collects and condenses sealing steam in the steam packing exhauster condenser. The condensate from the steam packing exhauster is returned to the main condenser. Non-condensable gases are exhausted to the offgas system.

The Hydrogen Seal Oil System provides a constant flow of oil to the two seals located on either end of the generator rotor. The seals prevent hydrogen from escaping into the Turbine Building atmosphere and prevent air from entering the generator casing along the shaft. The hydrogen seal oil main pump draws oil from the seal oil vacuum tank and delivers it to the two seals via a pressure regulator and a strainer. The pressure regulator ensures seal oil pressure is higher than generator casing pressure.

The hydrogen seal oil vacuum pump maintains the seal oil vacuum tank below atmospheric pressure. A hydrogen seal oil emergency pump is provided to maintain seal oil pressure in the event of system failure.

The Main Generator Gas Control System supplies hydrogen gas to the main generator which provides a low density gas which is circulated through the main generator and through hydrogen coolers to provide cooling to the field windings.

The Stator Cooling System removes heat from the main generator stator and main field rectifiers while the generator is under load. During normal operation, one of the stator coolant pumps provides flow through the system while the other pump is in standby. The operating pump takes suction on the stator winding cooling water tank and discharges to the stator water coolers and a bypass line around the coolers.

The cooling water is divided into three parallel paths, one path for the main generator stator windings, another for the main field rectifiers, and the third for the system deionizer.

The Turbine Generator requires a clean supply of lubricating oil during operation to maintain proper performance. The Turbine Lube Oil System provides lubricating oil for turbine bearings, thrust bearing wear detector, turbine overspeed switch, turbine low speed switch, and seal oil vacuum tank. The Lube Oil Transfer and Storage System is used to ensure a source of clean oil is always available for use by the Turbine Lube Oil System.

The major components of the Turbine Lube Oil System are the lube oil tank, lube oil tank vapor extractor, lube oil coolers, turning gear oil pump, turbine bearing lift pumps, motor suction pump, oil driven booster pump, main shaft oil pump, and the emergency bearing oil pump. The emergency bearing oil pump, turning gear oil pump, bearing lift pumps, and turning gear drive motor protect the main turbine in the event of a trip or malfunction.

2.3.4.5.2 System Function Listing

The Turbine System is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1))
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2))

2.3.4.5.3 UFSAR Reference

Additional Turbine System details are provided in Sections 7.7.2, 10.2 and 10.4.3 of the Duane Arnold UFSAR.

2.3.4.5.4 License Renewal Drawings

The license renewal drawings for the Turbine System are listed below:

BECH-M103(1)-LR	BECH-M103(2)-LR	BECH-M103(3)-LR
BECH-M104(1)-LR	BECH-M104(2)-LR	BECH-M104(3)-LR
BECH-M105(1)-LR	BECH-M105(2)-LR	BECH-M105(3)-LR
BECH-M106-LR	BECH-M111-LR	BECH-M131-LR
BECH-M145(1)-LR	BECH-M145(2)-LR	BECH-M145(4)-LR

2.3.4.5.5 Components Subject to an Aging Management Review

LRA Table 2.3.4-5 lists the components and commodity groups of the Turbine System that require aging management review, including their intended function(s).

LRA Table 3.4.2-5 provides a summary of the results of the aging management review for the Turbine System.

Table 2.3.4-1
Condensate and Demineralized Water System

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial) Pressure boundary
Demineralizer	Leakage boundary (spatial)
Eductor	Leakage boundary (spatial)
Fasteners	Leakage boundary (spatial) Pressure boundary
Filters	Leakage boundary (spatial)
Flow elements	Leakage boundary (spatial)
Flow gauge	Leakage boundary (spatial)
Flow orifice	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Level gauge	Leakage boundary (spatial)
Piping	Leakage boundary (spatial) Pressure boundary
Pump casings	Leakage boundary (spatial)
Thermowell	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.4-2
Condensate and Feedwater System

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial)
Fasteners	Leakage boundary (spatial)
Filters	Leakage boundary (spatial)
Flow elements	Leakage boundary (spatial)
Flow gauge	Leakage boundary (spatial)
Flow orifice	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Level gauge	Leakage boundary (spatial)
Piping	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)
Pump casings	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.4-3
Condenser and Condenser Air Removal System

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial)
Expansion joint	Leakage boundary (spatial)
Fasteners	Leakage boundary (spatial)
Filters	Leakage boundary (spatial)
Flow elements	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Level gauge	Leakage boundary (spatial)
Piping	Leakage boundary (spatial)
Pump casings	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial)

Table 2.3.4-4
Main Steam Isolation and Automatic Depressurization System

Component Groups	Intended Function
Pressure vessel	Pressure boundary
Fasteners	Pressure boundary
Flow element Class 1	Throttle
Flow orifice	Leakage boundary (spatial) Pressure boundary
Piping	Leakage boundary (spatial) Pressure boundary
Valve operator (Pilot valve)	Pressure boundary
Valve body	Leakage boundary (spatial) Pressure boundary

Table 2.3.4-5
Turbine

Component Groups	Intended Function
Pressure vessel	Leakage boundary (spatial)
Blower	Leakage boundary (spatial)
Fasteners	Leakage boundary (spatial)
Filters	Leakage boundary (spatial)
Heat exchanger	Leakage boundary (spatial)
Instrumentation (Flow Gauges, Flow Indicators, Sight Glass, Level Gauges, Flow Elements, Flow Orifices)	Leakage boundary (spatial)
Piping	Leakage boundary (spatial) Pressure boundary
Pump casings	Leakage boundary (spatial)
Thermowell	Leakage boundary (spatial)
Turbine	Leakage boundary (spatial)
Valve body	Leakage boundary (spatial) Pressure boundary

2.3.5 REFERENCES

2.3-1 10 CFR 50.67- Code of Federal Regulations, Title 10 – Energy, Accident Source Term.

2.3-2 Regulatory Guide 1.183, Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors.

2.3-3 NUREG-0737, Clarification of TMI Action Plan Requirements

2.3-4 Regulatory Guide 1.2.1, Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants, Revision 1.

2.4 SCOPING AND SCREENING RESULTS: STRUCTURES AND STRUCTUAL COMPONENTS

The determination of structures and structural components within the scope of license renewal is made by identifying Duane Arnold structures and structural components and then reviewing them to determine which ones satisfy one or more of the criteria in 10 CFR 54.4. This process is described in LRA Section 2.1 and the results of the structures and structural components review are contained in LRA Section 2.2.

LRA Section 2.1 also provides the methodology for determining the components within the scope of 10 CFR 54.4 that meet the requirements contained in 10 CFR 54.21(a)(1). The structural components that meet these screening criteria are identified in this section. These identified structural components subsequently require an aging management review for license renewal.

The major structures and structural components in the scope of license renewal:

- Buildings, Structures Affecting Safety
- Control Building
- Cranes and Hoists
- Intake Structure
- Miscellaneous Yard Structures
- Offgas Stack
- Primary Containment Structure
- Pump House
- Reactor Building
- Supports
- Turbine Building

2.4.1 BUILDINGS, STRUCTURES AFFECTING SAFETY

2.4.1.1 System Description

Low-Level Radwaste Processing Facility

The Low-Level Radwaste Processing Facility is a concrete and steel structure that houses various components which process low-level radwaste. It is located next to the Low Level Radwaste Storage Building and adjacent to, but structurally separated from the Machine Shop, the Railroad Extension (Truck Bay), and the Offgas Retention Building.

Machine Shop

The Machine Shop is a single-story steel and concrete structure at grade. It is divided into general shop areas, tool room, maintenance office, toilet room, and decontamination area with all facilities serviced by a 5-ton overhead bridge crane. It is adjacent to, but separate from the Reactor Building, Low-Level Radwaste Storage Building, Low Level Radwaste Processing Facility, the Offgas Retention Building, and the Railroad Airlock.

Offgas Retention Building

The Offgas Retention Building is a two-level concrete and steel structure, with one level below grade and one level above grade. The Offgas Retention Building houses the principal components of the Offgas System. It is adjacent to the Low-Level Radwaste Processing Facility, Machine Shop, and the Railroad Airlock.

Radwaste Building

The Radwaste Building is a steel and concrete structure that houses the various components of the Radwaste System, as well as the control center for the Radwaste System. The structure is adjacent to, but structurally separated from, the Reactor Building.

Railroad Airlock

The Railroad Airlock is a non-seismic single-level building. The structure contains an airlock door leading to the Reactor Building and is part of the secondary containment. It is adjacent to the Reactor Building, the Machine Shop, and the Off-Gas Retention Building.

2.4.1.2 System Functions

The Buildings, Structures Affecting Safety are in scope for license renewal because they contain:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1)
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2)
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)

2.4.1.3 UFSAR Reference

Additional Buildings, Structures Affecting Safety details are provided in Sections 1.2.4 and 6.2.3 of the Duane Arnold UFSAR.

2.4.1.4 License Renewal Drawings

No license renewal drawing for the Buildings, Structures Affecting Safety is being provided.

2.4.1.5 Components Subject to an Aging Management Review

LRA Table 2.4-1 lists the components and commodity groups of the Buildings, Structures Affecting Safety that require aging management review, including their intended function(s).

LRA Table 3.5.2-1 provides a summary of the results of the aging management review for the Buildings, Structures Affecting Safety.

2.4.2 CONTROL BUILDING

2.4.2.1 System Description

The Control Building is a steel and concrete structure that houses the control room and associated auxiliaries, switchgear, battery rooms, and cable spreading room. The structure is adjacent to, but physically separate from the reactor and turbine buildings. The Control Building provides protection/support of safety related systems and equipment, and habitability for personnel and equipment in the event of a loss of coolant accident (LOCA) or hazardous chemical release.

2.4.2.2 System Functions

The Control Building is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1)
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2)
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Environmental Qualification (10 CFR 50.49)
    - Anticipated Transients Without Scram (10 CFR 50.62)
    - Station Blackout (10 CFR 50.63)

2.4.2.3 UFSAR Reference

Additional Control Building details are provided in Sections 1.2.4.5 and 6.4 of the Duane Arnold UFSAR.

2.4.2.4 License Renewal Drawings

No license renewal drawing for the Control Building is being provided.

2.4.2.5 Components Subject to an Aging Management Review

LRA Table 2.4-2 lists the components and commodity groups of the Control Building that require aging management review, including their intended function(s).

LRA Table 3.5.2-2 provides a summary of the results of the aging management review for the Control Building.

2.4.3 CRANES AND HOISTS

2.4.3.1 System Description

The following overhead handling systems and equipment are those at Duane Arnold from which a load drop could result in damage to irradiated fuel, plant shutdown systems, or decay heat removal systems:

- Reactor building crane.
- Turbine building crane.
- Recirculation pump motor hoist.
- Drywell shield blocks and personnel air lock hoist.
- Fuel pool demineralizer area hoist.
- Drywell equipment hatch hoist.
- Spent fuel pool gamma scan collimator port hoist.
- Torus monorail.

The following components are included because of their proximity to the reactor vessel and the spent fuel pool:

- Refueling platform
- Fuel pool jib crane

The following NUREG 0612 component is also included:

- South torus equipment hatch hoist

2.4.3.2 System Functions

The Cranes and Hoists are in scope for license renewal because they contain:

- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions(10 CFR 54.4(a)(2)

2.4.3.3 UFSAR Reference

Additional Cranes and Hoists details are provided in Section 9.1.4.4.1 of the Duane Arnold UFSAR.

2.4.3.4 License Renewal Drawings

There are no license renewal drawings for the Cranes and Hoists.

2.4.3.5 Components Subject to an Aging Management Review

LRA Table 2.4-3 lists the components and commodity groups of the Cranes and Hoists that require aging management review, including their intended function(s).

LRA Table 3.5.2-3 provides a summary of the results of the aging management review for the Cranes and Hoists.

2.4.4 INTAKE STRUCTURE

2.4.4.1 System Description

The Intake Structure is a reinforced-concrete structure that contains the pumps for the plant makeup water, a trash rake, traveling screens, and stop logs. The underground portion of the Intake Structure serves as channels for incoming water and the upper portions enclose the motors and controls. The Intake Structure is located on the west bank of the Cedar River. The location was selected because the largest river flows occur near the west bank and because the lateral movement of sediment is toward the east bank due to the secondary currents created by the bend upstream.

Seismic Category I equipment contained within the Intake Structure is located above the peak stage of the flood for the Cedar River. Therefore, no flood protection is required.

2.4.4.2 System Functions

The Intake Structure is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1)
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2)
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)

2.4.4.3 UFSAR Reference

Additional Intake Structure details are provided in Sections 1.2.4.7, 3.4.1.1.4.3, and 9.2.2.2 of the Duane Arnold UFSAR.

2.4.4.4 License Renewal Drawings

No license renewal drawing for the Intake Structure is being provided.

2.4.4.5 Components Subject to an Aging Management Review

LRA Table 2.4-4 lists the components and commodity groups of the Intake Structure that require aging management review, including their intended function(s).

LRA Table 3.5.2-4 provides a summary of the results of the aging management review for the Intake Structure.

2.4.5 MISCELLANEOUS YARD STRUCTURES

2.4.5.1 System Description

Miscellaneous Yard Structures includes structures and their structural components located outside the power block and auxiliary buildings. These structures include the yard and substation structures required to cope with station blackout event, the condensate storage tank foundations, the emergency diesel generator fuel oil tank anchors and the underground duct banks and manholes containing safety related circuitry. The Circulating Water dilution structure, located near the Pump House is included with the Miscellaneous Yard Structures.

2.4.5.2 System Functions

The Miscellaneous Yard Structures are in scope for license renewal because they contain:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1)
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2)
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Anticipated Transients Without Scram (10 CFR 50.62)
    - Station Blackout (10 CFR 50.63)

2.4.5.3 UFSAR Reference

Additional Miscellaneous Yard Structures details are provided in Sections 8.2, 8.3, and 11.2 of the Duane Arnold UFSAR.

2.4.5.4 License Renewal Drawings

No license renewal drawing for the Miscellaneous Yard Structures is being provided.

2.4.5.5 Components Subject to an Aging Management Review

LRA Table 2.4-5 lists the components and commodity groups of the Miscellaneous Yard Structures that require aging management review, including their intended function(s).

LRA Table 3.5.2-5 provides a summary of the results of the aging management review for the Miscellaneous Yard Structures.

2.4.6 OFFGAS STACK

2.4.6.1 System Description

The 100-meter Offgas Stack discharges gases to the atmosphere from the Standby Gas Treatment and Offgas Exhaust systems. The Offgas Stack is provided with required appurtenances, such as aviation obstruction lights and radiation monitoring instruments, in accordance with applicable codes and regulations. The Offgas Stack is designed in accordance with the criteria for Seismic Category I structures. However, the tornado design criteria are excluded because a collapse of the Offgas Stack would not prevent safe plant shutdown. It is more than 100 meters from the nearest Seismic Category I structure or equipment.

2.4.6.2 System Functions

The Offgas Stack is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1)
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2)

2.4.6.3 UFSAR Reference

Additional Offgas Stack details are provided in Section 1.2.4.3 of the Duane Arnold UFSAR.

2.4.6.4 License Renewal Drawings

No license renewal drawing for the Offgas Stack is being provided.

2.4.6.5 Components Subject to an Aging Management Review

LRA Table 2.4-6 lists the components and commodity groups of the Offgas Stack that require aging management review, including their intended function(s).

LRA Table 3.5.2-6 provides a summary of the results of the aging management review for the Offgas Stack.

2.4.7 PRIMARY CONTAINMENT STRUCTURE

2.4.7.1 System Description

The Primary Containment Structure is a Mark I containment system employing a drywell and a separate pressure suppression chamber (torus). The drywell houses the reactor vessel, reactor coolant recirculation loops, and branch connections of the Reactor Coolant System that have isolation valves at the primary containment boundary. The pressure suppression chamber consists of an air volume and a suppression water volume. The drywell and suppression chamber are connected through a vent system which directs flow from the drywell into the suppression water through submerged downcomers. The suppression chamber provides a source of water for Emergency Core Cooling Systems and is a heat sink in the event of a loss of coolant accident (LOCA).

2.4.7.2 System Functions

The Primary Containment Structure is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1)
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2)
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Environmental Qualification (10 CFR 50.49)
  - Anticipated Transients Without Scram (10 CFR 50.62)
  - Station Blackout (10 CFR 50.63)

2.4.7.3 UFSAR Reference

Additional Primary Containment Structure details are provided in Section 6.2 of the Duane Arnold UFSAR.

2.4.7.4 License Renewal Drawings

No license renewal drawing for the Primary Containment Structure is being provided.

2.4.7.5 Components Subject to an Aging Management Review

LRA Table 2.4-7 lists the components and commodity groups of the Primary Containment Structure that require aging management review, including their intended function(s).

LRA Table 3.5.2-7 provides a summary of the results of the aging management review for the Primary Containment Structure.

2.4.8 PUMP HOUSE

2.4.8.1 System Description

The Pump House is a single-level reinforced concrete structure constructed over a two-compartment basin. The circulating water pumps, general service water pumps, and fire pump are located in the area over one basin and the emergency service water pumps and RHR service water pumps are located over the other. Makeup to the pump house sumps is obtained directly from the Cedar River by the River Water System.

The portion of the Pump House containing the emergency service water pumps and the RHR service water pumps are designed to Seismic Category I criteria.

The Pump House was reviewed for the maximum probable flood for the Cedar River. All stoplogs, caulking and bracing required for flood protection are maintained at the site. In an event of circulating water line rupture in the Pump House, the pump room area housing the emergency service water pumps and the RHR service water pumps is protected by a seismic category I wall, including a watertight door.

2.4.8.2 System Functions

The Pump House is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1)
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Anticipated Transients Without Scram (10 CFR 50.62)
    - Station Blackout (10 CFR 50.63)

2.4.8.3 UFSAR Reference

Additional Pump House details are provided in Sections 1.2.4, 1.2.5, 1.3.2, 1.8.27, 3.4.1.1.4, and 10.4.5.3 of the Duane Arnold UFSAR.

2.4.8.4 License Renewal Drawings

No license renewal drawing for the Pump House is being provided.

2.4.8.5 Components Subject to an Aging Management Review

LRA Table 2.4-8 lists the components and commodity groups of the Pump House that require aging management review, including their intended function(s).

LRA Table 3.5.2-8 provides a summary of the results of the aging management review for the Pump House.

2.4.9 REACTOR BUILDING

2.4.9.1 System Description

The Reactor Building is a reinforced concrete structure that encloses the reactor, primary containment, spent fuel storage pools, and other auxiliary systems associated with the Nuclear Steam Supply System. Above the refueling floor, the Reactor Building is a steel rigid frame structure that supports roofing and a 100 ton traveling bridge crane.

The Reactor Building provides secondary containment for the reactor when in service and primary containment for the auxiliary systems and the reactor during periods when the primary containment is open for refueling or servicing. Normal primary containment for the reactor consists of the drywell and the pressure suppression chamber.

2.4.9.2 System Functions

The Reactor Building is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1)
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2)
- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Environmental Qualification (10 CFR 50.49)
    - Anticipated Transients Without Scram (10 CFR 50.62)
    - Station Blackout (10 CFR 50.63)

2.4.9.3 UFSAR Reference

Additional Reactor Building details are provided in Section 1.2.4.1 of the Duane Arnold UFSAR.

2.4.9.4 License Renewal Drawings

No license renewal drawing for the Reactor Building is being provided.

2.4.9.5 Components Subject to an Aging Management Review

LRA Table 2.4-9 lists the components and commodity groups of the Reactor Building that require aging management review, including their intended function(s).

LRA Table 3.5.2-9 provides a summary of the results of the aging management review for the Reactor Building.

2.4.10 SUPPORTS

2.4.10.1 System Description

Supports provide the connection between a system's equipment or component and a plant structural member (e.g., wall, floor, ceiling, column, and beam). They provide support for distributed loads (e.g., piping, tubing, ventilation ductwork, conduit, and cable trays) and localized loads (e.g., individual equipment). Specific types of equipment and components evaluated as part of this commodity group include:

- Pipe Supports/Restraints, Tube Track, and Instrument Tubing Supports - Includes all items used for supporting and / or restraining piping and components, tube track and instrument tubing. The support boundary includes the auxiliary steel back to the structure's surface, grout and anchor bolts.
- Equipment Supports - Includes structural steel, sliding surfaces, fasteners (e.g., bolts, studs, nuts) and vibration mounts that secure equipment to structures.
- Ventilation Ductwork Supports - Includes structural steel and fasteners that support / attach ventilation ductwork to structures.
- Raceways - Generic component type that is designed specifically for holding electrical wires and cables, such as cable trays, exposed and concealed metallic conduit or wireways. Commodity assets for raceways include both the component and the component's support and attachment.
- Electrical Enclosures - Generic component type that contains electrical components such as conduit, panels, boxes, cabinets, consoles, and bus ducts. An electrical enclosure includes both the enclosure and its supports and attachments.
- Platform and Masonry Wall Supports - Includes structural steel, fasteners that secure platforms and masonry walls to structures.

2.4.10.2 System Functions

The structural component Supports is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1)
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2)

- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
    - Fire Protection (10 CFR 50.48)
    - Environmental Qualification (10 CFR 50.49)
    - Anticipated Transients Without Scram (10 CFR 50.62)
    - Station Blackout (10 CFR 50.63)

2.4.10.3 UFSAR Reference

Additional structural component Supports details are provided in Section 3.2 of the Duane Arnold UFSAR.

2.4.10.4 License Renewal Drawings

There are no license renewal drawings for the structural component Supports.

2.4.10.5 Components Subject to an Aging Management Review

LRA Table 2.4-10 lists the components and commodity groups of the structural component Supports that require aging management review, including their intended function(s).

LRA Table 3.5.2-10 provides a summary of the results of the aging management review for the structural component Supports.

2.4.11 TURBINE BUILDING

2.4.11.1 System Description

The Turbine Building is a steel and concrete structure that houses the turbine-generator and other components of the power conversion system. The Turbine Building houses the standby diesel generators and the plant heating boiler and associated auxiliaries. The Turbine Building has a steel superstructure of rigid frame construction in the main turbine house and of braced framed construction in the auxiliary bay. The rigid frame supports runway for a 125-ton crane.

2.4.11.2 System Functions

The Turbine Building is in scope for license renewal because it contains:

- SCs that are safety related and are relied upon to remain functional during and following design basis events (10 CFR 54.4(a)(1)
- SCs that are non-safety related whose failure could prevent satisfactory accomplishment of the safety related functions (10 CFR 54.4(a)(2)

- SCs that are relied upon to demonstrate compliance with the following NRC regulations (10 CFR 54.4(a)(3)):
  - Fire Protection (10 CFR 50.48)
  - Environmental Qualification (10 CFR 50.49)
  - Anticipated Transients Without Scram (10 CFR 50.62)
  - Station Blackout (10 CFR 50.63)

2.4.11.3 UFSAR Reference

Additional Turbine Building details are provided in Sections 1.2.4.2, 2.5.4.11, 3.4.1.1.4.2, and 3.6.1 of the Duane Arnold UFSAR.

2.4.11.4 License Renewal Drawings

No license renewal drawings for the Turbine Building are being provided.

2.4.11.5 Components Subject to an Aging Management Review

LRA Table 2.4-11 lists the components and commodity groups of the Turbine Building that require aging management review, including their intended function(s).

LRA Table 3.5.2-11 provides a summary of the results of the aging management review for the Turbine Building.

Table 2.4-1
Buildings, Structures Affecting Safety

Component Groups	Intended Function
Railroad airlock carbon steel in air/gas	Structural support
Railroad airlock door secondary containment seal in air/gas	Structural pressure barrier
Railroad airlock doors carbon steel in air/gas	Structural pressure barrier
Railroad airlock exterior concrete in atmosphere/weather	Structural pressure barrier
Railroad airlock interior concrete in air/gas	Structural pressure barrier Structural support
Low Level Radwaste Processing Facility concrete in air/gas	Structural pressure barrier
Machine shop concrete in air/gas	Structural pressure barrier
Off gas retention building concrete in air/gas	Structural pressure barrier
Radwaste building in air gas	Structural pressure barrier
Low Level Radwaste Processing Facility carbon steel in air/gas	Structural pressure barrier
Machine shop carbon steel in air/gas	Structural pressure barrier
Off gas retention building carbon steel in air/gas	Structural pressure barrier
Radwaste building carbon steel in air/gas	Structural pressure barrier

Table 2.4-2
Control Building

Component Groups	Intended Function
Built-up roofing in atmosphere/weather	Shelter, protection
Concrete below grade	Structural support
Concrete in air/gas	Fire barrier Missile barrier Shielding Structural support
Concrete in atmosphere/weather	Fire barrier Missile barrier Shielding Structural support
Concrete masonry units in air/gas	Fire barrier Missile barrier Shielding Structural support
Concrete masonry units in atmosphere/weather	Fire barrier Missile barrier Shelter, protection Structural support
Door carbon steel in air/gas	Control building habitability Structural support
Fire door in air/gas	Fire barrier
Penetration fire seal in air/gas	Control building habitability Fire barrier
Structural steel fire proofing in air/gas	Fire barrier
Structural steel in air/gas	Missile barrier Structural support
Control room suspended ceiling carbon steel in air/gas	Structural support

Table 2.4-3
Cranes and Hoists

Component Groups	Intended Function
Drywell monorails carbon steel in air/gas	Structural support
Reactor building crane in air/gas	Structural support
Reactor building crane carbon steel rails in air/gas	Structural support
Reactor building crane trolley in air/gas	Structural support
Reactor building monorails carbon steel in air/gas	Structural support
Refueling floor jib crane in air/gas	Structural support
Refueling platform in air/gas	Structural support
Refueling platform auxiliary hoist monorail in air/gas	Structural support
Refueling platform carbon steel rails in air/gas	Structural support
Torus monorail carbon steel in air/gas	Structural support
Turbine building crane in air/gas	Structural support
Turbine building crane carbon steel rails in air/gas	Structural support

Table 2.4-4
Intake Structure

Component Groups	Intended Function
Concrete masonry units in air/gas	Fire barrier Structural support
Built-up roofing in atmosphere/weather	Shelter, protection
Carbon steel buried	Structural support
Carbon steel embedded in concrete	Missile barrier Structural support
Carbon steel fire door in air/gas	Fire barrier
Carbon steel in air/gas	Structural integrity (attached) Structural support
Carbon steel in atmosphere/weather	Shutdown cooling water Structural support
Carbon steel in raw water	Structural support Structure
Concrete below grade	Shelter, protection Structural support Structure
Concrete in air/gas	Fire barrier Structural support Structure
Concrete in atmosphere/weather	Missile barrier Shelter, protection Structural support Structure
Concrete in raw water	Shelter, protection Structural support Structure
Grout in air/gas	Fire barrier Structural support

Table 2.4-5
Miscellaneous Yard Structures

Component Groups	Intended Function
Concrete masonry units inside manhole in atmosphere/weather	Fire barrier
Cooling tower basin concrete in atmosphere/weather	Structure
Cooling tower basin concrete in soil	Structure
Cooling tower basin concrete in raw water	Structure
Cooling tower basin concrete pipe in soil	Structure
Cooling tower basin concrete pipe in raw water	Structure
Condensate storage tank anchor bolt carbon steel in atmosphere/weather	Structure
Condensate storage tank foundation concrete below grade	Structural support Structure
Condensate storage tank foundation concrete in atmosphere/weather	Structural support Structure
Diesel generator fuel oil tank concrete anchor below grade	Structural support Structure
Diesel generator fuel oil tank wire rope below grade	Structural support Structure
Dilution structure reinforced concrete below grade	Structural support
Dilution structure reinforced concrete in atmosphere/weather	Missile barrier Structural support

Table 2.4-5 (continued)
Miscellaneous Yard Structures

Component Groups	Intended Function
Electrical cable manhole carbon steel lid in atmosphere/weather	Missile barrier Shelter, protection Structural support Structure
Electrical cable manhole concrete below grade	Shelter, protection Structural support Structure
Electrical cable manhole concrete in atmosphere/weather	Missile barrier Structural support Structure
Electrical cable manhole concrete masonry unit grout in atmosphere/weather	Fire barrier
Electrical cable trench concrete below grade	Structural support Structure
Electrical cable trench concrete in atmosphere/weather	Structural support Structure
Electrical duct bank concrete below grade	Shelter, protection Structural support Structure
Exhaust extension pipe carbon steel in atmosphere/weather	Flood barrier
Rigid steel duct embedded in reinforced concrete duct bank	Structural support
Stop logs carbon steel in atmosphere/weather	Flood barrier
Stop logs timber in atmosphere/weather	Flood barrier

Table 2.4-5 (continued)
Miscellaneous Yard Structures

Component Groups	Intended Function
Substation carbon steel structures in atmosphere/weather	Structure
Substation structure foundation below grade	Structural support Structure
Substation structure foundation in atmosphere/weather	Structural support Structure
Substation structure carbon steel control house in air/gas	Structure
Substation structure carbon steel control house in atmosphere/weather	Structure
Substation control building concrete in air/gas	Structural support Structure
Transformer foundation concrete below grade	Structural support Structure
Transformer foundation concrete in atmosphere/weather	Structural support Structure

Table 2.4-6
Offgas Stack

Component Groups	Intended Function
Concrete below grade	Shelter, protection Structural support
Exterior carbon steel fasteners in atmosphere/weather	Structural support
Exterior concrete	Shelter, protection Structural support
Exterior structural steel	Structural support
Interior block wall	Structural support
Interior carbon steel fasteners	Structural support
Interior concrete	Shelter, protection Structural support
Interior grout	Shelter, protection Structural support
Interior stainless steel fasteners	Structural support
Interior structural steel	Structural support
Interior structural steel - non-safety related affecting safety related	Structural support

Table 2.4-7
Primary Containment Structure

Component Groups	Intended Function
Drywell carbon steel liner and skirt embedded in concrete	Structural pressure barrier Structural support
Drywell electrical penetration carbon steel in air/gas	Shelter, protection Structural pressure barrier Structural support
Drywell hatches and airlock carbon steel in air/gas	Shelter, protection Structural pressure barrier Structural support
Drywell head access, equipment and control rod drive hatch elastomer in air/gas	Structural pressure barrier
Drywell head carbon steel in air/gas	Shelter, protection Structural pressure barrier Structural support
Drywell head elastomer in air/gas	Structural pressure barrier
Drywell head fasteners carbon steel in air/gas	Structural pressure barrier Structural support
Drywell head hatch carbon steel in air/gas	Structural pressure barrier
Drywell penetration carbon steel in air/gas	Structural pressure barrier Shelter. Protection Structural support
Drywell radial beam seat lubrite bearing in air/gas	Expansion/separation Structural support
Drywell shell carbon steel in air/gas	Shelter, protection Structural pressure barrier Structural support
Drywell shell carbon steel in air/gas (at air gap)	Shelter, protection Structural pressure barrier Structural support
Drywell structures carbon steel in air/gas	Missile barrier Pipe whip restraint Structural support

Table 2.4-7 (continued)
Primary Containment Structure

Component Groups	Intended Function
Miscellaneous elastomers in air/gas	Shelter, protection
Non-structural drywell/reactor pressure vessel bioshield concrete in air/gas	Shielding
Penetration bellows carbon steel in air/gas	Flood barrier HELB shielding Structural pressure barrier
Penetration bellows stainless steel in air/gas	Flood barrier HELB shielding Structural pressure barrier
Personnel airlock elastomer in air/gas	Structural pressure barrier
Primary containment reinforced concrete in air/gas	Shielding Structural support
Primary containment reinforced concrete in raw water	Shielding Structural support
Seismic restraint inspection port carbon steel in air/gas	Shelter, protection Structural pressure barrier
Seismic restraint inspection port elastomer (gasket) in air/gas	Structural pressure barrier
Torus downcomer carbon steel treated water	Pressure boundary
Torus carbon steel in air/gas	Shelter, protection Structural pressure barrier Structural support
Torus carbon steel structural steel in treated water	Structural support
Torus electrical penetration carbon steel in air/gas	Shelter, protection Structural pressure barrier Structural support
Torus hatch carbon steel in air/gas	Shelter, protection Structural pressure barrier
Torus hatch elastomer in air/gas	Structural pressure barrier
Torus penetration carbon steel in treated water	Structural pressure barrier Structural support

Table 2.4-7 (continued)
Primary Containment Structure

Component Groups	Intended Function
Torus shell and ring girders carbon steel in air/gas	Shelter, protection Structural pressure barrier Structural support
Torus shell and ring girders carbon steel in treated water	Structural pressure barrier Structural support
Torus thermowells carbon steel in treated water	Structural pressure barrier Structural support
Torus vent header and downcomer carbon steel in air/gas	Pressure boundary Structural pressure barrier
Vent line bellows stainless steel in air/gas	Expansion/separation Structural pressure barrier
Vent line carbon steel in air/gas	Pressure boundary Structural pressure barrier

Table 2.4-8
Pump House

Component Groups	Intended Function
Carbon steel in air/gas	Shelter, protection Structural support Structure
Carbon steel in atmosphere/weather	Shelter, protection Structural support Structure
Concrete below grade	Shelter, protection Structural support Structure
Concrete in air/gas	Fire barrier Shelter, protection Structural support Structure
Concrete in atmosphere/weather	Shelter, protection Structural support Structure
Concrete in raw water	Structural support Structure
Concrete masonry units in air/gas	Fire barrier Shelter, protection Structural support Structure
Fire door in air/gas	Fire barrier
Grout in air/gas	Fire barrier Shelter, protection Structural support Structure
Penetration fire seal elastomer in air/gas	Fire barrier
Penetration fire seal elastomer in atmosphere/weather	Fire barrier

Table 2.4-8 (continued)
Pump House

Component Groups	Intended Function
Penetration in air/gas	Fire barrier Flood barrier
Penetration in atmosphere/weather	Fire barrier Flood barrier
Roofing in atmosphere/weather	Shelter, protection
Wall/ceiling fire barrier	Fire barrier
Watertight (submarine) door in air/gas	Fire barrier Flood barrier
Watertight door fire seal elastomer in air/gas	Fire barrier Flood barrier

Table 2.4-9
Reactor Building

Component Groups	Intended Function
Airlock door in air/gas	Structural pressure barrier
Aluminum in air/gas	Shielding Structural support
Carbon steel in air/gas	Shelter, protection Structural support Structure
Carbon steel in atmosphere/weather	Shelter, protection Structural support Structure
Concrete below grade	Shelter, protection Structural support Structure
Concrete in air/gas	Fire barrier Missile barrier Shelter, protection Shielding Structural support
Concrete in atmosphere/weather	Shelter, protection Structural support Structure
Concrete masonry units in air/gas	Fire barrier Missile barrier Shelter, protection Structural support Structure
Door carbon steel in air/gas	Structural support

Table 2.4-9 (continued)
Reactor Building

Component Groups	Intended Function
Fire barrier in air/gas	Fire barrier
Fire door in air/gas	Fire barrier
Grout in air/gas	Fire barrier Shelter, protection Structural support Structure
Penetration bellows, carbon steel	Flood barrier Structural pressure barrier HELB shielding
Penetration bellows, stainless steel	Flood barrier Structural pressure barrier HELB shielding
Penetration fire barrier in air/gas	Fire barrier
Penetration fire barrier in atmosphere/weather	Fire barrier
Penetration flood barrier in air/gas	Fire barrier Flood barrier Structural pressure barrier
Penetration flood barrier in atmosphere/weather	Fire barrier Flood barrier Structural pressure barrier
Penetration secondary containment barrier in air/gas	Fire barrier Shielding Structural support
Penetration secondary containment barrier in atmosphere/weather	Fire barrier Shielding Structural support
Roofing in atmosphere/weather	Shelter, protection Structural pressure boundary

Table 2.4-9 (continued)
Reactor Building

Component Groups	Intended Function
Siding, carbon steel in air/gas	Structural pressure barrier
Siding, carbon steel in atmosphere/weather	Structural pressure barrier
Stainless steel in air/gas	Shelter, protection Structural support Structure
Stainless steel in atmosphere/weather	Shelter, protection Structural support Structure
Fuel Pool and components in treated water	Shelter, protection Structural support Structure
Steam tunnel blow out panels in air/gas	Pressure relief
Watertight (submarine) door in air/gas	Flood barrier
Watertight doors fire seal elastomer in air/gas	Fire barrier

Table 2.4-10
Supports

Component Groups	Intended Function
Fasteners, spring hangers, guides, stops, supports, new fuel storage racks, panels, carbon steel in air/gas	Structural support Structure
Panels, junction boxes, aluminum in air/gas	Structural support Structure
Reactor vessel stabilizer support, carbon steel embedded in concrete	Structural support Structure
Supports & platforms, carbon steel in treated water	Structural support
Supports & platforms, carbon steel in raw water	Structural support
Supports & platforms, concrete in atmosphere/weather	Structural support Structure
Supports, concrete below grade (soil)	Structural support Structure
Supports & platforms, concrete masonry units in air/gas	Structural support Structure
Support, defective fuel storage container stainless steel in air/gas	Structural support Structure
Supports, defective fuel storage container, Holtec spent fuel storage rack support stainless steel in treated water	Structural support Structure
Supports, panels carbon steel in atmosphere/weather	Structural support Structure
Supports (sliding surfaces) lubrite in air/gas	Structural support Structure
Vibration isolation elements, elastomer in air/gas	Structural support Structure

Table 2.4-11
Turbine Building

Component Groups	Intended Function
Carbon steel in air/gas	Shelter, protection Structural support Structure
Carbon steel in atmosphere/weather	Shelter, protection Structural support Structure
Concrete below grade	Structural support
Concrete in air/gas	Fire barrier Missile barrier Shelter, protection Shielding Structural support
Concrete in atmosphere/weather	Flood barrier Missile barrier Shelter, protection Structural support
Concrete masonry units in air/gas	Fire barrier Missile barrier Shelter, protection Shielding Structural integrity (attached) Structural support Structure

Table 2.4-11 (continued
Turbine Building

Component Groups	Intended Function
Concrete masonry units in atmosphere/weather	Missile barrier Shelter, protection Shielding Structural integrity (attached) Structural support Structure
Door carbon steel in air/gas	Structural support
Fire door in air/gas	Fire barrier
Airlock door in air/gas	Structural pressure barrier
Grout in air/gas	Fire barrier Shelter, protection Structural support Structure
Penetration elastomer in air/gas	Fire barrier Flood barrier Structural pressure barrier
Penetration elastomer in atmosphere/weather	Fire barrier Flood barrier Structural pressure barrier
Roofing in atmosphere/weather	Shelter, protection
Siding in air/gas	Shelter, protection
Siding in atmosphere/weather	Shelter, protection
Structural steel non-metallic fire proofing in air/gas	Fire barrier Shelter, protection

2.5 SCOPING AND SCREENING RESULTS: ELECTRICAL / INSTRUMENTATION AND CONTROLS (I&C) SYSTEMS

The determination of electrical / I&C systems within the scope of license renewal is made by initially identifying the electrical / I&C systems and their design functions. Each system is then reviewed to determine those that satisfy one or more of the criteria contained in 10 CFR 54.4 [Reference 2.5-1]. This process is described in LRA Subsection 2.1.3.4 and the results of the electrical / I&C systems review are listed in LRA Table 2.2-3.

The screening of electrical / I&C components was performed on a generic component commodity group basis for the in-scope electrical / I&C systems listed in LRA Table 2.2-3, as well as the electrical / I&C component commodity groups associated with the in-scope mechanical systems and buildings/structures listed in LRA Tables 2.2-1 and 2.2-2. The methodology employed is consistent with the guidance of NEI 95-10 [Reference 2.5-2].

The interface of electrical /I&C components with other types of components and the assessments of these components are provided in the appropriate mechanical or civil / structural sections. For example, the assessment of electrical racks, panels, frames, cabinets, cable trays, conduit, and their supports is provided in the civil / structural assessment documented in LRA Section 2.4. Active electrical components with passive mechanical functions, such as pressure switches, are covered in the associated mechanical system.

The screening included electrical / I&C components that were separate and not part of a larger component. For example, the wiring, terminal blocks, and connections located internal to a breaker cubicle were considered to be parts of the breaker. Accordingly, the breaker was screened, but not the internal parts.

2.5.1 ELECTRICAL / I&C COMMODITY GROUPS

The electrical / I&C component commodity groups were identified from a review of controlled drawings, the plant equipment database, and interface with parallel mechanical and civil / structural screening efforts. The list of electrical / I&C component commodity groups was reviewed against the commodity groups identified in Appendix B of NEI 95-10 [Reference 2.5-2]. The in-scope electrical / I&C component commodity groups identified at Duane Arnold are listed in LRA Table 2.5-1.

LRA Table 2.5-1 also contains the typical components associated with each commodity group and the intended functions for each commodity group.

2.5.2 APPLICATION OF SCREENING CRITERION 10 CFR 54.21(a)(1)(i) TO ELCTRICAL / I&C COMPONENT COMMODITY GROUPS

Following the identification of the electrical / I&C component commodity groups, the criterion 10 CFR 54.21(a)(1)(i) was applied to component commodity groups that perform their intended function passively. This evaluation was performed utilizing the guidance of 10 CFR 54.21(a)(1)(i) and NEI 95-10 [Reference 2.5-2]. Active components do not require an aging management review.

The following electrical / I&C component commodity groups were determined to meet screening criterion of 10 CFR 54.21(a)(1)(i) and were further evaluated against criterion 10 CFR 54.21(a)(1)(ii):

- Electrical Conductors including:
  - Transmission conductors and connections
  - Insulated cables and connections
  - Electrical Connections
  - Fuse Holders
  - Switchyard bus and connections
  - Metal Enclosed Bus
- High voltage insulators
- Electrical penetration assemblies

Note that the screening process determined that ground conductor and isolated phase electrical bus are not in-scope for license renewal since they are non-safety related and do meet the license renewal scoping criteria. In addition, Duane Arnold does not have a segregated electrical bus.

2.5.3 APPLICATION OF SCREENING CRITERION 10 CFR 54.21(a)(1)(ii) TO ELCTRICAL / I&C COMPONENT COMMODITY GROUPS

10 CFR 54.21(a)(1)(ii) allows the exclusion of those commodity groups that are subject to replacement based on a qualified life or specified time period. The 10 CFR 54.21(a)(1)(ii) screening criterion was applied to the specific component commodity groups that were not eliminated by application of the 10 CFR 54.21(a)(1)(i) screening criterion. The results of this review are discussed below:

2.5.3.1 Electrical Conductors

Electrical conductors that are not within the scope of the Environmental Qualification Program are in-scope for license renewal, are not periodically replaced, and are subject to an aging management review.

2.5.3.2 High Voltage Insulators

High voltage insulators are not within the scope of the Environmental Qualification Program. The high voltage insulators associated with Station Blackout Recovery are in-scope for license renewal, are not periodically replaced, and are subject to an aging management review.

2.5.3.3 Electrical Penetration Assemblies

There are 19 electrical penetration assemblies at Duane Arnold Energy Center. Seven of these penetrations are within the scope of the Environmental Qualification Program. The 12 remaining penetrations are in-scope for license renewal, are not periodically replaced, and are subject to an aging management review.

2.5.4 ELECTRICAL / I&C COMPONENTS REQUIRING AN AGING MANAGEMENT REVIEW

The electrical / I&C component commodity groups subject to an aging management review are listed:

- Electrical Conductors including:
  - Transmission conductors and connections
  - Insulated cables and connections
  - Electrical Connections
  - Fuse Holders
  - Switchyard bus and connections
  - Metal Enclosed Bus
- High Voltage Insulators
- Electrical Penetration Assemblies

The intended function for the electrical / I&C component commodity groups subject to an aging management review is to electrically connect specified sections of an electrical circuit to deliver voltage, current, or signal. The aging management review results for the electrical / I&C component commodity groups is discussed in LRA Section 3.6.

2.5.5 STATION BLACKOUT BOUNDARY

In addition to the plant electrical systems, certain switchyard components required to restore offsite power following a station blackout were included within the scope of license renewal as required by NUREG-1800 Section 2.5.2.1.1. These components are not relied on in safety analyses or plant evaluations to perform a function that demonstrates compliance with the current licensing basis for station blackout (SBO) (10 CFR 50.63). The scoping boundaries of the offsite power system are described below and shown on Figure 2.5-1. The scope includes the control cables for the breakers that are in scope.

2.5.5.1 Preferred Electrical Path

The Startup Transformer is the preferred offsite power source for the essential electrical buses. The in scope portion of preferred restoration paths are:

- Path A from the West 161 KV Switchyard Bus to the Essential Switchgear (1A3 and 1A4) includes 161 kV breaker CB5560 (Breaker K) and the Startup Transformer.

- Path B from the East 161 KV Switchyard Bus to the Essential Switchgear (1A3 and 1A4) includes 161 kV breaker CB5550 (Breaker J) and the Startup Transformer.

2.5.5.2 Secondary Electrical Path

The Standby Transformer is the secondary offsite power source for the essential electrical buses. The in scope portion of secondary restoration from the 36 KV Switchyard Bus to the Essential Switchgear (1A3 and 1A4) includes 36 kV breaker CB8490 (Breaker M) and the Standby Transformer.

2.5.6 REFERENCES

2.5-1 10 CFR, Code of Federal Regulations, Title 10, Energy

2.5-2 NEI 95-10, Industry Guidelines for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," Revision 6, Nuclear Energy Institute, June 2005.

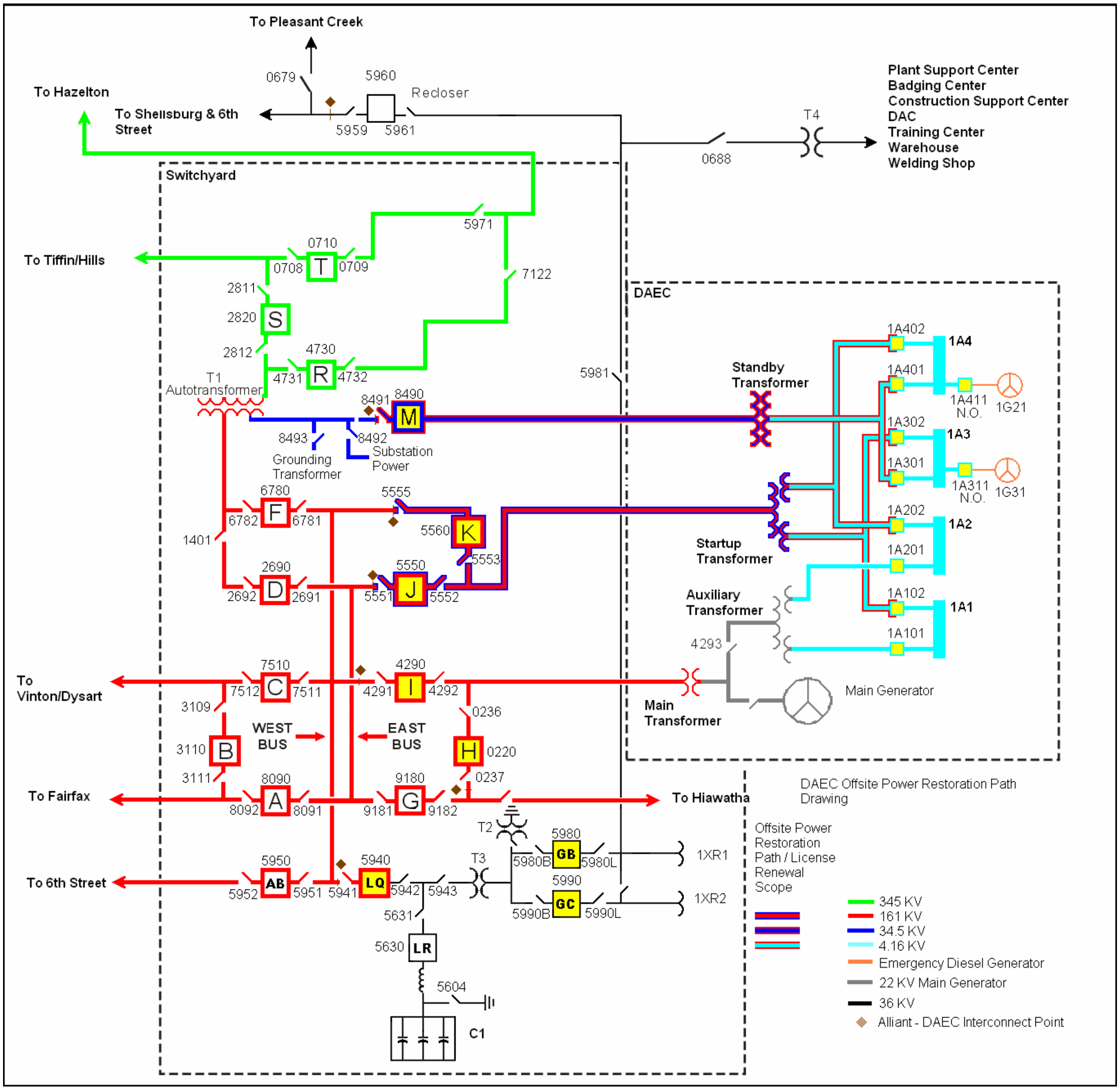
TABLE 2.5-1
ELECTRICAL / I&C COMPONENT COMMODITY GROUPS

Commodity Group	Typical Components	Intended Function	Active/Passive	Requires AMR
Electrical conductor	Transmission conductors and connections Insulated cables and connections Electrical Connections Fuse Holders Switchyard bus and connections Metal Enclosed Bus	Electrically connect specified sections of an electrical circuit to deliver voltage, current, or signal	Passive	Yes
Electrical penetration assembly	Primary containment penetrations	Electrically connect specified sections of an electrical circuit to deliver voltage, current, or signal	Passive	Yes
High voltage insulator	High voltage insulator	Insulate and support an electrical conductor	Passive	Yes

Notes:

1. This table does not include active electrical components.
2. Electrical racks, panels, frames, cabinets, cable trays, conduit, and their supports is provided in the civil / structural assessment documented in LRA Section 2.4.
3. Active electrical components with passive mechanical functions, such as pressure switches, are covered in the associated mechanical system.

Figure 2.5-1 Station Blackout Boundary / License Renewal Scope



3.0 AGING MANAGEMENT REVIEW RESULTS

For those structures and components that are identified as being subject to an aging management review, 10 CFR 54.21(a)(3) [Reference 3.0-1] requires demonstration that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. The information provided in this chapter provides essential input to the required aging management review as this chapter identifies and discusses the aging effects requiring management.

This chapter describes the results of the aging management reviews of the structures and components identified in LRA Chapter 2.0, "Structures and Components Subject to an Aging Management Review." This chapter:

- identifies the components, structural components, and commodity groups subject to aging management review, and their intended functions
- discusses the materials and internal and external environments
- describes or references the processes used to identify aging effects
- describes industry and plant-specific operating experiences with respect to the aging effects
- identifies the aging effects requiring management
- lists the aging management programs for aging effects requiring management
- provides references to the descriptions of common aging management programs

For those structures and components identified as being subject to an aging management review, the results are contained in following LRA Sections:

- Section 3.1 - Reactor Coolant Systems
- Section 3.2 - Engineered Safety Features
- Section 3.3 - Auxiliary Systems
- Section 3.4 - Steam And Power Conversion Systems
- Section 3.5 - Structures and Structural Components
- Section 3.6 - Electrical and Instrumentation and Control

Aging management program descriptions are contained in LRA Appendix B.

Descriptions of the internal and external service environments at Duane Arnold which are used in the aging management review to determine the aging effects requiring management are included in LRA Table 3.0-1, “Service Environment.” The environments used in the aging management reviews are listed in the Environment column.

3.0.1 GENERAL AGING MANAGEMENT REVIEW METHODOLOGY

3.0.1.1 Aging Management Review Process Overview

The aging management review process identifies those aging effects that require management during the period of extended operation and demonstrates either that the effects of aging will be managed by existing program(s) or that additional aging management program activities are required to ensure that the system or component intended function(s) will be maintained during the period of extended operation.

The aging effects and mechanisms that apply to a structure, component, or commodity group were determined by the material(s) of construction, operating environment(s), and stressors to which the material is exposed. Structures, components, or commodity groups constructed of the same material and exposed to the same environment are susceptible to the same aging effects and mechanisms. As a result, components were grouped according to material/environment combinations. Industry analysis tools and guidelines were the primary means to identify and evaluate aging effects. Operating experience, both industry and plant-specific, was also used to identify aging effects and to confirm the effectiveness of aging management programs.

The determination of the aging management programs credited for managing aging for the period of extended operation included a review of potential programs. Existing Duane Arnold programs were credited or were enhanced to adequately manage the effects of aging. When no existing program would satisfactorily manage aging, new programs were recommended. All programs that were credited for aging management were reviewed to assure that they satisfied the ten program elements described in NUREG-1800, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, and NUREG-1801 Generic Aging Lessons Learned (GALL) Report [References 3.0-2 and 3.0-3, respectively].

Any time-limited aging analyses (TLAAs) identified during the aging management review process are addressed in Section 4.0 of this application.

3.0.1.2 Use of NUREG-1800 and NUREG-1801

NUREG-1800 provides guidance to the NRC staff reviewers that perform safety reviews of license renewal applications in accordance with 10 CFR Part 54. The principal purpose of NUREG-1800 is to ensure the quality and uniformity of staff reviews and to present a well-defined base from which to evaluate applicant programs and activities for the period of extended operation.

NUREG-1801 is the technical basis document for NUREG-1800, which provides the NRC staff with guidance in reviewing an LRA. NUREG-1801 contains a compilation of aging management programs that the NRC has found to be generically acceptable to manage aging during the period of extended operation.

NUREG-1801 contains one acceptable method of managing aging effects for license renewal. An applicant may reference the NUREG in an LRA to demonstrate that the aging management programs at the applicant's facility correspond to those reviewed and approved in NUREG-1801. An applicant may also propose alternative plant-specific programs for managing aging effects.

Aging management program descriptions are provided in LRA Appendix B for each program credited for managing the effects of aging based on the aging management review results provided in LRA Sections 3.1 through 3.6. The aging management programs described in Appendix B each have ten program elements in accordance with the guidance in NUREG-1800. Each of the new or existing aging management programs has been evaluated for consistency with the ten elements described n NUREG-1801, Section X or XI program description. Evaluation results are provided for each program to indicate whether the program elements are consistent, consistent with enhancements, or consistent with exceptions, to the corresponding program in NUREG-1801.

3.0.1.3 Operating Experience

Operating experience is an important resource used to identify aging effects requiring management and to confirm the effectiveness of aging management programs. Both industry and plant-specific operating experience records were reviewed to identify information that is related to aging effects and aging management programs. The relevant operating experience records were further evaluated as necessary to support the aging management review process and the aging management program review process.

Extended power uprates (EPU) can affect aging management. In a NRC staff letter to the Advisory Committee on Reactor Safeguards, dated October 26, 2004, the NRC Executive Director for Operation states that, "All license renewal applications with an approved EPU will be required to perform an operating experience review and its impact on [aging] management programs for structures, and components before entering the period of extended operation." Duane Arnold implemented an extended power uprate in 2001. To satisfy this criterion, a commitment to perform an operating experience review and its impact on aging management programs for systems, structures, and components (SSCs) before entering the period of extended operation is being made as part of this license renewal application.

3.0.2 AGING MANAGEMENT REVIEW RESULTS DISPLAY METHOD

This section provides the results of the aging management review for those structures and components identified in LRA Chapter 2.0, Structures and Components Subject to an Aging Management Review.

Most of the aging management review results information is presented in the following two tables:

Table 3.x-1 - where '3' indicates the license renewal application chapter number, 'x' indicates the section number from NUREG-1801, Volume 1, and '1' indicates that this is the first table type in Section 3.x. For example, in the Reactor Coolant System Subsection, this table would be number 3.1-1, in the Engineered Safety Features subsection, this table would be 3.2-1, and so on.

Table 3.x.2-y - where '3' indicates the license renewal application chapter number, 'x' indicates the section number from NUREG-1801, Volume 1, and '2' indicates that this is the second table type in Section 3.x; and 'y' indicates the system table number. For example, for the Nuclear Boiler System, this table would be 3.1.2-1, and for the Reactor Vessel Recirculation System, it would be

table 3.1.2-2. For the Reactor Core Isolation Cooling System, within the Engineered Safety Features section, this table would be 3.2.2-4. For the next system (arranged alphabetically) within the Engineered Safety Features section, it would be table 3.2.2-5.

3.0.2.1 Table Description

NUREG-1801 is the NRC staff's generic evaluation of existing plant programs. It documents the technical basis for determining where existing programs are adequate without modification, and where existing programs should be augmented for the period of extended operation. The evaluation results documented in the report indicate that many existing programs are adequate to manage the effects of aging for particular structures or components, within the scope of license renewal without change. The report also contains recommendations on specific areas where existing programs should be augmented for license renewal. In order to take full advantage of NUREG-1801, a comparison between the aging management review results and the tables of NUREG-1801 has been made. The results of that review are provided in the two tables.

Table 3.x-1

The purpose of Table 3.x-1 is to provide a summary comparison of how the facility aligns with the corresponding tables of NUREG-1801, Volume 1. The table is essentially the same as Tables 1 through 6 provided in NUREG-1801, Volume 1, except that the "Type" column has been replaced by an "Item Number" column and the "Item Number in GALL" column has been replaced by a "Discussion" column.

The "Item Number" column provides the reviewer with a means to cross-reference from Table 3.x.2-y to Table 3.x-1.

The "Discussion" column provides clarifying/amplifying information. The following are examples of information that might be contained within this column:

1) "Further Evaluation Recommended" information or reference to where that information is located.
2) The name of a plant specific program being used.
3) Exceptions to the NUREG-1801 assumptions.
4) A discussion of how the line is consistent with the corresponding line item in NUREG-1801, Volume 1, when that may not be intuitively obvious.
5) A discussion of how the item is different from the corresponding line item in NUREG-1801, Volume 1, when it may appear to be consistent (e.g., when there is exception taken to an aging management program that is listed in NUREG-1801, Volume 1).

The format of Table 3.x-1 provides the reviewer with a means of aligning this table row with the corresponding NUREG-1801, Volume 1 table row, thereby allowing for the ease of checking consistency.

Table 3.x.2-y

Table 3.x.2-y provides the detailed results of the aging management reviews for those components and commodity groups identified in LRA Chapter 2.0 as being subject to aging management review. There will be a Table 3.x.2-y for each of the in-scope systems within a “system” grouping. For example, for Duane Arnold, the Engineered Safety Features System Group contains tables for High Pressure Coolant Injection System and Core Spray System.

Table 3.x.2-y consists of the following nine columns:

1) Component Type
2) Intended Function
3) Material
4) Environment
5) Aging Effect Requiring Management
6) Aging Management Programs
7) NUREG-1801 Volume 2 Line Item
8) Table 3.x-1 Line Item
9) Notes

These columns provide the following information:

1) Component Type

The first column identifies the component type (components or commodity group) from LRA Chapter 2.0 that are subject to aging management review. They are listed in alphabetical order.

2) Intended Function

The second column contains the license renewal intended functions for the listed component type. Definitions of intended functions are listed in LRA Table 2.1-1.

3) Material

The third column lists the particular materials of construction for the component type.

4) Environment

The fourth column lists the environment(s) to which the component type are exposed. Internal and external service environments are indicated. Table 3.0-1 lists the service environments applicable to Duane Arnold.

5) Aging Effect Requiring Management

As part of the aging management review process, the applicant determines any aging effects requiring management for the material and environment combination in order to maintain the intended function of the component type. These aging effects requiring management are listed in the fifth column.

6) Aging Management Programs

The aging management programs used to manage the aging effects requiring management are listed in the sixth column.

7) NUREG-1801 Vol. 2 Line Item

Each combination of component type, material, environment, aging effect requiring management, and aging management program that is listed in Table 3.x.2-y, is compared to NUREG-1801, Volume 2 with consideration given to the standard notes, to identify consistencies. When they are identified, they are documented by noting the appropriate NUREG-1801, Volume 2 item number in column seven of Table 3.x.2-y. If there is no corresponding item number in NUREG-1801, Volume 2, this row in column seven is blank. That way, a reviewer can readily identify where there is correspondence between the plant specific tables and the NUREG-1801, Volume 2 tables.

8) Table 3.x-1 Line Item

Each combination of component type, material, environment, aging effect requiring management, and aging management program that has an identified NUREG-1801 Volume 2 item number must also have a Table 3.x-1 line item reference number. The corresponding line item from Table 3.x-1 is listed in column eight of Table 3.x.2-y. If there is no corresponding item in NUREG-1801, Volume 1, this row in column eight is blank. This allows the information from the two tables to be correlated.

9) Notes

Column 9 contains notes that are used to describe the degree of consistency with the line items in NUREG-1801, Volume 2. Notes that use letter designations are standard notes based on Appendix F of Reference 3.0-3.

3.0.3 REFERENCES

3.0-1 Title 10, Code of Federal Regulations, Energy

3.0-2 NUREG-1800, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, Revision 1, September 2005.

3.0-3 NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Revision 1, September 2005.

TABLE 3.0-1
SERVICE ENVIRONMENTS

Category	Description
Adverse Localized Environments	The conductor insulation used for electrical commodities can be subjected to an adverse localized environment. This can be represented within a specific GALL AMR line item as being due to any of the following: (1) exposure to moisture and voltage (2) heat, radiation, or moisture, in the presence of oxygen (3) heat, radiation, or moisture, in the presence of oxygen or >60-year service limiting temperature, or (4) adverse localized environment caused by heat, radiation, oxygen, moisture, or voltage. The term ">60-year service limiting temperature" refers to that temperature that exceeds the temperature below which the material has a 60-year or greater service lifetime.
Air/gas	Air or gas on systems with temperatures higher than the dew point, i.e., condensation can occur but only rarely, equipment surfaces are normally dry. The drywell is made inert with nitrogen to render the primary containment atmosphere non-flammable by maintaining the oxygen content below 4% by volume during normal operation.
Atmosphere/weather	The outdoor environment consists of moist atmospheric air, ambient temperatures and humidity, and exposure to weather, including precipitation and wind. The component is exposed to air and local weather conditions. A component is considered susceptible to a wetted environment when it is submerged, has the potential to pool water, or is subject to external condensation.
Chemical other than Boric Acid	Chemical in liquid form other than Boric Acid.
Dried Air/Gas	Air or gas that has been treated to reduce the dew point well below the system operating temperature.
Embedded in Concrete	Components that come in contact, externally, with a concrete environment.
Fuel Oil	Diesel oil, No. 2 oil, or other liquid hydrocarbons used to fuel diesel engines. Fuel oil is used for combustion engines with possible water contamination.
Gas – Carbon Dioxide	Carbon Dioxide Gas
Glycol Corr Inhibited Treated Water	Treated Water with Glycol and Corrosion Inhibitor Added.
Hydraulic Oil	Hydraulic Oil used in instrumentation systems. Water contamination of hydraulic fluid is not assumed unless indicated by operating experience.
Lube Oil	Lubricating oils are low-to-medium viscosity hydrocarbons, with the possibility of containing contaminants and/or moisture, used for bearing, gear, and engine lubrication. Piping, piping components, and piping elements, whether copper, stainless steel, or steel, when exposed to lubricating oil that does not have water pooling, will have limited susceptibility to aging degradation, due to general or localized corrosion.

TABLE 3.0-1 (continued)
SERVICE ENVIRONMENTS

Category	Description
Raw water	Raw water is water that enters the plant from a river, lake, pond, or rain/ground water source that has not been demineralized or chemically treated to any significant extent. In general, the water is rough-filtered to remove large particles. Biocides may be added to control microorganisms or macroorganisms. Raw water includes water that leaks from any system and damp soil (moist soil/earth) containing groundwater.
Soil	Mixture of inorganic materials produced by the weathering of rocks and clays, and organic material produced by the decomposition of vegetation. Voids containing air and moisture occupy ~50% of the soil volume. Properties of soil that can affect degradation kinetics include water content, pH, ion exchange capacity, density, and permeability. External environment for components exposed to soil (including the air/soil interface) or buried in the soil, including groundwater in the soil.
Steam	Steam, subject to BWR water chemistry program. Defining temperature of steam is not considered necessary for analysis.
Treated water	Treated water is demineralized water, which is the base water for all clean systems. Depending on the system, this demineralized water may require additional processing. Treated water could be deaerated and include corrosion inhibitors, biocides, or some combination of these treatments.
Wet Air Gas	The environment to which the internal or external surface of the component or structure is exposed. Condensation on the surfaces of systems with temperatures below the dew point is considered raw water, due to potential for surface contamination.

3.1 AGING MANAGEMENT OF REACTOR COOLANT SYSTEMS

This section provides the results of the aging management review for those components and commodity groups identified in LRA Subsection 2.3.1, Scoping and Screening Results: Reactor Coolant Systems, as being subject to aging management review. The systems, or portions of systems, which are addressed in this section, are described in the indicated sections.

- Subsection 2.3.1.1 – Nuclear Boiler
- Subsection 2.3.1.2 - Reactor Vessel Recirculation System

Table 3.1-1, Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 [Reference 3.1-1] for Reactor Coolant Systems, provides the summary of the programs evaluated in NUREG-1801 for the Reactor Coolant Systems components and commodity groups that are relied on for license renewal. This table uses the format described in Section 3.0. Note that this table only includes those components and commodity groups that are applicable to a boiling water reactor.

3.1.1 RESULTS SUMMARY

The materials that specific components and commodity groups are fabricated from, the environments to which components and commodity groups are exposed, the potential aging effects requiring management, and the aging management programs used to manage these aging effects are provided for each of the Reactor Coolant Systems in the following subsections: The corresponding tables summarize the results of the aging management review for systems in the Reactor Coolant Systems group:

- Nuclear Boiler - Subsection 3.1.1.1 and Table 3.1.2-1
- Reactor Vessel Recirculation System - Subsection 3.1.1.2 and Table 3.1.2-2.

3.1.1.1 Nuclear Boiler

Materials

The materials of construction for the Nuclear Boiler components and commodity groups are:

- Carbon steel
- Carbon steel with stainless steel cladding
- Cast austenitic stainless steel
- Inconel
- Low alloy steel
- Low alloy steel with stainless steel cladding
- Nickel alloy
- Stainless steel

Environments

The Nuclear Boiler components and commodity groups are exposed to the following environments:

- Air/gas
- Steam
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Nuclear Boiler components and commodity groups, require management:

- Cracking
- Cumulative fatigue damage/fatigue
- Loss of material
- Loss of preload
- Loss of fracture toughness

Aging Management Programs

The following aging management programs manage the aging effects for the Nuclear Boiler components and commodity groups:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Bolting Integrity Program
- BWR Control Rod Drive Return Line Nozzle Program
- BWR Feedwater Nozzle Program
- BWR Penetrations Program
- BWR Stress Corrosion Cracking Program
- BWR Vessel ID Attachment Welds Program
- BWR Vessel Internals Program
- One-Time Inspection Program
- Reactor Head Closure Studs Program
- Reactor Vessel Surveillance Program
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.1.2-1.

3.1.1.2 Reactor Vessel Recirculation System

Materials

The materials of construction for the Reactor Vessel Recirculation System components and commodity groups are:

- Carbon steel
- Cast austenitic stainless steel
- Glass
- Stainless steel

Environment

The Reactor Vessel Recirculation System components and commodity groups are exposed to the following environments:

- Lube oil
- Air/gas
- Raw water
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Reactor Vessel Recirculation System components and commodity groups, require management:

- Cracking
- Cumulative fatigue damage/fatigue
- Loss of material
- Loss of preload
- Loss of fracture toughness

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Vessel Recirculation System components and commodity groups:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Bolting Integrity Program
- BWR Stress Corrosion Cracking Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program

- One-Time Inspection Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.1.2-2.

3.1.2 FURTHER EVALUATION OF AGING MANAGEMENT AS RECOMMENDED BY NUREG-1801

NUREG-1801 Volume 1 Tables provide the basis for identifying those programs that warrant further evaluation by the reviewer in the license renewal application. For the Reactor Coolant Systems components and commodity groups, those programs are addressed in the following sections. (The following subsections are numbered to correspond to the appropriate section of NUREG-1800.) [Reference 3.1-2]

3.1.2.2.1 Cumulative Fatigue Damage

Fatigue is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). This TLAA is addressed separately in Section 4.3, “Metal Fatigue Analysis,” of NUREG-1800.

Fatigue is a TLAA for the reactor pressure vessel and components of the reactor coolant pressure boundary. The evaluation of this TLAA is addressed separately in LRA Subsection 4.3.

3.1.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

1. Loss of material due to general, pitting, and crevice corrosion could occur in the steel PWR steam generator shell assembly exposed to secondary feedwater and steam. Loss of material due to general, pitting, and crevice corrosion could also occur for the steel top head enclosure (without cladding) top head nozzles [vent, top head spray or reactor core isolation cooling (RCIC), and spare] exposed to reactor coolant.

   At Duane Arnold, the reactor pressure vessel and reactor coolant pressure boundary steel components exposed to treated water (reactor coolant) are managed for loss of material due to general, crevice, and pitting corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of stagnant flow.

2. Loss of material due to pitting and crevice corrosion could occur in stainless steel BWR isolation condenser components exposed to reactor coolant. Loss of material due to general, pitting and crevice corrosion could occur in steel BWR isolation condenser components exposed to reactor coolant.

   This paragraph in NUREG-1800 pertains to BWR isolation condenser components. Duane Arnold does not have an isolation condenser.

   However, at Duane Arnold, the reactor pressure vessel and reactor coolant pressure boundary steel and stainless steel piping and components exposed to treated water (reactor coolant) are managed for loss of material due to general, crevice and pitting corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of stagnant flow.

3. Loss of material due to pitting and crevice corrosion could occur in stainless steel, nickel alloy, and steel with stainless steel or nickel alloy cladding flanges, nozzles, penetrations, pressure housings, safe ends, and vessel shells, heads and welds exposed to reactor coolant.

   At Duane Arnold, the reactor pressure vessel and reactor coolant pressure boundary stainless steel, nickel alloy, and steel with stainless steel or nickel cladding piping and components exposed to treated water (reactor coolant) are managed for loss of material due to crevice and pitting corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of stagnant flow.

4. Loss of material due to general, pitting, and crevice corrosion could occur in steel PWR steam generator upper and lower shell and transition cone exposed to secondary feedwater and steam.

   Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

<u>3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement</u>

1. Neutron irradiation embrittlement is a TLAA to be evaluated for the period of extended operation for all ferritic materials that have a neutron fluence greater than 10^{17} n/cm^2 (E >1 MeV) at the end of the license renewal term. Certain aspects of neutron irradiation embrittlement are TLAAs as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). This TLAA is addressed separately in Section 4.2, “Reactor Vessel Neutron Embrittlement Analysis,” of NUREG-1800.

   The evaluation of loss of fracture toughness for the reactor vessel beltline shell and welds is discussed in LRA Subsection 4.2.

2. Loss of fracture toughness due to neutron irradiation embrittlement could occur in BWR and PWR reactor vessel beltline shell, nozzle, and welds exposed to reactor coolant and neutron flux.

   At Duane Arnold, the Reactor Vessel Surveillance Program manages reduction in fracture toughness due to neutron embrittlement of reactor vessel beltline materials. Duane Arnold is a participant in the Boiling Water Reactor Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP). This program monitors changes in the fracture toughness properties of ferric materials in the reactor pressure vessel beltline.

3.1.2.2.4 Cracking Due to Stress Corrosion Cracking and Intergranular Stress Corrosion Cracking

1. Cracking due to SCC and IGSCC could occur in the stainless steel and nickel alloy BWR top head enclosure vessel flange leak detection lines.

   At Duane Arnold, the reactor vessel flange leak-off line is made of carbon steel; no program is therefore required to manage stress corrosion cracking or intergranular stress corrosion cracking.

2. Cracking due to SCC and IGSCC could occur in stainless steel BWR isolation condenser components exposed to reactor coolant.

   Not applicable for Duane Arnold. Duane Arnold does not have an isolation condenser.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

Crack growth due to cyclic loading could occur in reactor vessel shell forgings clad with stainless steel using a high-heat-input welding process.

Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.1.2.2.6 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement and Void Swelling

Loss of fracture toughness due to neutron irradiation embrittlement and void swelling could occur in stainless steel and nickel alloy reactor vessel internals components exposed to reactor coolant and neutron flux.

Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.1.2.2.7 Cracking Due to Stress Corrosion Cracking

1. Cracking due to SCC could occur in the PWR stainless steel reactor vessel flange leak detection lines and bottom-mounted instrument guide tubes exposed to reactor coolant.

   Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

2. Cracking due to SCC could occur in Class 1 PWR cast austenitic stainless steel (CASS) reactor coolant system piping, piping components, and piping elements exposed to reactor coolant.

   Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.1.2.2.8 Cracking Due to Cyclic Loading

1. Cracking due to cyclic loading could occur in the stainless steel BWR jet pump sensing lines.

   The jet pump sensing lines inside the reactor vessel do not form part of the RCS pressure boundary and their failure would not affect the performance of any functions in the scope of license renewal. At DAEC, these lines have no license renewal component intended function and thus are not subject to aging management review. However, the jet pump sensing lines outside the vessel are part of the RCS pressure boundary and hence are subject to aging management review.

2. Cracking due to cyclic loading could occur in steel and stainless steel BWR isolation condenser components exposed to reactor coolant.

   Not applicable for Duane Arnold. Duane Arnold does not have an isolation condenser.

3.1.2.2.9 Loss of Preload Due to Stress Relaxation

Loss of preload due to stress relaxation could occur in stainless steel and nickel alloy PWR reactor vessel internals screws, bolts, tie rods, and hold-down springs exposed to reactor coolant.

Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.1.2.2.10 Loss of Material Due to Erosion

Loss of material due to erosion could occur in steel steam generator feedwater impingement plates and supports exposed to secondary feedwater.

Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.1.2.2.11 Cracking Due to Flow-Induced Vibration

Cracking due to flow-induced vibration could occur for the BWR stainless steel steam dryers exposed to reactor coolant.

At Duane Arnold, the stainless steel steam dryers are managed for cracking due to flow-induced vibration by the BWR Vessels Internals Program and the Water Chemistry Program. The BWR Vessel Internals Program includes BWRVIP-139, “BWR Vessel and Internals Project Steam Dryer Inspection and Flaw Evaluation Guidelines”.

3.1.2.2.12 Cracking Due to Stress Corrosion Cracking and Irradiation-Assisted Stress Corrosion Cracking (IASCC)

Cracking due to SCC and IASCC could occur in PWR stainless steel reactor internals exposed to reactor coolant.

Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.1.2.2.13 Cracking Due to Primary Water Stress Corrosion Cracking (PWSCC)

Cracking due to PWSCC could occur in PWR components made of nickel alloy and steel with nickel alloy cladding, including reactor coolant pressure boundary components and penetrations inside the RCS such as pressurizer heater sheathes and sleeves, nozzles, and other internal components.

Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.1.2.2.14 Wall Thinning Due to Flow-Accelerated Corrosion

Wall thinning due to flow-accelerated corrosion could occur in steel feedwater inlet rings and supports.

Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.1.2.2.15 Changes in Dimensions due to Void Swelling

Changes in dimensions due to void swelling could occur in stainless steel and nickel alloy PWR reactor internal components exposed to reactor coolant.

Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.1.2.2.16 Cracking Due to Stress Corrosion Cracking and Primary Water Stress Corrosion Cracking

1. Cracking due to SCC could occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with stainless steel. Cracking due to PWSCC could occur on the primary coolant side of PWR steel steam generator upper and lower heads, tubesheets, and tube-to-tube sheet welds made or clad with nickel alloy.

   Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

2. Cracking due to SCC could occur on stainless steel pressurizer spray heads. Cracking due to PWSCC could occur on nickel-alloy pressurizer spray heads.

   Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.1.2.2.17 Cracking Due to Stress Corrosion Cracking, Primary Water Stress Corrosion Cracking, and Irradiation-Assisted Stress Corrosion Cracking

Cracking due to stress corrosion cracking (SCC), primary water stress corrosion cracking (PWSCC), and irradiation assisted stress corrosion cracking (IASCC) could occur in PWR stainless steel and nickel alloy reactor vessel internals components.

Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.1.2.2.18 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1 (Appendix A.2 of NUREG-1800).

See LRA Appendix B Subsection B.1.3 for discussion of the Duane Arnold quality assurance procedures and administrative controls for aging management programs.

3.1.3 TIME-LIMITED AGING ANALYSIS

The time-limited aging analyses (TLAA) identified below are associated with the Reactor Coolant Systems components and commodity groups:

- Neutron Embrittlement of Reactor Vessel and Internals (LRA Subsection 4.2)
- Metal Fatigue – Reactor Pressure Vessel, and Pressure Boundary (LRA Subsection 4.3)

3.1.4 CONCLUSION

The Reactor Coolant Systems components and commodity groups that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Reactor Coolant Systems components and commodity groups are identified in LRA Subsection 3.1.2 above.

A description of these aging management programs is provided in LRA Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the conclusions provided in LRA Appendix B, the effects of aging associated with the Reactor Coolant Systems components and commodity groups will be adequately managed so that there is reasonable assurance that the intended functions will be maintained consistent with the current licensing basis during the period of extended operation.

3.1.5 REFERENCES

3.1-1 NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Revision 1, Nuclear Regulatory Commission, September 2005.

3.1-2 NUREG 1800, Standard Review Plan for License Renewal Applications for Nuclear Power Plants, Revision 1, Nuclear Regulatory Commission, September 2005.

TABLE 3.1-1
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-1	Steel pressure vessel support skirt and attachment welds	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.1.
3.1.1-2	Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor vessel components: flanges; nozzles; penetrations; safe ends; thermal sleeves; vessel shells, heads and welds	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes, TLAA	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.1.
3.1.1-3	Steel; stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor coolant pressure boundary piping, piping components, and piping elements exposed to reactor coolant	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) and environmental effects are to be addressed for Class 1 components	Yes, TLAA	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.1.
3.1.1-4	Steel pump and valve closure bolting	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c) check Code limits for allowable cycles (less than 7000 cycles of thermal stress range	Yes, TLAA	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.1.
3.1.1-5	Stainless steel and nickel-alloy reactor vessel internals components	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	No plant specific fatigue analysis was conducted at Duane Arnold for the reactor vessel internals and so is not in the current licensing basis and therefore not a TLAA. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.1.

**TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM**

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-6	Pressurized water reactor only				
3.1.1-7	Pressurized water reactor only				
3.1.1-8	Pressurized water reactor only				
3.1.1-9	Pressurized water reactor only				
3.1.1-10	Pressurized water reactor only				
3.1.1-11	Steel top head enclosure (without cladding) top head nozzles (vent, top head spray or RCIC, and spare exposed to reactor coolant)	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Program consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.2, Item 1.
3.1.1-12	Pressurized water reactor only				
3.1.1-13	Steel and stainless steel isolation condenser components exposed to reactor coolant	Loss of material due to general (steel only), pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Duane Arnold does not use an isolation condenser, loss of material in other steel components within the reactor coolant pressure boundary are managed by programs consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.2, Item 2.

TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-14	Stainless steel; nickel-alloy, steel with nickel-alloy or stainless steel cladding reactor vessel flanges, nozzles, penetrations, safe ends, vessel shells, heads, and welds	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.2, Item 3.
3.1.1-15	Stainless steel; steel with nickel-alloy or stainless steel cladding; nickel-alloy reactor coolant pressure boundary components exposed to reactor coolant	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.2, Item 3.
3.1.1-16	Pressurized water reactor only				
3.1.1-17	Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with Appendix G of 10 CFR 50 and RG 1.99. The applicant may choose to demonstrate that the materials of the nozzles are not controlling for the TLAA evaluations	Yes, TLAA	Program consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.3, Item 1.
3.1.1-18	Steel (with or without stainless steel cladding) reactor vessel beltline shell, nozzles, and welds; safety injection nozzles	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor Vessel Surveillance	Yes, plant specific	Program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.3, Item 2.

TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-19	Stainless steel and nickel alloy top head enclosure vessel flange leak detection line	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	A plant-specific aging management program is to be evaluated because existing programs may no be capable of mitigating or detecting crack initiation and growth due to stress corrosion cracking in the vessel flange leak detection line	Yes, plant specific	Not applicable. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.4, Item 1.
3.1.1-20	Stainless steel isolation condenser components exposed to reactor coolant	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and plant-specific verification program	Yes, detection of aging effect is to be evaluated	Not applicable; Duane Arnold does not have an isolation condenser. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.4, Item 2.
3.1.1-21	Pressurized water reactor only				
3.1.1-22	Pressurized water reactor only				
3.1.1-23	Pressurized water reactor only				
3.1.1-24	Pressurized water reactor only				

TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-25	Stainless steel jet pump sensing line	Cracking due to cyclic loading	A plant-specific aging management program is to be evaluated	Yes, plant specific	The jet pump instrumentation lines inside the reactor vessel are not subject to aging management review. The lines outside the vessel are part of the RCS pressure boundary and hence are subject to aging management review. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.8, Item 1.
3.1.1-26	Steel and stainless steel isolation condenser components exposed to reactor coolant	Cracking due to cyclic loading	Inservice Inspection (IWB, IWC, and IWD), and plant-specific verification program	Yes, detection of aging effect is to be evaluated	Not applicable; Duane Arnold does not have an isolation condenser. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.8, Item 2.
3.1.1-27	Pressurized water reactor only				
3.1.1-28	Pressurized water reactor only				

TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-29	Stainless steel steam dryers exposed to reactor coolant	Cracking due to flow-induced vibration	A plant-specific aging management program is to be evaluated	Yes, plant specific	The BWR Vessel Internals Program will manage cracking in the stainless steel steam dryers. The Water Chemistry Program supplements the BWR Vessel Internals Program. Further evaluation is provided in LRA Subsection 3.1.2, NUREG-1800 Section 3.1.2.2.11.
3.1.1-30	Pressurized water reactor only				
3.1.1-31	Pressurized water reactor only				
3.1.1-32	Pressurized water reactor only				
3.1.1-33	Pressurized water reactor only				
3.1.1-34	Pressurized water reactor only				
3.1.1-35	Pressurized water reactor only				
3.1.1-36	Pressurized water reactor only				
3.1.1-37	Pressurized water reactor only				
3.1.1-38	Steel (with or without stainless steel cladding) control rod drive return line nozzles exposed to reactor coolant	Cracking due to cyclic loading	BWR Control Rod Drive Return Line Nozzle	No	Consistent with NUREG-1801. At Duane Arnold, the BWR Control Rod Drive Return Line Nozzle Program manages cracking in low-alloy steel with stainless steel cladding exposed to reactor coolant.

TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-39	Steel (with or without stainless steel cladding) feedwater nozzles exposed to reactor coolant	Cracking due to cyclic loading	BWR Feedwater Nozzle	No	Consistent with NUREG-1801. At Duane Arnold, The BWR Feedwater Nozzle Program manages cracking in the low alloy steel feedwater nozzles exposed to reactor coolant.
3.1.1-40	Stainless steel and nickel alloy penetrations for control rod drive stub tubes instrumentation, jet pump instrument, standby liquid control, flux monitor, and drain line exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, cyclic loading	BWR Penetration and Water Chemistry	No	Consistent with NUREG-1801. At Duane Arnold, cracking in stainless steel, nickel alloy and steel clad with nickel-alloy nozzles and penetrations in the reactor vessel is managed by the Water Chemistry Program and the BWR Penetrations Program or BWR Vessel Internals Program. The drain nozzle is managed by ASME Section XI.
3.1.1-41	Stainless steel and nickel alloy piping, piping components, and piping elements greater than or equal to 4 NPS; nozzle safe ends and associated welds	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Consistent with NUREG-1801. At Duane Arnold, cracking in stainless steel, nickel alloy and steel clad with stainless steel components in reactor coolant is managed by the BWR Stress Corrosion Cracking Program and Water Chemistry Program.

TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-42	Stainless steel and nickel alloy vessel shell attachment welds exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	BWR Vessel ID Attachment Welds and Water Chemistry	No	Consistent with NUREG-1801. At Duane Arnold, the vessel shell ID attachment welds are carbon steel with stainless steel cladding and is managed by the BWR Vessel ID Attachment Welds Program and Water Chemistry Program.
3.1.1-43	Stainless steel fuel supports and control rod drive assemblies control rod drive housing exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	BWR Vessel Internals and Water Chemistry	No	Consistent with NUREG-1801. At Duane Arnold, cracking in stainless steel components of the reactor vessel and vessel internals is managed by the BWR Vessel Internals Program and Water Chemistry Program.
3.1.1-44	Stainless steel and nickel alloy core shroud, core plate, core plate bolts, support structure, top guide, core spray lines, spargers, jet pump assemblies, control rod drive housing, nuclear instrumentation guide tubes	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	BWR Vessel Internals and Water Chemistry	No	Consistent with NUREG-1801. At Duane Arnold, cracking is being managed by the BWR Vessel Internals Program and Water Chemistry Program.

TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-45	Steel piping, piping components and piping elements exposed to reactor coolant	Wall thinning due to flow- accelerated corrosion	Flow-Accelerated Corrosion	No	Consistent with NUREG-1801. At Duane Arnold, the Flow-Accelerated Corrosion Program manages wall thinning of steel components of the reactor coolant pressure boundary.
3.1.1-46	Nickel alloy core shroud and core plate access hole cover (mechanical covers)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Not applicable; the Duane Arnold access hole covers are welded, not mechanical (bolted). Duane Arnold does not have a Nickel Alloy core shroud.
3.1.1-47	Stainless steel and nickel alloy reactor vessel internals exposed to reactor coolant	Loss of material due to pitting and crevice corrosion	Inservice Inspection (IWB, IWC, and IWD), and Water Chemistry	No	Consistent with NUREG-1801. At Duane Arnold, loss of material in stainless steel and nickel-alloy components of the reactor vessel internals is managed by the Water Chemistry Program and the BWR Vessel Internals Program.

TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-48	Steel and stainless steel Class 1 piping, fittings, and branch connections <NPS 4 exposed to reactor coolant	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking (for stainless steel only), and thermal and mechanical loading	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and One-Time Inspection of ASME Code Class 1 Small-Bore Piping	No	Consistent with NUREG-1801. At Duane Arnold, cracking in stainless steel components of the reactor coolant pressure boundary exposed to reactor coolant is managed by the ASME XI In-Service Inspection, Subsection IWB, IWC & IWD and Water Chemistry Program. At Duane Arnold, small bore piping is included in the ASME Section XI, ISI Program.
3.1.1-49	Nickel alloy core shroud and core plate access hole cover (welded covers)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking, irradiation-assisted stress corrosion cracking	Inservice Inspection (IWB, IWC, and IWD), Water Chemistry, and for BWRs with a crevice in the access hole covers, augmented inspection using ultrasonic testing or other demonstrated acceptable inspection of the access hole cover welds	No	Consistent with NUREG-1801. At Duane Arnold, the Core Plate Access Hole Covers are managed by ASME XI In-Service Inspection, Subsection IWB, IWC & IWD and Water Chemistry Program. Duane Arnold has a crevice so augmented UT exam will be done per BWRVIP-180.
3.1.1-50	High-strength low alloy steel top head closure studs and nuts exposed to air with reactor coolant leakage	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	Reactor Head Closure Studs	No	Consistent with NUREG-1801. At Duane Arnold, the Reactor Head Closure Studs Program manages cracking in low alloy steel head closure flange bolting.

TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-51	Cast austenitic stainless steel jet pump assembly castings; orifices fuel support	Loss of fracture toughness due to thermal aging and neutron irradiation embrittlement	Thermal Aging and Neutron Embrittlement of CASS	No	Consistent with NUREG-1801. At Duane Arnold, the Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program manages the reduction of fracture toughness in cast austenitic stainless steel components of the reactor vessel internals.
3.1.1-52	Steel and stainless steel reactor coolant pressure boundary (RCPB) pump and valve closure bolting, manway and holding bolting, flange bolting, and closure bolting in high-pressure and high-temperature systems	Cracking due to stress corrosion cracking, loss of material due to wear, loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Consistent with NUREG-1801. At Duane Arnold, the Bolting Integrity Program manages cracking, loss of material and loss of preload.
3.1.1-53	Steel piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable to Duane Arnold. There are no steel components in the Class 1 reactor vessel, vessel internals or reactor coolant pressure boundary exposed to closed cycle cooling water.

TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-54	Copper alloy piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable to Duane Arnold. There are no copper alloy components in the Class 1 reactor vessel, vessel internals or reactor coolant pressure boundary.
3.1.1-55	Cast austenitic stainless steel Class 1 pump casings, and valve bodies and bonnets exposed to reactor coolant >250°C (>482°F)	Loss of fracture toughness due to thermal aging embrittlement	Inservice Inspection (IWB, IWC, IWD), Thermal aging susceptibility screening is not necessary, inservice inspection requirements are sufficient for managing these aging effects. ASME Code Case N-481 also provides an alternative for pump casings.	No	Consistent with NUREG-1801. At Duane Arnold, ASME Section XI, ISI (IWB,IWC,IWD) Program manages the reduction of fracture toughness in CASS pump casings and valve bodies and bonnets exposed to reactor coolant.
3.1.1-56	Copper alloy >15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable. There are no copper alloy components >15% Zinc exposed to closed cooling water in the Class 1 reactor vessel, vessel internals or reactor coolant pressure boundary.

TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-57	Cast austenitic stainless steel Class 1 piping, piping components, and piping elements and control rod drive pressure housings exposed to reactor coolant >250°C (>482°F)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program manages the reduction of fracture toughness in the CASS components.
3.1.1-58	Pressurized water reactor only				
3.1.1-59	Pressurized water reactor only				
3.1.1-60	Pressurized water reactor only				
3.1.1-61	Pressurized water reactor only				
3.1.1-62	Pressurized water reactor only				
3.1.1-63	Pressurized water reactor only				
3.1.1-64	Pressurized water reactor only				
3.1.1-65	Pressurized water reactor only				
3.1.1-66	Pressurized water reactor only				
3.1.1-67	Pressurized water reactor only				
3.1.1-68	Pressurized water reactor only				
3.1.1-69	Pressurized water reactor only				
3.1.1-70	Pressurized water reactor only				
3.1.1-71	Pressurized water reactor only				
3.1.1-72	Pressurized water reactor only				

TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-73	Pressurized water reactor only				
3.1.1-74	Pressurized water reactor only				
3.1.1-75	Pressurized water reactor only				
3.1.1-76	Pressurized water reactor only				
3.1.1-77	Pressurized water reactor only				
3.1.1-78	Pressurized water reactor only				
3.1.1-79	Pressurized water reactor only				
3.1.1-80	Pressurized water reactor only				
3.1.1-81	Pressurized water reactor only				
3.1.1-82	Pressurized water reactor only				
3.1.1-83	Pressurized water reactor only				
3.1.1-84	Pressurized water reactor only				
3.1.1-85	Nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external)	None	None	NA – No aging effect management or aging management program	Consistent with NUREG-1801.
3.1.1-86	Stainless steel piping, piping components, and piping elements exposed to air – indoor uncontrolled (external); air with borated water leakage; concrete; gas	None	None	NA – No aging effect management or aging management program	Consistent with NUREG-1801.

TABLE 3.1-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER IV OF NUREG-1801
REACTOR COOLANT SYSTEM

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.1.1-87	Steel piping, piping components and piping elements in concrete	None	None	NA – No aging effect management or aging management program	There are no components in the Class 1 reactor vessel, vessel internals or reactor coolant pressure boundary exposed to concrete.

TABLE 3.1.2-1
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Nozzles	Pressure boundary	Steel	Reactor Coolant & neutron Flux	Loss of fracture toughness/neutron irradiation embrittlement	TLAA	IV.A1-4 (R-67)	3.1.1-17	A
Reactor pressure vessel support skirt and attachment welds	Structural support	Carbon steel	Air/gas (external)	Cumulative fatigue damage/fatigue	TLAA	IV.A1-6 (R-70)	3.1.1-1	A
Reactor vessel components	Pressure boundary	Steel; stainless steel; steel with stainless steel clad; nickel alloy	Reactor Coolant (internal)	Cumulative fatigue damage/fatigue	TLAA	IV.A1-7 (R-04)	3.1.1-2	A
Vessel shell Intermediate beltline shell Beltline welds	Pressure boundary	Low-alloy steel with or without stainless steel cladding	Reactor Coolant & neutron Flux	Loss of fracture toughness	TLAA	IV.A1-13 (R-62)	3.1.1-17	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Reactor coolant Pressure boundary components: Piping, piping components, and piping elements	Pressure boundary	Steel, stainless steel	Reactor Coolant (internal)	Cumulative fatigue damage/ fatigue	TLAA	IV.C1-15 (R-220)	3.1.1-3	A
Access hole covers	Structural support	Nickel-alloy	Treated water (external)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.B1-5 (R-94)	3.1.1-49	A
				Loss of material	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
Aligner	Structural support	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	C

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Aligner (continued)	Structural support	Stainless steel	Treated water (external)	Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
Clamps, bracket, and jackbolt	Structural support	Stainless steel	Treated water or steam (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	C
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	202, E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	202, A
Control rod drive mechanism	Pressure boundary	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-8 (R-104)	3.1.1-43	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Control rod drive stub tubes	Structural supports	Inconel	Air/gas (external)	None	None	IV.E-1 (RP-03)	3.1.1-85	A
			Treated water (internal)	Cracking	BWR Vessel Internals Program	IV.A1-5 (R-69)	3.1.1-40	E
					Water Chemistry Program	IV.A1-5 (R-69)	3.1.1-40	A
				Loss of material	BWR Vessel Internals Program	IV.A1-8 (RP-25)	3.1.1-14	E
					Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Control rod guide tube	Pressure boundary Structural support	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-8 (R-104)	3.1.1-43	A
				Loss of material	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Control rod guide tube (continued)	Pressure boundary Structural support	Stainless steel	Treated water (internal)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-8 (R-104)	3.1.1-43	A
				Loss of material	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
Core plate	Structural support	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-1 (R-92)	3.1.1-44	A
				Loss of material	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Core plate bolts	Structural support	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-6 (R-93)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
Core shroud	Structural support	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-1 (R-92)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Core spray lines and spargers	Pressure boundary	Cast austenitic stainless steel	Treated water (internal)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-7 (R-99)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
				Reduction of fracture toughness	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program	IV.C1-2 (R-52)	3.1.1-57	A
			Treated water or steam (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-7 (R-99)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Core spray lines and spargers (continued)	Pressure boundary	Cast austenitic stainless steel	Treated water or steam (external)	Reduction of fracture toughness	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program	IV.B1-11 (R-101)	3.1.1-51	C
		Stainless steel	Treated water (internal)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-7 (R-99)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
			Treated water or steam (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-7 (R-99)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	V.E-4 (EP-25)	3.2.1-23	203, A
				Loss of preload	Bolting Integrity Program	V.E-5 (EP-24)	3.2.1-24	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Feedwater sparger	Pressure boundary	Stainless steel	Treated water (internal)	Cracking	BWR Feedwater Nozzle Program	IV.A1-3 (R-65)	3.1.1-39	A
				Loss of material	BWR Feedwater Nozzle Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
			Treated water or steam (external)	Cracking	BWR Feedwater Nozzle Program	IV.A1-3 (R-65)	3.1.1-39	A
				Loss of material	BWR Feedwater Nozzle Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow orifice Class 1	Pressure boundary Throttle	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water or steam (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
Fuel supports	Structural support	Cast austenitic stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-8 (R-104)	3.1.1-43	A
				Loss of material	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fuel supports (continued)	Structural support	Cast austenitic stainless steel	Treated water (external)	Reduction of fracture Toughness	Thermal Aging and Neutron Embrittlement of Cast Austenitic Stainless Steel Program	IV.B1-9 (R-103)	3.1.1-51	A
		Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-8 (R-104)	3.1.1-43	A
				Loss of material	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
Incore housings	Pressure boundary Structural Support	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-10 (R-105)	3.1.1-44	C
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Intermediate and source range monitor dry tubes	Pressure boundary	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-10 (R-105)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
Jet pump assembly - casting, collar, flare	Pressure boundary	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (R-26)	3.1.1-47	A
			Treated water (internal)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (R-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Jet pump assembly - diffuser	Pressure boundary	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
			Treated water (internal)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Jet pump assembly - elbow	Pressure boundary	Cast austenitic stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
				Reduction of fracture toughness	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program	IV.B1-11 (R-101)	3.1.1-51	A
			Treated water (internal)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
				Reduction of fracture toughness	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel Program	IV.B1-11 (R-101)	3.1.1-51	A

**TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Jet pump assembly - holddown beams	Structural support	Inconel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
Jet pump assembly - riser brace arm	Structural support	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
Jet pump assembly - riser pipe	Pressure boundary	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Jet pump assembly - riser pipe (continued)	Pressure boundary	Stainless steel	Treated water (internal)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
Level elements	Pressure boundary	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	V.D2-29 (E-37)	3.2.1-18	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Nozzle - core differential pressure and standby liquid control	Pressure boundary	Carbon steel with stainless steel cladding	Air/gas (external)	None	None			231, I
			Treated water (internal)	Cracking	BWR Penetrations Program Water Chemistry Program	IV.A1-5 (R-69)	3.1.1-40	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Nozzle - core spray	Pressure boundary	Carbon steel with stainless steel cladding	Air/gas (external)	None	None			231, I
			Treated water (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.A1-1 (R-68)	3.1.1-41	C
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Nozzle – control rod drive return line	Pressure boundary	Carbon steel with stainless steel cladding	Air/gas (external)	None	None			231, I
			Treated water (internal)	Cracking	BWR Control Rod Drive Return Line Nozzle Program	IV.A1-2 (R-66)	3.1.1-38	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Nozzle - drain	Pressure boundary	Carbon steel with stainless steel cladding	Air/gas (external)	None	None			231, I
			Treated water (internal)	Cracking	ASME Section XI IWB, IWC & IWD ISI Program	IV.A1-5 (R-69)	3.1.1-40	E
					Water Chemistry Program	IV.A1-5 (R-69)	3.1.1-40	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Nozzle - feedwater	Pressure boundary	Carbon steel with stainless steel cladding	Air/gas (external)	None	None			231, I
			Treated water (internal)	Cracking	BWR Feedwater Nozzle Program	IV.A1-3 (R-65)	3.1.1-39	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Nozzle – high pressure/low pressure seal leak detection	Pressure boundary	Nickel-alloy	Air/gas (external)	None	None	IV.E-1 (RP-03)	3.1.1-85	A
			Treated water or steam (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	IV.A1-10 (R-61)	3.1.1-19	C
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Nozzle - instrumentation	Pressure boundary	Carbon steel with stainless steel cladding	Air/gas (external)	None	None			231, I
			Treated water or steam (internal)	Cracking	BWR Penetrations Program Water Chemistry Program	IV.A1-5 (R-69)	3.1.1-40	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
				Reduction of fracture toughness	Reactor Vessel Surveillance Program	IV.A1-14 (R-63)	3.1.1-18	C
Nozzle - jet pump instrumentation	Pressure boundary	Carbon steel with stainless steel cladding	Air/gas (external)	None	None			231, I
			Treated water (internal)	Cracking	BWR Penetrations Program Water Chemistry Program	IV.A1-5 (R-69)	3.1.1-40	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Nozzle - jet pump instrumentation (continued)	Pressure boundary	Carbon steel with stainless steel cladding	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Nozzle - recirculation inlet and outlet	Pressure boundary	Carbon steel with stainless steel cladding	Air/gas (external)	None	None			231, I
			Treated water (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.A1-1 (R-68)	3.1.1-41	C
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
				Reduction of fracture toughness	Reactor Vessel Surveillance Program	IV.A1-14 (R-63)	3.1.1-18	C

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Nozzle - spare	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-11 (R-59)	3.1.1-11	A
Nozzle - steam outlet	Pressure boundary	Carbon steel with stainless steel clad	Air/gas (external)	None	None			231, I
			Steam (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.A1-1 (R-68)	3.1.1-41	C
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Nozzle - vent	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-11 (R-59)	3.1.1-11	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe Class 1, pipe fittings, tubing	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C
			Treated water (internal	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C
		Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water or steam (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk	Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	None	None			231, I
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
	Pressure boundary	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water or steam (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	V.D2-29 (E-37)	3.2.1-18	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Reactor pressure vessel intermediate shell and welds	Pressure boundary	Low-alloy steel with stainless steel cladding	Air/gas (external)	None	None			231, I
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program	IV.A1-12 (R-64)	3.1.1-42	E
					Water Chemistry Program	IV.A1-12 (R-64)	3.1.1-42	A
				Reduction in fracture toughness	Reactor Vessel Surveillance Program	IV.A1-14 (R-63	3.1.1-18	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Reactor pressure vessel lower shell and welds	Pressure boundary	Low-alloy steel with stainless steel cladding	Air/gas (external)	None	None			231, I
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program	IV.A1-12 (R-64)	3.1.1-42	E
					Water Chemistry Program	IV.A1-12 (R-64)	3.1.1-42	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Reactor pressure vessel lower shell and welds (continued)	Pressure boundary	Low-alloy steel with stainless steel cladding	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Reactor pressure vessel shell flanges	Pressure boundary	Low-alloy steel	Air/gas (external)	None	None			231, I
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-11 (R-59)	3.1.1-11	C
Reactor pressure vessel shell ID attachment welds	Structural support	Carbon steel with stainless steel cladding	Treated water (external)	Cracking	BWR Vessel ID Attachment Welds Program Water Chemistry Program	IV.A1-12 (R-64)	3.1.1-42	A
				Loss of material	BWR Vessel ID Attachment Welds Program	IV.A1-8 (RP-25)	3.1.1-14	E
					Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Reactor pressure vessel upper shell and welds	Pressure boundary	Low-alloy steel with stainless steel cladding	Air/gas (external)	None	None			231, I
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program	IV.A1-12 (R-64)	3.1.1-42	E
					Water Chemistry Program	IV.A1-12 (R-62)	3.1.1-42	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Reactor pressure vessel support skirt and welds	Structural support	Carbon steel	Air/gas (external)	None	None			231, I
Recirc inlet - thermal sleeves	Structural support	Nickel alloy	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	C
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Restrainer	Structural support	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-13 (R-100)	3.1.1-44	C
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
Safe end - control rod drive	Pressure boundary	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	BWR Penetrations Program Water Chemistry Program	IV.A1-1 (R-68)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Safe end - core differential pressure and standby liquid control	Pressure boundary	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.A1-1 (R-68)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Safe end - core spray	Pressure boundary	Nickel-alloy	Air/gas (external)	None	None	IV.E-1 (RP-03)	3.1.1-85	A
			Treated water (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.A1-1 (R-68)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Safe end – core spray extension	Pressure boundary	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.A1-1 (R-68)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Safe end - feedwater	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-11 (R-59)	3.1.1-11	C
Safe end - feedwater extension	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-11 (R-59)	3.1.1-11	C

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Safe end - instrumentation	Pressure boundary	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	BWR Penetrations Program Water Chemistry Program	IV.A1-5 (R-69)	3.1.1-40	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Safe end - jet pump instrumentation	Pressure boundary	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	BWR Penetrations Program Water Chemistry Program	IV.A1-5 (R-69)	3.1.1-40	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Safe end - recirculation inlet	Pressure boundary	Nickel alloy	Air/gas (external)	None	None	IV.E-1 (RP-03)	3.1.1-85	A
			Treated water (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.A1-1 (R-68)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Safe end – recirc inlet extension	Pressure boundary	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.A1-1 (R-68)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Safe end - recirculation outlet	Pressure boundary	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.A1-1 (R-68)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-8 (RP-25)	3.1.1-14	A
Safe end - steam outlet	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-11 (R-59)	3.1.1-11	C
Shroud support structure (shroud support cylinder,	Structural support	Nickel-alloy	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-2 (R-96)	3.1.1-44	A
				Loss of material	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Steam dryer	Structural integrity (attached)	Stainless steel	Steam (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-16 (RP-18)	3.1.1-29	E
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
		Stainless steel	Steam (internal)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-16 (RP-18)	3.1.1-29	E
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
Thermal sleeve - control rod drive	Structural support	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program	IV.A1-5 (R-69)	3.1.1-40	E
					Water Chemistry Program	IV.A1-5 (R-69)	3.1.1-40	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Thermal sleeve - core spray	Structural support	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-7 (R-99)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
Thermal sleeve - feedwater	Structural support	Nickel-alloy	Treated water (external)	Cracking	BWR Feedwater Nozzle Program			207, F
				Loss of material	BWR Feedwater Nozzle Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A
Top guide	Structural support	Stainless steel	Treated water (external)	Cracking	BWR Vessel Internals Program Water Chemistry Program	IV.B1-17 (R-98)	3.1.1-44	A
				Loss of material	BWR Vessel Internals Program	IV.B1-15 (RP-26)	3.1.1-47	E
					Water Chemistry Program	IV.B1-15 (RP-26)	3.1.1-47	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Top head enclosure	Pressure boundary	Low-alloy steel	Air/gas (external)	None	None			231, I
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-11 (R-59)	3.1.1-11	A
Top head enclosure flange	Pressure boundary	Low-alloy steel	Air/gas (external)	None	None			231, I
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.A1-11 (R-59)	3.1.1-11	C
Top head enclosure studs and nuts	Pressure boundary	Low-alloy steel	Treated water (external)	Cracking	Reactor Head Closure Studs Program	IV.A1-9 (R-60)	3.1.1-50	A
				Loss of material	Reactor Head Closure Studs Program			207, H

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve Class 1	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C
		Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Steam (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A

TABLE 3.1.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
NUCLEAR BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve Class 1 (continued)	Pressure boundary	Stainless steel	Treated water or steam (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
Valve, damper	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
		Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water or steam (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	V.D2-29 (E-37)	3.2.1-18	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A

TABLE 3.1.2-2
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR VESSEL RECIRCULATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pump and valve closure bolting	Pressure boundary	Carbon steel, stainless steel	Reactor coolant (internal)	Cumulative fatigue damage/fatigue	TLAA	IV.C1-11 (R-28)	3.1.1-4	A
Reactor coolant Pressure boundary components: Piping, piping components, and piping elements	Pressure boundary	Steel; stainless steel	Reactor Coolant (internal)	Cumulative fatigue damage/ fatigue	TLAA	IV.C1-15 (R-220)	3.1.1-3	A
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	V.E-4 (EP-25)	3.2.1-23	203, A
				Loss of preload	Bolting Integrity Program	V.E-5 (EP-24)	3.2.1-24	A
	Pressure boundary	Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	A

TABLE 3.1.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR VESSEL RECIRCULATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow element Class 1	Pressure boundary	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.C1-9 (R-20)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
Flow indicator	Leakage boundary (spatial)	Glass	Air/gas (external)	None	None	V.F-6 (EP-15)	3.2.1-52	A
			Treated water (internal)	None	None	V.F-10 (EP-29)	3.2.1-52	A
		Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A

TABLE 3.1.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR VESSEL RECIRCULATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow switch	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
Heat exchanger, condenser, cooler, fan coil (heat exchanger shell and channelhead)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	202, C
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-5 (A-64)	3.3.1-77	208, E

TABLE 3.1.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR VESSEL RECIRCULATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Level gauge	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	202, A
		Glass	Air/gas (external)	None	None	V.F-6 (EP-15)	3.2.1-52	A
			Lube oil (internal)	None	None	V.F-7 (EP-16)	3.2.1-52	A
Pipe Class 1, pipe fittings, tubing	Pressure boundary Throttle	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04	3.1.1-86	A
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
					BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.C1-9 (R-20)	3.1.1-41	A

TABLE 3.1.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR VESSEL RECIRCULATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe Class 1, pipe fittings, tubing (continued)	Pressure boundary Throttle	Stainless steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	202, A
	Leakage boundary (spatial) Pressure boundary Throttle	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A

TABLE 3.1.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR VESSEL RECIRCULATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pump Class 1	Pressure boundary	Cast austenitic stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.C1-9 (R-20)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	202, A

TABLE 3.1.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR VESSEL RECIRCULATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve Class 1	Pressure boundary	Cast austenitic stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
					BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.C1-9 (R-20)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (R-27)	3.1.1-15	A
				Reduction of fracture toughness	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program	IV.C1-3 (R-08)	3.1.1-55	A

TABLE 3.1.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR VESSEL RECIRCULATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve Class 1 (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
Valve, damper	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	202, A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	202, A

TABLE 3.1.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR VESSEL RECIRCULATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	IV.E-2 (RP-04)	3.1.1-86	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.C1-14 (AP-59)	3.3.1-33	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A

NOTES FOR TABLES 3.1.2-1 THROUGH 3.1.2-2

A. Consistent with NUREG-1801 item for component, material, environment, and aging effect. Aging management program is consistent with NUREG-1801 aging management program.

B. Consistent with NUREG-1801 item for component, material, environment, and aging effect. Aging management program takes some exceptions to NUREG-1801 aging management program.

C. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. Aging management program is consistent with NUREG-1801 aging management program.

D. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. Aging management program takes some exceptions to NUREG-1801 aging management program.

E. Consistent with NUREG-1801 item for material, environment, and aging effect, but a different aging management program is credited, or a plant-specific aging management program.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material, and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes:

201 Not Used

202 Aging mechanism is in addition to aging mechanisms in NUREG-1801. This may include galvanic corrosion, MIC and/or selective leaching.

203 Crevice and pitting corrosion is not applicable for an air/gas environment for carbon steel components due to not being exposed to a concentration of contaminates or aggressive environments.

204 Not Used

205 Components with a "wet air/gas" environment are analyzed in the same manner as raw water for conservatism.

206 Not Used

207 Material/environment combination and/or aging effect/mechanism not identified in NUREG-1801. The aging management program(s) referenced are appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.

208 Program is different than identified in NUREG-1801. The aging management program(s) referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.

209 Not Used

210 Component is different, but consistent with NUREG-1801 for material, environment, and aging effect. The aging management program(s) referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.

211 Not Used

212 These elastomers (neoprene, rubber, etc.) components are indoors and not subject to ultraviolet or ozone, nor are they in locations that are subject to radiation exposure. These locations are also not subject to temperatures where change in material properties or cracking could occur (>95^{o}F). Therefore, no aging management is required.

213 Not Used

214 Not Used

215 Not Used

216 Not Used

217 Not Used

218 Material science evaluation for this material in this environment results in no aging effects requiring management.

219 Galvanic corrosion is not applicable to the components since it is not in contact with metal higher in the galvanic series.

220 Well Water is Raw Water that comes from wells. Well Water does not contain (mussels, clams, bryozoa, etc) or silting. Therefore, Loss of Material due to macrofouling and/or lining/coating degradation are not potential aging effects.

221 Duane Arnold does not have operating experience supporting microbiologically-influenced corrosion in treated water and/or oil systems. Therefore, microbiologically-influenced corrosion is not an applicable aging mechanism.

222 As described in the plant operating experience database, erosion has occurred on some components. Loss of material due to erosion for these components in managed by the Flow Accelerated Corrosion Program.

223 The component and material are different, but consistent with NUREG-1801 for environment and aging effect. The aging management program referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects are effectively managed through the period of extended operation.

224 The component and environment are different, but consistent with NUREG-1801 for material and aging effect. The aging management program referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects are effectively managed through the period of extended operation.

225 Crevice and pitting corrosion are not applicable aging mechanisms for copper alloy components with less than 15% zinc and aluminum bronze components with less than 8% aluminum in fuel oil and lube oil environments at Duane Arnold.

226 Loss of material due to macro-fouling is not a potential aging effect for this lube oil heat exchanger.

227 Duane Arnold does not have operating experience that supports heat transfer degradation due to fouling in treated water and lube oil environments. Therefore, fouling is not a potential aging effect.

228 The material and environment are different, but consistent with NUREG-1801 for component and aging effect. The aging management program referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects are effectively managed through the period of extended operation.

229 Not Used

230 Loss of material due to fouling does not apply to carbon steel components exposed to fuel oil that are not tanks and do not have a potential for particulate fouling (sediment, silt, dust, and corrosion products).

231 Loss of material due to corrosion is not an applicable aging effect due to system temperatures are greater than 212^{o}F.

232 The component does not have the potential for water contamination.

233 The component is not located in an aggressive environment.

234 Non-metallic (fiberglass, PVC, CPVC) in this environment was evaluated and contained no aging effects.

235 Non-metallic elastomers (rubber) in this environment was evaluated and contains no aging effects.

236 Ducting, piping, piping components, piping elements or valves having air-indoor uncontrolled for both their internal and external environments have the same aging effects on both internal/external surfaces.

237 DAEC has plant specific OE for cracking of small bore piping. Therefore, Program XI.M35 is not applicable to DAEC. At DAEC small bore piping is included in the ASME Section XI, ISI Program.

3.2 AGING MANAGEMENT OF ENGINEERED SAFETY FEATURES

This section provides the results of the aging management review for those components and commodity groups identified in LRA Subsection 2.3.2, Scoping and Screening Results: Engineered Safety Features, as being subject to aging management review. The systems, or portions of systems, which are addressed in this section, are described in the indicated sections.

- Subsection 2.3.2.1 - Core Spray System
- Subsection 2.3.2.2 - High Pressure Coolant Injection System
- Subsection 2.3.2.3 – Primary Containment
- Subsection 2.3.2.4 - Reactor Core Isolation Cooling System
- Subsection 2.3.2.5 - Residual Heat Removal System
- Subsection 2.3.2.6 - Standby Gas Treatment System

Table 3.2-1, Summary of Aging Management Evaluations in Chapter V of NUREG-1801 [Reference 3.2-1] for Engineered Safety Features, provides the summary of the programs evaluated in NUREG-1801 for the Engineered Safety Features components and commodity groups that are relied on for license renewal. This table uses the format described in Section 3.0. Note that this table only includes those components and commodity groups that are applicable to a boiling water reactor.

3.2.1 RESULTS SUMMARY

The materials that specific components and commodity groups are fabricated from, the environments to which components and commodity groups are exposed, the potential aging effects requiring management, and the aging management programs used to manage these aging effects are provided for each of the Engineered Safety Features Systems in the following subsections: The corresponding tables summarize the results of the aging management review for systems in the Engineered Safety Features group:

- Core Spray System - Subsection 3.2.1.1 and Table 3.2.2-1
- High Pressure Coolant Injection System- Subsection 3.2.1.2 and Table 3.2.2-2
- Primary Containment - Subsection 3.2.1.3 and Table 3.2.2-3
- Reactor Core Isolation Cooling System - Subsection 3.2.1.4 and Table 3.2.2-4
- Residual Heat Removal System - Subsection 3.2.1.5 and Table 3.2.2-5
- Standby Gas Treatment System - Subsection 3.2.1.6 and Table 3.2.2-6

3.2.1.1 Core Spray System

<u>Materials</u>

The materials of construction for the Core Spray System components and commodity groups are:

- Carbon steel

- Stainless steel

Environments

The Core Spray System components and commodity groups are exposed to the following environments:

- Air/gas
- Dried air/gas
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Core Spray System components and commodity groups, require management:

- Cracking
- Cumulative fatigue damage/fatigue
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Core Spray System components and commodity groups:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Bolting Integrity Program
- BWR Stress Corrosion Cracking Program
- External Surfaces Monitoring Program
- Flow-Accelerated Corrosion Program
- One-Time Inspection Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.2.2-1.

3.2.1.2 High Pressure Coolant Injection System

Materials

The materials of construction for the High Pressure Coolant Injection System components and commodity groups are:

- Admiralty brass
- Carbon steel
- Cast iron

- Cast steel
- Glass
- Stainless steel

Environments

The High Pressure Coolant Injection System components and commodity groups are exposed to the following environments:

- Air/gas
- Lube oil
- Soil
- Steam
- Treated water
- Wet air/gas

Aging Effects Requiring Management

The following aging effects, associated with the High Pressure Coolant Injection System components and commodity groups, require management:

- Cracking
- Cumulative fatigue damage/fatigue
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the High Pressure Coolant Injection System components and commodity groups:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Bolting Integrity Program
- Buried Piping and Tanks Inspection Program
- External Surfaces Monitoring Program
- Flow-Accelerated Corrosion Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Selective Leaching of Materials Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.2.2-2.

3.2.1.3 Primary Containment

Materials

The materials of construction for the Primary Containment components and commodity groups are:

- Carbon steel
- Stainless steel

Environments

The Primary Containment components and commodity groups are exposed to the following environments:

- Air/gas
- Hydraulic oil
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Primary Containment components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Primary Containment components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- One-Time Inspection Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.2.2-3.

3.2.1.4 Reactor Core Isolation Cooling System

Materials

The materials of construction for the Reactor Core Isolation Cooling System components and commodity groups are:

- Admiralty brass
- Brass
- Bronze
- Carbon steel
- Cast iron
- Cast steel
- Glass
- Stainless steel

Environments

The Reactor Core Isolation Cooling System components and commodity groups are exposed to the following environments:

- Air/gas
- Lube oil
- Steam
- Treated water
- Wet air/gas

Aging Effects Requiring Management

The following aging effects, associated with the Reactor Core Isolation Cooling System components and commodity groups, require management:

- Cracking
- Cumulative fatigue damage/fatigue
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Core Isolation Cooling System components and commodity groups:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Bolting Integrity Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program

- Selective Leaching of Materials Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.2.2-4.

3.2.1.5 Residual Heat Removal System

Materials

The materials of construction for the Residual Heat Removal System components and commodity groups are:

- Carbon steel
- Cast austenitic stainless steel
- Cast iron
- Stainless steel

Environments

The Residual Heat Removal System components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water
- Treated water
- Reactor Coolant

Aging Effects Requiring Management

The following aging effects, associated with the Residual Heat Removal System components and commodity groups, require management:

- Cracking
- Heat transfer degradation
- Loss of material
- Loss of preload
- Cumulative fatigue damage/fatigue

Aging Management Programs

The following aging management programs manage the aging effects for the Residual Heat Removal System components and commodity groups:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Bolting Integrity Program
- BWR Stress Corrosion Cracking Program

- External Surfaces Monitoring Program
- Flow-Accelerated Corrosion Program
- One-Time Inspection Program
- Open-Cycle Cooling Water System Program
- Selective Leaching of Materials Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.2.2-5.

3.2.1.6 Standby Gas Treatment System

Materials

The materials of construction for the Standby Gas Treatment System components and commodity groups are:

- Aluminum alloy
- Carbon steel
- Carbon steel - galvanized
- Copper alloy
- Glass
- Stainless steel

Environments

The Standby Gas Treatment System components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water

Aging Effects Requiring Management

The following aging effects, associated with the Standby Gas Treatment System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Standby Gas Treatment System components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Fire Water System Program

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program

Summary of Aging Management Review Results

See LRA Table 3.2.2-6.

3.2.2 FURTHER EVALUATION OF AGING MANAGEMENT AS RECOMMENDED BY NUREG-1801

NUREG-1801 Volume 1 Tables provide the basis for identifying those programs that warrant further evaluation by the reviewer in the license renewal application. For the Engineered Safety Features, those programs are addressed in the following sections. (The following subsections are numbered to correspond to the appropriate section of NUREG-1800 [Reference 3.2-2])

3.2.2.2.1 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). This TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis" of NUREG-1800.

At Duane Arnold, the evaluation of this TLAA is addressed separately in LRA Subsection 4.3.

3.2.2.2.2 Loss of Material Due to Cladding Breach

Loss of material due to cladding breach could occur for PWR steel pump casings with stainless steel cladding exposed to treated borated water.

Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.2.2.2.3 Loss of Material Due to Pitting and Crevice Corrosion

1. Loss of material due to pitting and crevice corrosion could occur for internal surfaces of stainless steel containment isolation piping, piping components, and piping elements exposed to treated water.

   At Duane Arnold, containment isolation stainless steel piping and components exposed to a treated water environment are managed for loss of material due to pitting and crevice corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of stagnant flow.

2. Loss of material from pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil.

   At Duane Arnold, stainless steel buried piping exposed to a soil environment is managed for loss of material due to crevice, microbiologically influenced, and pitting corrosion by the Buried Piping and Tanks Inspection Program. The program relies on periodic inspection for loss of material caused by corrosion of the external surface of buried piping. This program includes preventive measures to mitigate corrosion and periodic inspections to manage the loss of material on the pressure-retaining capability of buried steel piping and tanks.

3. Loss of material from pitting and crevice corrosion could occur for BWR stainless steel and aluminum piping, piping components, and piping elements exposed to treated water.

   At Duane Arnold, stainless steel and cast austenitic stainless steel piping and components exposed to a treated water environment are managed for loss of material due to pitting and crevice corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of stagnant flow.

4. Loss of material from pitting and crevice corrosion could occur for stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil.

   At Duane Arnold, stainless steel components exposed to lubricating oil are being managed for loss of material due to pitting and crevice corrosion by the Lubricating Oil Analysis Program. The Lubricating Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program. Crevice and pitting corrosion are not applicable mechanisms for copper alloy components with less than 15 per cent Zinc and Aluminum Bronze components with less than 8 per cent Aluminum in a fuel oil or lube oil environment.

5. Loss of material from pitting and crevice corrosion could occur for partially encased stainless steel tanks exposed to raw water due to cracking of the perimeter seal from weathering.

   The engineered safety features systems at DAEC have no partially encased stainless steel tanks exposed to raw water.

6. Loss of material from pitting and crevice corrosion could occur for stainless steel piping, piping components, piping elements, and tanks exposed to internal condensation.

   At Duane Arnold, stainless steel components exposed to condensation (wet air/gas) are managed for loss of material due to pitting and crevice corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. Inspections are performed during periodic system and component surveillances or during the performance of maintenance activities when surfaces are made accessible for visual inspection. The program includes visual inspections to assure that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions.

3.2.2.2.4 Reduction of Heat Transfer Due to Fouling

1. Reduction of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil.

   At Duane Arnold, the engineered safety features systems have no plant specific operating experience that supports heat transfer degradation of copper alloy heat exchanger tubes in a lubricating oil environment.

2. Reduction of heat transfer due to fouling could occur for stainless steel heat exchanger tubes exposed to treated water.

   At Duane Arnold, the engineered safety features systems have no plant specific operating experience that supports heat transfer degradation of stainless steel heat exchanger tubes in a treated water environment.

3.2.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation

Hardening and loss of strength due to elastomer degradation could occur in elastomer seals and components associated with the BWR Standby Gas Treatment System ductwork and filters exposed to air-indoor uncontrolled.

At Duane Arnold, the engineered safety features standby gas treatment system has no elastomer seals or components associated with ductwork or filters.

3.2.2.2.6 Loss of Material Due to Erosion

Loss of material due to erosion could occur in the stainless steel high pressure safety injection (HPSI) pump miniflow recirculation orifice exposed to treated borated water.

Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.2.2.2.7 Loss of Material Due to General Corrosion and Fouling

Loss of material due to general corrosion and fouling can occur for steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air - indoor uncontrolled.

At Duane Arnold, the engineered safety features systems have no steel spray nozzles or orifices with an internal environment of air.

3.2.2.2.8 Loss of Material Due to General, Pitting, and Crevice Corrosion

1. Loss of material due to general, pitting and crevice corrosion could occur for BWR steel piping, piping components, and piping elements exposed to treated water.

   At Duane Arnold, carbon steel piping, piping components, and piping elements exposed to treated water are being managed for general, crevice, and pitting corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of stagnant flow.
2. Loss of material due to general, pitting and crevice corrosion could occur for the internal surfaces of steel containment isolation piping, piping components, and piping elements exposed to treated water.

   At Duane Arnold, steel containment isolation piping, piping components, and piping elements exposed to treated water are being managed for loss of material due to general, crevice, and pitting corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of stagnant flow.

3. Loss of material due to general, pitting and crevice corrosion could occur for steel piping, piping components, and piping elements exposed to lubricating oil.

   At Duane Arnold, carbon steel piping, piping components, and piping elements exposed to lubricating oil are managed for loss of material due to general, crevice, and pitting corrosion by the Lubricating Oil Analysis Program. The Lubricating Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program.

3.2.2.2.9 Loss of Material Due to General, Pitting, Crevice Corrosion, and Microbiologically-Influenced Corrosion (MIC)

Loss of material due to general, pitting, crevice, and MIC could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil.

At Duane Arnold, the engineered safety features systems have no steel piping, piping components, and piping elements buried in soil.

3.2.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1 (Appendix A.2 of NUREG-1800.)

See LRA Appendix B Subsection B.1.3 for discussion of the Duane Arnold quality assurance procedures and administrative controls for aging management programs.

3.2.3 TIME-LIMITED AGING ANALYSIS

The time-limited aging analyses (TLAA) identified below are associated with the Engineered Safety Features components and commodity groups:

- Metal fatigue (LRA Subsection 4.3)

3.2.4 CONCLUSION

The Engineered Safety Features components and commodity groups that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Engineered Safety Features components and commodity groups are identified in the summaries in LRA Subsection 3.2.2 above.

A description of these aging management programs is provided in LRA 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 LRA Appendix B, the effects of aging associated with the Engineered Safety Features components and commodity groups will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

3.2.5 REFERENCES

3.2-1 NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Revision 1, Nuclear Regulatory Commission, September 2005.

3.2-2 NUREG 1800, Standard Review Plan for License Renewal Applications for Nuclear Power Plants, Revision 1, Nuclear Regulatory Commission, September 2005.

TABLE 3.2-1
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER V OF NUREG-1801
ENGINEERED SAFETY FEATURES

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-1	Steel and stainless steel piping, piping components, and piping elements in emergency core cooling system	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue is a TLAA. Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.1
3.2.1-2	Pressurized water reactor only				
3.2.1-3	Stainless steel containment isolation piping and components internal surfaces exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.3, Item 1
3.2.1-4	Stainless steel piping, piping components, and piping elements exposed to soil	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated	Yes, plant-specific	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.3, Item 2
3.2.1-5	Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.3, Item 3
3.2.1-6	Stainless steel and copper alloy piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.3, Item 4

TABLE 3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER V OF NUREG-1801
ENGINEERED SAFETY FEATURES

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-7	Partially encased stainless steel tanks with breached moisture barrier exposed to raw water	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated for pitting and crevice corrosion of tank bottoms because moisture and water can egress under the tank due to cracking of the perimeter seal from weathering	Yes, plant-specific	Not applicable to DAEC. The engineered safety features systems do not have partially encased tanks. Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.3, Item 5
3.2.1-8	Stainless steel piping, piping components, piping elements, and tank internal surfaces exposed to condensation (internal)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated	Yes, plant-specific	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.3, Item 6
3.2.1-9	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil	Reduction in heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not applicable to DAEC. The engineered safety features systems have no plant specific OE. Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.4, Item 1
3.2.1-10	Stainless steel heat exchanger tubes exposed to treated water	Reduction in heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not applicable to DAEC. The engineered safety features systems have no plant specific OE. Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.4, Item 2

TABLE 3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER V OF NUREG-1801
ENGINEERED SAFETY FEATURES

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-11	Elastomer seals and components in standby gas treatment system exposed to air – indoor uncontrolled	Hardening and loss of strength due to elastomer degradation	A plant-specific aging management program is to be evaluated	Yes, plant-specific	Not applicable to DAEC. The engineered safety features standby gas treatment system has no elastomer components. Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.5
3.2.1-12	Pressurized water reactor only				
3.2.1-13	Steel drywell and suppression chamber spray system nozzle and flow orifice internal surfaces exposed to air – indoor uncontrolled (internal)	Loss of material due to general corrosion and fouling	A plant-specific aging management program is to be evaluated	Yes, plant-specific	Not applicable to DAEC. The engineered safety features systems have no steel nozzles or orifices in air. Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.7
3.2.1-14	Steel piping, piping components, and piping elements exposed to treated water	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.8, Item 1
3.2.1-15	Steel containment isolation piping, piping components, and piping elements internal surfaces exposed to treated water	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.8, Item 2
3.2.1-16	Steel piping, piping components, and piping elements internal surfaces exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.2.2, NUREG-1800 Section 3.2.2.2.8, Item 3

TABLE 3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER V OF NUREG-1801
ENGINEERED SAFETY FEATURES

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-17	Steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes, detection of aging effects and operating experience are to be further evaluated	Not applicable to DAEC. The engineered safety features systems have no steel piping components buried in soil.
3.2.1-18	Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking and intergranular stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Consistent with NUREG-1801. Cracking of stainless steel piping and components is managed by the BWR Stress Corrosion Cracking Program and Water Chemistry Program.
3.2.1-19	Steel piping, piping components, and piping elements exposed to steam or treated water	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	The engineered safety features systems have steel components managed for FAC according to an evaluation performed by the DAEC Corrosion Monitoring Program at DAEC.
3.2.1-20	Cast austenitic stainless steel piping, piping components, and piping elements exposed to treated water (borated or unborated) >250°C (>482°F)	Loss of fracture toughness due to thermal aging embrittlement	Thermal Aging Embrittlement of CASS	No	Not applicable. The engineered safety features systems have no CASS components with temperatures >482 °F at DAEC.
3.2.1-21	High-strength steel closure bolting exposed to air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Not applicable. The engineered safety features systems have no high strength steel closure bolting exposed to air with steam or water leakage at DAEC.

TABLE 3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER V OF NUREG-1801
ENGINEERED SAFETY FEATURES

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-22	Steel closure bolting exposed to air with steam or water leakage	Loss of material due to general corrosion	Bolting Integrity	No	Not applicable. The engineered safety features systems have no steel closure bolting exposed to air with steam or water leakage at DAEC.
3.2.1-23	Steel bolting and closure bolting exposed to air – outdoor (external) or air – indoor uncontrolled (external)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Consistent with NUREG-1801. The loss of material in steel bolting exposed to air indoor is managed by the Bolting Integrity Program at DAEC.
3.2.1-24	Steel closure bolting exposed to air – indoor uncontrolled (external)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Consistent with NUREG-1801. The loss of preload in steel bolting exposed to air indoor is managed by the Bolting Integrity Program at DAEC.
3.2.1-25	Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water >60°C (>140°F)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	Not applicable. The engineered safety features systems have no stainless steel components exposed to CCW at DAEC.
3.2.1-26	Steel piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable. The engineered safety features systems have no steel components exposed to CCW at DAEC.
3.2.1-27	Steel heat exchanger components exposed to closed cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable. The engineered safety features systems have no steel components exposed to CCW at DAEC.

TABLE 3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER V OF NUREG-1801
ENGINEERED SAFETY FEATURES

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-28	Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable. The engineered safety features systems have no stainless steel components exposed to CCW at DAEC.
3.2.1-29	Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable. The engineered safety features systems have no copper alloy components exposed to CCW at DAEC.
3.2.1-30	Stainless steel and copper alloy heat exchanger tubes exposed to closed cycle cooling water	Reduction of heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Not applicable. The engineered safety features systems have no stainless steel or copper alloy components exposed to CCW at DAEC.
3.2.1-31	External surfaces of steel components including ducting, piping, ducting closure bolting, and containment isolation piping external surfaces exposed to air – indoor uncontrolled (external); condensation (external) and air – outdoor (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. The loss of material of steel external surfaces in air is managed by the External Surfaces Monitoring Program at DAEC.
3.2.1-32	Steel piping and ducting components and internal surfaces exposed to air – indoor uncontrolled (internal)	Loss of material due to general corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Consistent with NUREG-1801. The loss of material of steel piping and ducting components internal surfaces in air is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program at DAEC.

TABLE 3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER V OF NUREG-1801
ENGINEERED SAFETY FEATURES

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-33	Steel encapsulation components exposed to air – indoor uncontrolled (internal)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Not applicable. The engineered safety features systems have no steel encapsulation components exposed to internal air at DAEC.
3.2.1-34	Steel piping, piping components, and piping elements exposed to condensation (internal)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Consistent with NUREG-1801. The loss of material of steel piping, piping components or piping elements in internal condensation (wet air/gas) is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program at DAEC.
3.2.1-35	Steel containment isolation piping and components internal surfaces exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The loss of material of steel containment isolation piping and components internal surfaces in raw water is managed by the Open-Cycle Cooling Water System Program at DAEC.
3.2.1-36	Steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The loss of material of steel heat exchanger components in raw water is managed by the Open-Cycle Cooling Water System Program at DAEC.

TABLE 3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER V OF NUREG-1801
ENGINEERED SAFETY FEATURES

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-37	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The loss of material of stainless steel, steel piping, piping components or piping elements in raw water is managed by the Open-Cycle Cooling Water System Program at DAEC.
3.2.1-38	Stainless steel containment isolation piping and components internal surfaces exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Not applicable. The engineered safety features systems have no stainless steel containment isolation piping and components exposed to raw water at DAEC.
3.2.1-39	Stainless steel heat exchanger components exposed to raw water	Loss of material due to pitting, crevice, and microbiologically-influenced corrosion, and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The loss of material of stainless steel heat exchanger components in raw water is managed by the Open-Cycle Cooling Water System Program at DAEC.
3.2.1-40	Steel and stainless steel heat exchanger tubes (serviced by open-cycle cooling water) exposed to raw water	Reduction in heat transfer due to fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. The reduction of heat transfer of stainless steel heat exchanger tubes in raw water is managed by the Open-Cycle Cooling Water System Program at DAEC.

TABLE 3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER V OF NUREG-1801
ENGINEERED SAFETY FEATURES

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-41	Copper alloy >15% Zn piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable. The engineered safety features systems have no copper alloy piping, piping components, piping elements or heat exchangers exposed to CCW at DAEC.
3.2.1-42	Gray cast iron piping, piping components, and piping elements exposed to closed-cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable. The engineered safety features systems have no cast iron piping, piping components or piping elements exposed to CCW at DAEC.
3.2.1-43	Gray cast iron piping, piping components, and piping elements exposed to soil	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable. The engineered safety features systems have no cast iron piping, piping components or piping elements exposed to soil at DAEC.
3.2.1-44	Gray cast iron motor cooler exposed to treated water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable. The engineered safety features systems have no cast iron motor coolers at DAEC.
3.2.1-45	Pressurized water reactor only				
3.2.1-46	Pressurized water reactor only				
3.2.1-47	Pressurized water reactor only				
3.2.1-48	Pressurized water reactor only				
3.2.1-49	Pressurized water reactor only				

TABLE 3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER V OF NUREG-1801
ENGINEERED SAFETY FEATURES

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-50	Aluminum piping, piping components, and piping elements exposed to air – indoor uncontrolled (internal / external)	None	None	NA, no aging effect management or aging management program	Consistent with NUREG-1801. Aluminum components exposed to air have no aging effect and therefore have no aging management program.
3.2.1-51	Galvanized steel ducting exposed to air – indoor controlled (external)	None	None	NA, no aging effect management or aging management program	Consistent with NUREG-1801. Galvanized steel components exposed to air have no aging effect and therefore have no aging management program.
3.2.1-52	Glass piping elements exposed to air – indoor uncontrolled (external), lubricating oil, raw water, treated water, or treated borated water	None	None	NA, no aging effect management or aging management program	Consistent with NUREG-1801. Glass components exposed to air have no aging effect and therefore have no aging management program
3.2.1-53	Stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external)	None	None	NA, no aging effect management or aging management program	Consistent with NUREG-1801. Stainless steel and cooper alloy components exposed to air have no aging effect and therefore have no aging management program.
3.2.1-54	Steel piping, piping components, and piping elements exposed to air – indoor controlled (external)	None	None	NA, no aging effect management or aging management program	Not applicable. The engineered safety features systems have no steel piping, piping components or piping elements in a controlled air environment at DAEC.

TABLE 3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER V OF NUREG-1801
ENGINEERED SAFETY FEATURES

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.2.1-55	Steel and stainless steel piping, piping components, and piping elements in concrete	None	None	NA, no aging effect management or aging management program	Consistent with NUREG-1801. For the Engineered Safety Features Systems, components exposed to concrete have no aging effects at DAEC.
3.2.1-56	Steel, stainless steel, and copper alloy piping, piping components, and piping elements exposed to gas	None	None	NA, no aging effect management or aging management program	Consistent with NUREG-1801. For the Engineered Safety Features Systems, components exposed to gas have no aging effects at DAEC.
3.2.1-57	Pressurized water reactor only				

TABLE 3.2.2-1
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CORE SPRAY SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Piping, piping components and piping elements	Pressure boundary	Steel, stainless steel	Reactor Coolant (internal)	Cumulative fatigue damage/fatigue	TLAA	IV.C1-15 (R-220)	3.1.1-3	A
			Treated water (internal)	Cumulative fatigue damage/fatigue	TLAA	V.D2-32 (E-10)	3.2.1-1	A
Accumulator, pulsation damper, low pressure tank	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	V.E-4 (EP-25)	3.2.1-23	203, A
				Loss of preload	Bolting Integrity Program	V.E-5 (EP-24)	3.2.1-24	A
			Treated water (external)	Loss of material	Bolting Integrity Program	V.D2-33 (EP-08)	3.2.1-14	202, 210, E
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F

TABLE 3.2.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CORE SPRAY SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Filter, screens, strainer	Filter	Stainless steel	Treated water (external)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
Flow elements	Pressure boundary Throttle	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
Pipe Class 1, pipe fittings, tubing	Pressure boundary	Carbon steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	202, C
	Pressure boundary Throttle	Carbon steel	Air/gas (external)	None	None			231, I
		Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
					BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.C1-9 (R-20)	3.1.1-41	A

TABLE 3.2.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CORE SPRAY SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe Class 1, pipe fittings, tubing (continued)	Pressure boundary Throttle	Stainless steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A, 202
	Pressure boundary	Carbon steel	Air/gas (internal)	None	None	V.F-18 (EP-7)	3.2.1-56	A
			Treated water (external)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A, 202
			Treated water (internal)	Loss of material	Flow Accelerated Corrosion Program			222, H
					One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	202, A

**TABLE 3.2.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CORE SPRAY SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Structural integrity (attached)	Carbon steel	Dried air/gas (internal)	None	None	V.F-18 (EP-7)	3.2.1-56	A
	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
	Throttle		Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
Pumps, positive pressure devices (except blowers)	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
Valve Class 1	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C

TABLE 3.2.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CORE SPRAY SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve Class 1 (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
Valve, damper	Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Air/gas (internal)	None	None	V.F-18 (EP-7)	3.2.1-56	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	202, A

TABLE 3.2.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CORE SPRAY SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A

TABLE 3.2.2-2
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HIGH PRESSURE COOLANT INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Piping, piping components and piping elements	Pressure boundary	Steel, stainless steel	Reactor Coolant (internal)	Cumulative fatigue damage/fatigue	TLAA	IV.C1-15 (R-220)	3.1.1-3	A
			Treated water, Steam (internal)	Cumulative fatigue damage/fatigue	TLAA	V.D2-32 (E-10)	3.2.1-1	A
Blower, compressor, fan, vacuum pump	Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Wet air/gas (internal)	Loss of material	Inspection Of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.D2-17 (E-27)	3.2.1-34	A
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	V.E-4 (EP-25)	3.2.1-23	203, A
				Loss of preload	Bolting Integrity Program	V.E-5 (EP-24)	3.2.1-24	A

TABLE 3.2.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HIGH PRESSURE COOLANT INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Filter, screens, strainer	Filter Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	A
	Filter	Stainless steel	Treated water (internal)	Loss of material	Water Chemistry Program, One-Time Inspection Program	V.D2-28 (EP-32)	3.2.1-5	202, A
			Treated water (external)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	202, A
Flow gauge	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
		Glass	Air/gas (external)	None	None	V.F-6 (EP-15)	3.2.1-52	A
			Treated water (internal)	None	None	V.F-10 (EP-29)	3.2.1-52	A

TABLE 3.2.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HIGH PRESSURE COOLANT INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil	Pressure boundary Heat transfer	Admiralty brass	Lube oil (external)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-22 (EP-45)	3.2.1-6	C
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-9 (AP-64)	3.3.1-31	219, C
	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Lube oil (external)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	202, C
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	C
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	C
Level Gauge	Leakage boundary (spatial)	Glass	Air/gas (external)	None	None	V.F-6 (EP-15)	3.2.1-52	A
			Treated water (internal)	None	None	V.F-10 (EP-29)	3.2.1-52	A

TABLE 3.2.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HIGH PRESSURE COOLANT INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe Class 1, pipe fittings, tubing)	Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C
	Pressure boundary	Carbon steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	202, C
	Pressure boundary Throttle	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Steam (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (R-27)	3.1.1-15	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	A

TABLE 3.2.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HIGH PRESSURE COOLANT INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary Structural integrity (attached)	Carbon steel	Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-15 (S-04)	3.4.1-2	A
			Treated water (internal)	Loss of material	Flow Accelerated Corrosion Program			222, H
					One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
	Structural integrity (attached)	Carbon steel	Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
	Pressure boundary	Carbon steel	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	A

TABLE 3.2.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HIGH PRESSURE COOLANT INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary Structural integrity (attached)	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.C2-12 (AP-59)	3.3.1-33	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
	Pressure boundary	Stainless steel	Soil (external)	Loss of material	Buried Piping and Tanks Inspection Program	V.D2-27	3.2.1-4	202, A
			Steam (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.B2-1 (SP-45)	3.4.1-13	A
				Loss of material	One-Time Inspection Program	VIII.B2-2 (SP-46)	3.4.1-37	E
					Water Chemistry Program	VIII.B2-2 (SP-46)	3.4.1-37	A

TABLE 3.2.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HIGH PRESSURE COOLANT INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pumps, positive pressure devices (except blowers)	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	A
					Selective Leaching of Materials Program			207, G
Thermowell	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-15 (S-04)	3.4.1-2	A

TABLE 3.2.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HIGH PRESSURE COOLANT INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Turbine	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-15 (S-04)	3.4.1-2	C
Valve Class 1	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C

TABLE 3.2.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HIGH PRESSURE COOLANT INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve Class 1 (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Steam (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (R-27)	3.1.1-15	A
Valve, damper	Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-15 (S-04)	3.4.1-2	202, A
			Treated water (internal)	Loss of material	Flow-Accelerated Corrosion Program			222, H
					One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	202, A

TABLE 3.2.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HIGH PRESSURE COOLANT INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Carbon steel	Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	A
			Wet air/gas (internal)	Loss of material	Inspection Of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	A
	Pressure boundary	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	A
					Selective Leaching of Materials Program			207, G
			Wet air/gas (internal)	Loss of material	Inspection Of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	A
					Selective Leaching of Materials Program			207, G

TABLE 3.2.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HIGH PRESSURE COOLANT INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Cast steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
		Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.C1-14 (AP-59)	3.3.1-33	A
			Treated water (internal	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
			Wet air/gas (internal)	Loss of material	Inspection Of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.D2-35 (E-14)	3.2.1-8	E

TABLE 3.2.2-3
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.x-1 Item	Notes
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	V.E-4 (EP-25)	3.2.1-23	203, A
				Loss of preload	Bolting Integrity Program	V.E-5 (EP-24)	3.2.1-24	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Instrumentation, level element	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-15 (EP-22)	3.2.1-56	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Pressure boundary Structural Integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.D2-16 (E-29)	3.2.1-32	A
	Pressure boundary	Carbon steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	202, A

TABLE 3.2.2-3 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.x-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-15 (EP-22)	3.2.1-56	A
			Hydraulic oil (internal)	None	None			232, I
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
Valve, damper	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.D2-16 (E-29)	3.2.1-32	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
		Stainless steel	Air/gas (external)	None	None	V.F-15 (EP-22)	3.2.1-56	A
			Air/gas (internal)	None	None	V.F-15 (EP-22)	3.2.1-56	A
			Hydraulic oil (internal)	None	None			232, I

TABLE 3.2.2-3 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.x-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Stainless steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A

TABLE 3.2.2-4
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR CORE ISOLATION COOLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Piping, piping components and piping elements	Pressure boundary	Steel, stainless steel	Reactor Coolant (internal)	Cumulative fatigue damage/fatigue	TLAA	IV.C1-15 (R-220)	3.1.1-3	A
			Treated water, Steam (internal)	Cumulative fatigue damage/fatigue	TLAA	V.D2-32 (E-10)	3.2.1-1	A
Blower, compressor, fan, vacuum pump	Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	A
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	V.E-4 (EP-25)	3.2.1-23	203, A
				Loss of preload	Bolting Integrity Program	V.E-5 (EP-24)	3.2.1-24	A

TABLE 3.2.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR CORE ISOLATION COOLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Filter, screens, strainer	Pressure boundary	Carbon steel	Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	A
			Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
	Filter	Stainless steel	Treated water (external)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
Heat exchanger, condenser, cooler, fan coil	Heat transfer Pressure boundary	Admiralty brass	Lube oil (external)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-22 (EP-45)	3.2.1-6	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-9 (AP-64)	3.3.1-31	219, C
	Pressure boundary	Brass	Air/gas (external)	None	None	V.F-3 (EP-10)	3.2.1-53	A
			Lube oil (internal)	None	None			232, I

**TABLE 3.2.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR CORE ISOLATION COOLING SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil (continued)	Pressure boundary	Bronze	Lube oil (external)	None	None			232, I
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-9 (AP-64)	3.3.1-31	219, C
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	C
	Leakage boundary (spatial)	Carbon steel	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	C
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	C
				Loss of material	Selective Leaching of Materials Program	VII.A4-10 (AP-31)	3.3.1-85	A

TABLE 3.2.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR CORE ISOLATION COOLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow gauge	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	A
		Glass	Air/gas (external)	None	None	V.F-6 (EP-15)	3.2.1-52	A
			Lube oil (internal)	None	None	V.F-7 (EP-16)	3.2.1-52	A
Pipe Class 1, pipe fittings, tubing	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	202, C
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C

TABLE 3.2.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR CORE ISOLATION COOLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe Class 1, pipe fittings, tubing (continued)	Pressure boundary Throttle	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Steam (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (R-27)	3.1.1-15	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
	Pressure boundary Structural integrity (attached)	Carbon steel	Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program	V.D2-30 (EP-46)	3.2.1-16	A
					One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	A

**TABLE 3.2.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR CORE ISOLATION COOLING SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary	Carbon steel	Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-15 (S-04)	3.4.1-2	A
			Treated water (external)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
	Pressure boundary Structural integrity (attached	Carbon steel	Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
	Structural integrity (attached)	Carbon steel	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	A

TABLE 3.2.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR CORE ISOLATION COOLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Glass	Air/gas (external)	None	None	V.F-6 (EP-15)	3.2.1-52	A
			Treated water (internal)	None	None	V.F-10 (EP-29)	3.2.1-52	A
	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.C1-14 (AP-59)	3.3.1-33	A
			Steam (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.B2-1 (SP-45)	3.4.1-13	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A

TABLE 3.2.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR CORE ISOLATION COOLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pumps, positive pressure devices (except blowers)	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	A
					Selective Leaching of Materials Program			207, G
Turbine	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-15 (S-04)	3.4.1-2	C

TABLE 3.2.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR CORE ISOLATION COOLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve Class 1	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-3	C
		Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Steam (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (R-27)	3.1.1-15	A

TABLE 3.2.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR CORE ISOLATION COOLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper	Pressure boundary	Brass	Air/gas (external)	None	None	V.F-3 (EP-10)	3.2.1-53	A
			Lube oil (internal)	None	None			232, I
	Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-15 (S-04)	3.4.1-2	202, A
	Pressure boundary	Carbon steel	Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	202, A

**TABLE 3.2.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR CORE ISOLATION COOLING SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Carbon steel	Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
	Structural integrity (attached)	Carbon Steel	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	A
	Pressure boundary	Cast steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
	Pressure boundary Structural Integrity (attached)	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A

TABLE 3.2.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR CORE ISOLATION COOLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Stainless steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
	Structural integrity (attached)	Stainless steel	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.D2-35 (E-14)	3.2.1-8	202, E

TABLE 3.2.2-5
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RESIDUAL HEAT REMOVAL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Piping, piping components and piping elements	Pressure boundary	Steel, stainless steel	Reactor Coolant (internal)	Cumulative fatigue damage/fatigue	TLAA	IV.C1-15 (R-220)	3.1.1-3	A
			Treated water (internal)	Cumulative fatigue damage/fatigue	TLAA	V.D2-32 (E-10)	3.2.1-1	A
			Treated water (internal)	Cumulative fatigue damage/fatigue	TLAA	VII.E4-13 (A-62)	3.3.1-2	A
Accumulator, pulsation damper, low pressure tank	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	V.E-4 (EP-25)	3.2.1-23	203, A
				Loss of preload	Bolting Integrity Program	V.E-5 (EP-24)	3.2.1-24	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F

TABLE 3.2.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RESIDUAL HEAT REMOVAL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Filter, screens, strainer	Filter	Stainless steel	Treated water (external)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
Heat exchanger, condenser, cooler, fan coil	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Raw water (external)	Loss of material	Open-Cycle Cooling Water System Program	V.D2-8 (E-18)	3.2.1-36	219, A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	V.D2-8 (E-18)	3.2.1-36	219, A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	202, C
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	V.D2-8 (E-18)	3.2.1-36	A
					Selective Leaching of Materials Program	VII.C1-11	3.3.1-85	C

TABLE 3.2.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RESIDUAL HEAT REMOVAL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil (continued)	Pressure boundary	Stainless steel	Raw water (external)	Heat transfer degradation	Open-Cycle Cooling Water System Program	V.D2-12 (E-21)	3.2.1-40	A
				Loss of material	Open-Cycle Cooling Water System Program	V.D2-6 (E-20)	3.2.1-39	A
	Heat transfer Pressure boundary	Stainless steel	Raw water (internal)	Heat transfer degradation (fouling)	Open-Cycle Cooling Water System Program	V.D2-12 (E-21)	3.2.1-40	A
				Loss of material	Open-Cycle Cooling Water System Program	V.D2-6 (E-20)	3.2.1-39	A
			Treated water (external)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	C
	Pressure boundary	Stainless steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	C
Pipe Class 1, pipe fittings, tubing	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	202, C

TABLE 3.2.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RESIDUAL HEAT REMOVAL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe Class 1, pipe fittings, tubing (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-12	3.2.1-53	A
			Treated water (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.C1-9 (R-20)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	Flow-Accelerated Corrosion Program			222, H
					One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	202, A

TABLE 3.2.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RESIDUAL HEAT REMOVAL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
Pumps, positive pressure devices (except blowers)	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
		Cast austenitic stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A

TABLE 3.2.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RESIDUAL HEAT REMOVAL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve Class 1	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C
		Cast austenitic stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A

TABLE 3.2.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RESIDUAL HEAT REMOVAL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve Class 1 (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
Valve, damper	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A

TABLE 3.2.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RESIDUAL HEAT REMOVAL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-18)	3.2.1-53	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A

TABLE 3.2.2-6
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY GAS TREATMENT SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Drip pans	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-24 (A-33)	3.3.1-86	208, E
Ductwork	Pressure boundary	Aluminum alloy	Air/gas (external)	None	None	V.F-2 (EP-3)	3.2.1-50	C
			Air/gas (internal)	None	None	V.F-2 (EP-3)	3.2.1-50	C
		Carbon steel - galvanized	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.B-3 (E-26)	3.2.1-31	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.B-3 (E-26)	3.2.1-31	A
		Glass	Air/gas (external)	None	None	V.F-6 (EP-15)	3.2.1-52	A
			Air/gas (internal)	None	None	V.F-6 (EP-15)	3.2.1-52	A

TABLE 3.2.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY GAS TREATMENT SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Ductwork (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-48)	3.2.1-53	236, C
			Air/gas (internal)	None	None	V.F-12 (EP-48)	3.2.1-53	236, C
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	V.E-4 (EP-25)	3.2.1-23	203, A
				Loss of preload	Bolting Integrity Program	V.E-5 (EP-24)	3.2.1-24	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Filter	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-48)	3.2.1-53	236, A
Instrumentation, (flow elements)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-48)	3.2.1-53	236, A
			Air/gas (internal)	None	None	V.F-12 (EP-48)	3.2.1-53	236, A
Pipe, pipe fittings, hoses, tubes, rupture disk	Pressure boundary	Aluminum alloy	Air/gas (external)	None	None	V.F-2 (EP-3)	3.2.1-50	A
			Air/gas (internal)	None	None	V.F-2 (EP-3)	3.2.1-50	A

TABLE 3.2.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY GAS TREATMENT SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.B-1 (E-25)	3.2.1-32	A
			Raw water (external)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-5 (A-64)	3.3.1-77	219, E
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-5 (A-64)	3.3.1-77	219, E
	Pressure boundary	Copper alloy	Air/gas (external)	None	None	V.F-3 (EP-10)	3.2.1-53	236, A
			Air/gas (internal)	None	None	V.F-3 (EP-10)	3.2.1-53	236, A
		Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-48)	3.2.1-53	236, C
			Air/gas (internal)	None	None	V.F-12 (EP-48)	3.2.1-53	236, C

**TABLE 3.2.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY GAS TREATMENT SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.B-1 (E-25)	3.2.1-32	A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E-24 (A-33)	3.3.1-68	208, E
		Copper alloy	Air/gas (external)	None	None	V.F-3 (EP-10)	3.2.1-53	236, A
			Air/gas (internal)	None	None	V.F-3 (EP-10)	3.2.1-53	236, A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-12 (A-45)	3.3.1-70	A
		Stainless steel	Air/gas (external)	None	None	V.F-12 (EP-48)	3.2.1-53	236, C
			Air/gas (internal)	None	None	V.F-12 (EP-48)	3.2.1-53	236, C

NOTES FOR TABLES 3.2.2-1 THROUGH 3.2.2-6

A. Consistent with NUREG-1801 item for component, material, environment, and aging effect. Aging management program is consistent with NUREG-1801 aging management program.

B. Consistent with NUREG-1801 item for component, material, environment, and aging effect. Aging management program takes some exceptions to NUREG-1801 aging management program.

C. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. Aging management program is consistent with NUREG-1801 aging management program.

D. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. Aging management program takes some exceptions to NUREG-1801 aging management program.

E. Consistent with NUREG-1801 item for material, environment, and aging effect, but a different aging management program is credited, or a plant-specific aging management program.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material, and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes:

201. Not Used

202. Aging mechanism is in addition to aging mechanisms in NUREG-1801. This may include galvanic corrosion, MIC and/or selective leaching.

203. Crevice and pitting corrosion is not applicable for an air/gas environment for carbon steel components due to not being exposed to a concentration of contaminates or aggressive environments.

204. Not Used

205. Components with a “wet air/gas” environment are analyzed in the same manner as raw water for conservatism.

206. Not Used

207. Material/environment combination and/or aging effect/mechanism not identified in NUREG-1801. The aging management program(s) referenced are appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.

208. Program is different than identified in NUREG-1801. The aging management program(s) referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.

209. Not Used

210. Component is different, but consistent with NUREG-1801 for material, environment, and aging effect. The aging management program(s) referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.

211. Not Used

212. These elastomers (neoprene, rubber, etc.) components are indoors and not subject to ultraviolet or ozone, nor are they in locations that are subject to radiation exposure. These locations are also not subject to temperatures where change in material properties or cracking could occur (>95^{o}F). Therefore, no aging management is required.

213. Not Used

214. Not Used

215. Not Used

216. Not Used

217. Not Used

218. Material science evaluation for this material in this environment results in no aging effects requiring management.

219. Galvanic corrosion is not applicable to the components since it is not in contact with metal higher in the galvanic series.

220. Well Water is Raw Water that comes from wells. Well Water does not contain (mussels, clams, bryozoa, etc) or silting. Therefore, Loss of Material due to macrofouling and/or lining/coating degradation are not potential aging effects.

221. Duane Arnold does not have operating experience supporting microbiologically-influenced corrosion in treated water and/or oil systems. Therefore, microbiologically-influenced corrosion is not an applicable aging mechanism.

222. As described in the plant operating experience database, erosion has occurred on some components. Loss of material due to erosion for these components in managed by the Flow Accelerated Corrosion Program.

223. The component and material are different, but consistent with NUREG-1801 for environment and aging effect. The aging management program referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects are effectively managed through the period of extended operation.

224. The component and environment are different, but consistent with NUREG-1801 for material and aging effect. The aging management program referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects are effectively managed through the period of extended operation.

225. Crevice and pitting corrosion are not applicable aging mechanisms for copper alloy components with less than 15% zinc and aluminum bronze components with less than 8% aluminum in fuel oil and lube oil environments at Duane Arnold.

226. Loss of material due to macro-fouling is not a potential aging effect for this lube oil heat exchanger.

227. Duane Arnold does not have operating experience that supports heat transfer degradation due to fouling in treated water and lube oil environments. Therefore, fouling is not a potential aging effect.

228. The material and environment are different, but consistent with NUREG-1801 for component and aging effect. The aging management program referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects are effectively managed through the period of extended operation.

229. Not Used

230. Loss of material due to fouling does not apply to carbon steel components exposed to fuel oil that are not tanks and do not have a potential for particulate fouling (sediment, silt, dust, and corrosion products).

231. Loss of material due to corrosion is not an applicable aging effect due to system temperatures are greater than 212^{o}F.

232. The component does not have the potential for water contamination.

233. The component is not located in an aggressive environment.

234. Non-metallic (fiberglass, PVC, CPVC) in this environment was evaluated and contained no aging effects.

235. Non-metallic elastomers (rubber) in this environment was evaluated and contains no aging effects.

236. Ducting, piping, piping components, piping elements or valves having air-indoor uncontrolled for both their internal and external environments have the same aging effects on both internal/external surfaces.

237. DAEC has plant specific OE for cracking of small bore piping. Therefore, Program XI.M35 is not applicable to DAEC. At DAEC small bore piping is included in the ASME Section XI, ISI Program.

3.3 AGING MANAGEMENT OF AUXILIARY SYSTEMS

This section provides the results of the aging management review for those components and commodity groups identified in LRA Subsection 2.3.3, Scoping and Screening Results: Auxiliary Systems, as being subject to aging management review. The systems, or portions of systems, which are addressed in this section, are described in the indicated sections.

- Subsection 2.3.3.1 – Auxiliary Heating Boiler
- Subsection 2.3.3.2 – Building Sumps
- Subsection 2.3.3.3 – Chlorination and Acid Feed System
- Subsection 2.3.3.4 – Circulating Water System
- Subsection 2.3.3.5 – Containment Atmosphere Control System
- Subsection 2.3.3.6 – Control Building Heating, Ventilation, and Air Conditioning
- Subsection 2.3.3.7 – Control Rod Drive System
- Subsection 2.3.3.8 – Drywell Sumps
- Subsection 2.3.3.9 – Electrical Manhole Sump Pump
- Subsection 2.3.3.10 – Emergency Service Water System
- Subsection 2.3.3.11 – Fire Protection System
- Subsection 2.3.3.12 – Fuel Pool Cooling and Cleanup System
- Subsection 2.3.3.13 – General Service Water System
- Subsection 2.3.3.14 – Hydrogen Water Chemistry System
- Subsection 2.3.3.15 – Instrument Air System
- Subsection 2.3.3.16 – Intake and Traveling Screens
- Subsection 2.3.3.17 – Offgas Exhaust System
- Subsection 2.3.3.18 – Plant Ventilation
- Subsection 2.3.3.19 – Post Accident Sampling System
- Subsection 2.3.3.20 – Primary Containment Heating Ventilation and Air Conditioning
- Subsection 2.3.3.21 – Reactor Building and Radwaste Building Sampling System
- Subsection 2.3.3.22 – Reactor Building Closed Cooling Water System
- Subsection 2.3.3.23 – Reactor Building Heating, Ventilation, and Air Conditioning
- Subsection 2.3.3.24 – Reactor Water Cleanup System
- Subsection 2.3.3.25 – RHR Service Water System
- Subsection 2.3.3.26 – River Water Supply System

- Subsection 2.3.3.27 – Safety Related Air System
- Subsection 2.3.3.28 – Solid and Liquid Radwaste
- Subsection 2.3.3.29 – Standby Diesel Generators
- Subsection 2.3.3.30 – Standby Liquid Control System
- Subsection 2.3.3.31 – Turbine Building Sampling System
- Subsection 2.3.3.32 – Well Water System
- Subsection 2.3.3.33 – Zinc Injection System

Table 3.3-1, Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 [Reference 3.3-1] for Engineered Safety Features, provides the summary of the programs evaluated in NUREG-1801 for the Auxiliary Systems components and commodity groups that are relied on for license renewal. This table uses the format described in Section 3.0. Note that this table only includes those components and commodity groups that are applicable to a boiling water reactor.

3.3.1 RESULTS SUMMARY

The materials that specific components and commodity groups are fabricated from, the environments to which components and commodity groups are exposed, the potential aging effects requiring management, and the aging management programs used to manage these aging effects are provided for each of the Auxiliary Systems in the following subsections: The corresponding tables summarize the results of the aging management review for systems in the Auxiliary Systems group:

- Auxiliary Heating Boiler - Subsection 3.3.1.1 and Table 3.3.2-1
- Building Sumps – Subsection 3.3.1.2 and Table 3.3.2-2
- Chlorination and Acid Feed System - Subsection 3.3.1.3 and Table 3.3.2-3
- Circulating Water System - Subsection 3.3.1.4 and Table 3.3.2-4
- Containment Atmosphere Control System - Subsection 3.3.1.5 and Table 3.3.2-5
- Control Building Heating, Ventilation, and Air Conditioning - Subsection 3.3.1.6 and Table 3.3.2-6
- Control Rod Drive System - Subsection 3.3.1.7 and Table 3.3.2-7
- Drywell Sumps - Subsection 3.3.1.8 and Table 3.3.2-8
- Electrical Manhole Sump Pump - Subsection 3.3.1.9 and Table 3.3.2-9
- Emergency Service Water System - Subsection 3.3.1.10 and Table 3.3.2-10
- Fire Protection System - Subsection 3.3.1.11 and Table 3.3.2-11
- Fuel Pool Cooling and Cleanup System - Subsection 3.3.1.12 and Table 3.3.2-12
- General Service Water System - Subsection 3.3.1.13 and Table 3.3.2-13
- Hydrogen Water Chemistry System - Subsection 3.3.1.14 and Table 3.3.2-14
- Instrument Air System - Subsection 3.3.1.15 and Table 3.3.2-15

- Intake and Traveling Screens - Subsection 3.3.1.16 and Table 3.3.2-16
- Offgas Exhaust System - Subsection 3.3.1.17 and Table 3.3.2-17
- Plant Ventilation - Subsection 3.3.1.18 and Table 3.3.2-18
- Post-Accident Sampling System - Subsection 3.3.1.19 and Table 3.3.2-19
- Primary Containment Heating, Ventilation, and Air Conditioning – Subsection 3.3.1.20 and Table 3.3.2-20
- Reactor Building and Radwaste Building Sampling - Subsection 3.3.1.21 and Table 3.3.2-21
- Reactor Building Closed Cooling Water System - Subsection 3.3.1.22 and Table 3.3.2-22
- Reactor Building Heating, Ventilation, and Air Conditioning, Subsection 3.3.1.23 and Table 3.3.2-23
- Reactor Water Cleanup System - Subsection 3.3.1.24 and Table 3.3.2-24
- RHR Service Water System - Subsection 3.3.1.25 and Table 3.3.2-25
- River Water Supply System - Subsection 3.3.1.26 and Table 3.3.2-26
- Safety Related Air System - Subsection 3.3.1.27 and Table 3.3.2-27
- Solid and Liquid Radwaste – Subsection 3.3.1.28 and Table 3.3.2-28
- Standby Diesel Generators - Subsection 3.3.1.29 and Table 3.3.2-29
- Standby Liquid Control System - Subsection 3.3.1.30 and Table 3.3.2-30
- Turbine Building Sampling System - Subsection 3.3.1.31 and Table 3.3.2-31
- Well Water System - Subsection 3.3.1.32 and Table 3.3.2-32
- Zinc Injection System – Subsection 3.3.1.33 and Table 3.3.2-33

3.3.1.1 Auxiliary Heating Boiler

Materials

The materials of construction for the Auxiliary Heating Boiler components and commodity groups are:

- Bronze
- Carbon steel
- Cast iron
- Glass
- Stainless steel

Environments

The Auxiliary Heating Boiler components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water
- Steam
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Auxiliary Heating Boiler components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Auxiliary Heating Boiler components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Flow Accelerated Corrosion Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Selective Leaching of Materials Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-1.

3.3.1.2 Building Sumps

Materials

The materials of construction for the Building Sumps components and commodity groups are:

- Carbon steel
- Cast iron
- Copper alloy
- PVC/plastic
- Stainless steel

Environments

The Building Sumps components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water

Aging Effects Requiring Management

The following aging effects, associated with the Building Sumps components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Building Sumps components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Selective Leaching of Materials Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-2.

3.3.1.3 Chlorination and Acid Feed System

Materials

The materials of construction for the Chlorination and Acid Feed System components and commodity groups are:

- Bronze
- Carbon steel
- Cast austenitic stainless steel
- Cast iron
- Ductile iron
- PVC/plastic
- Stainless steel

Environments

The Chlorination and Acid Feed System components and commodity groups are exposed to the following environments:

- Air/gas
- Chemical other than boric acid
- Raw water

Aging Effects Requiring Management

The following aging effects, associated with the Chlorination and Acid Feed System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Chlorination and Acid Feed System components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Selective Leaching of Materials Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-3.

3.3.1.4 Circulating Water System

Materials

The materials of construction for the Circulating Water System components and commodity groups are:

- Carbon steel
- Cast iron
- Copper alloy
- Ductile iron
- Glass
- PVC/plastic
- Stainless steel

Environments

The Circulating Water System components and commodity groups are exposed to the following environments:

- Air/gas
- Atmosphere/weather
- Raw water

Aging Effects Requiring Management

The following aging effects, associated with the Circulating Water System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Circulating Water System components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Flow Accelerated Corrosion Program
- Open-Cycle Cooling Water System Program
- Selective Leaching of Materials Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-4.

3.3.1.5 Containment Atmosphere Control System

Materials

The materials of construction for the Containment Atmosphere Control System components and commodity groups are:

- Aluminum alloy
- Carbon steel
- Copper
- Copper alloy
- Stainless steel

Environments

The Containment Atmosphere Control System components and commodity groups are exposed to the following environments:

- Air/gas
- Dried air/gas
- Raw water

Aging Effects Requiring Management

The following aging effects, associated with the Containment Atmosphere Control System components and commodity groups, require management:

- Loss of material

- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Containment Atmosphere Control System components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-5.

3.3.1.6 Control Building Heating, Ventilation, and Air Conditioning

Materials

The materials of construction for the Control Building Heating, Ventilation, and Air Conditioning components and commodity groups are:

- Aluminum alloy
- Brass
- Bronze
- Carbon steel
- Cast iron
- Copper
- Copper alloy
- Galvanized carbon steel
- Glass
- Neoprene
- Stainless steel

Environments

The Control Building Heating, Ventilation, and Air Conditioning components and commodity groups are exposed to the following environments:

- Air/gas
- Wet air/gas
- Lube oil
- Raw water
- Steam
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Control Building Heating, Ventilation, and Air Conditioning components and commodity groups, require management:

- Cracking
- Heat transfer degradation
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Control Building Heating, Ventilation, and Air Conditioning components and commodity groups:

- Bolting Integrity Program
- Closed Cycle Cooling Water System Program
- External Surfaces Monitoring Program
- Fire Water System Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Open Cycle Cooling Water System Program
- Selective Leaching of Materials Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-6.

3.3.1.7 Control Rod Drive System

Materials

The materials of construction for the Control Rod Drive System components and commodity groups are:

- Carbon steel
- Cast austenitic stainless steel
- Rubber
- Stainless steel

Environments

The Control Rod Drive System components and commodity groups are exposed to the following environments:

- Air/gas
- Lube oil
- Dried air/gas
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Control Rod Drive System components and commodity groups, require management:

- Cracking
- Cumulative fatigue damage/fatigue
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Control Rod Drive System components and commodity groups:

- Bolting Integrity Program
- BWR Control Rod Drive Return Line Nozzle Program
- External Surfaces Monitoring Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-7.

3.3.1.8 Drywell Sumps

Materials

The materials of construction for the Drywell Sumps components and commodity groups are:

- Carbon steel
- Stainless steel

Environments

The Drywell Sumps components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water

Aging Effects Requiring Management

The following aging effects, associated with the Drywell Sumps components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Drywell Sumps components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-8.

3.3.1.9 Electrical Manhole Sump Pump

Materials

The materials of construction for the Electrical Manhole Sump Pump components and commodity groups are:

- Brass
- Carbon steel
- PVC/plastic

Environments

The Electrical Manhole Sump Pump components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water

Aging Effects Requiring Management

The following aging effects, associated with the Electrical Manhole Sump Pump components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Electrical Manhole Sump Pump components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-9.

3.3.1.10 Emergency Service Water System

Materials

The materials of construction for the Emergency Service Water System components and commodity groups are:

- Bronze
- Carbon steel
- Cast austenitic stainless steel
- Cast iron
- Copper
- Glass
- Stainless steel

Environments

The Emergency Service Water System components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water
- Soil

Aging Effects Requiring Management

The following aging effects, associated with the Emergency Service Water System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Emergency Service Water System components and commodity groups:

- Bolting Integrity Program,
- Buried Piping and Tanks Inspection Program
- External Surfaces Monitoring Program
- Flow Accelerated Corrosion Program
- Open-Cycle Cooling Water System Program
- Selective Leaching of Materials Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-10.

3.3.1.11 Fire Protection System

Materials

The materials of construction for the Fire Protection System components and commodity groups are:

- Admiralty brass
- Brass
- Bronze
- Carbon steel
- Cast iron
- Copper alloy
- Ductile iron
- Galvanized carbon steel
- Glass
- Stainless steel

Environments

The Fire Protection System components and commodity groups are exposed to the following environments:

- Air/gas
- Fuel oil
- Lube oil
- Raw water
- Soil
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Fire Protection System components and commodity groups, require management:

- Heat transfer degradation
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Fire Protection System components and commodity groups:

- Bolting Integrity Program
- Buried Piping and Tanks Inspection Program
- External Surfaces Monitoring Program
- Fire Protection Program
- Fire Water System Program
- Flow Accelerated Corrosion Program
- Fuel Oil Chemistry Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- One-Time Inspection Program
- Selective Leaching of Materials Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-11.

3.3.1.12 Fuel Pool Cooling and Cleanup System

Materials

The materials of construction for the Fuel Pool Cooling and Cleanup System components and commodity groups are:

- Carbon steel
- Cast austenitic stainless steel
- Cast iron
- Stainless steel

Environments

The Fuel Pool Cooling and Cleanup System components and commodity groups are exposed to the following environments:

- Air/gas

- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Fuel Pool Cooling and Cleanup System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Fuel Pool Cooling and Cleanup System components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- One-Time Inspection Program
- Selective Leaching of Materials Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-12.

3.3.1.13 General Service Water System

Materials

The materials of construction for the General Service Water System components and commodity groups are:

- Brass
- Bronze
- Carbon steel
- Cast austenitic stainless steel
- Cast iron
- Copper
- Glass
- Nickel
- PVC/plastic
- Rubber
- Stainless steel

Environments

The General Service Water System components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water

Aging Effects Requiring Management

The following aging effect, associated with the General Service Water System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the General Service Water System components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Flow Accelerated Corrosion Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Selective Leaching of Materials Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-13.

3.3.1.14 Hydrogen Water Chemistry System

Materials

The materials of construction for the Hydrogen Water Chemistry System components and commodity groups are:

- Carbon steel
- Glass
- Stainless steel

Environments

The Hydrogen Water Chemistry System components and commodity groups are exposed to the following environments:

- Air/gas
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Hydrogen Water Chemistry System components and commodity groups, require management:

- Cracking

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Hydrogen Water Chemistry System components and commodity groups:

- Bolting Integrity Program
- Closed Cycle Cooling Water System Program
- External Surfaces Monitoring Program
- One-Time Inspection Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-14.

3.3.1.15 Instrument Air System

Materials

The materials of construction for the Instrument Air System components and commodity groups are:

- Carbon steel
- Copper alloy
- Stainless steel

Environments

The Instrument Air System components and commodity groups are exposed to the following environments:

- Air/gas
- Dried air
- Raw water

Aging Effects Requiring Management

The following aging effects, associated with the Instrument Air System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Instrument Air System components and commodity groups:

- Bolting Integrity Program

- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-15.

3.3.1.16 Intake and Traveling Screens

Materials

The materials of construction for the Intake and Traveling Screens components and commodity groups are:

- Bronze
- Carbon steel
- Cast iron
- Copper alloy
- Ductile iron
- PVC / plastic
- Stainless steel

Environments

The Intake and Traveling Screens components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water
- Wet air/gas

Aging Effects Requiring Management

The following aging effects, associated with the Intake and Traveling Screens components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Intake and Traveling Screens components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Open-Cycle Cooling Water System Program
- Selective Leaching of Materials Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-16.

3.3.1.17 Offgas Exhaust System

Materials

The materials of construction for the Offgas Exhaust System components and commodity groups are:

- Carbon steel
- Galvanized carbon steel
- Stainless steel

Environments

The Offgas Exhaust System components and commodity groups are exposed to the following environments:

- Air/gas
- Wet air/gas
- Steam
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Offgas Exhaust System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Offgas Exhaust System components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- One-Time Inspection Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-17.

3.3.1.18 Plant Ventilation

Materials

The materials of construction for the Plant Ventilation components and commodity groups are:

- Bronze
- Carbon steel
- Cast iron
- Copper
- Copper alloy
- Galvanized carbon steel
- Stainless steel

Environments

The Plant Ventilation components and commodity groups are exposed to the following environments:

- Air
- Air/gas
- Condensation
- Raw water
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Plant Ventilation components and commodity groups, require management:

- Cracking
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Plant Ventilation components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Flow Accelerated Corrosion Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Selective Leaching of Materials Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-18.

3.3.1.19 Post-Accident Sampling System

Materials

The materials of construction for the Post-Accident Sampling System components and commodity groups are:

- Carbon steel
- Cast austenitic stainless steel
- Copper alloy
- Stainless steel

Environments

The Post-Accident Sampling System components and commodity groups are exposed to the following environments:

- Air/gas
- Steam
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Post-Accident Sampling System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Post-Accident Sampling System components and commodity groups:

- Bolting Integrity Program
- Closed Cycle Cooling Water System Program
- One-Time Inspection Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-19.

3.3.1.20 Primary Containment Heating, Ventilation, and Air Conditioning System

Materials

The materials of construction for the Primary Containment Heating, Ventilation, and Air Conditioning System components and commodity groups are:

- Bronze
- Carbon steel

- Copper
- Copper-nickel
- Glass
- Stainless steel

Environments

The Primary Containment Heating, Ventilation, and Air Conditioning System components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water

Aging Effects Requiring Management

The following aging effects, associated with the Primary Containment Heating, Ventilation, and Air Conditioning System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Primary Containment Heating, Ventilation, and Air Conditioning System components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Flow Accelerated Corrosion Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-20.

3.3.1.21 Reactor Building and Radwaste Building Sampling System

Materials

The materials of construction for the Reactor Building and Radwaste Building Sampling System components and commodity groups are:

- Aluminum alloy
- Bronze
- Carbon steel
- Glass
- PVC/plastic

- Stainless steel

Environments

The Reactor Building and Radwaste Building Sampling System components and commodity groups are exposed to the following environments:

- Air/gas
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Reactor Building and Radwaste Building Sampling System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Building and Radwaste Building Sampling System components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- One-Time Inspection Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-21.

3.3.1.22 Reactor Building Closed Cooling Water System

Materials

The materials of construction for the Reactor Building Closed Cooling Water System components and commodity groups are:

- Brass
- Bronze
- Carbon steel
- Cast iron
- Copper
- Copper alloy
- Ductile iron
- Glass

- Stainless steel

Environments

The Reactor Building Closed Cooling Water System components and commodity groups are exposed to the following environments:

- Air/gas
- Lube oil
- Raw water
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Reactor Building Closed Cooling Water System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Building Closed Cooling Water System components and commodity groups:

- Bolting Integrity Program
- Closed Cycle Cooling Water System Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Selective Leaching of Materials Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-22.

3.3.1.23 Reactor Building Heating, Ventilation, and Air Conditioning

Materials

The materials of construction for the Reactor Building Heating, Ventilation, and Air Conditioning components and commodity groups are:

- Bronze
- Carbon steel
- Cast austenitic stainless steel
- Cast iron
- Copper
- Galvanized carbon steel

- Stainless steel

Environments

The Reactor Building Heating, Ventilation, and Air Conditioning components and commodity groups are exposed to the following environments:

- Air/gas
- Condensation
- Raw water
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Reactor Building Heating, Ventilation, and Air Conditioning components and commodity groups, require management:

- Heat transfer degradation
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Building Heating, Ventilation, and Air Conditioning components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Flow Accelerated Corrosion Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Open-Cycle Cooling Water System Program
- Selective Leaching of Materials Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-23.

3.3.1.24 Reactor Water Cleanup System

Materials

The materials of construction for the Reactor Water Cleanup System components and commodity groups are:

- Carbon steel
- Cast austenitic stainless steel
- Stainless steel

Environments

The Reactor Water Cleanup System components and commodity groups are exposed to the following environments:

- Air/gas
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Reactor Water Cleanup System components and commodity groups, require management:

- Cracking
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Water Cleanup System components and commodity groups:

- ASME Section XI In-service Inspection, IWB, IWC, and IWD Program
- Bolting Integrity Program
- BWR Reactor Water Cleanup System Program
- BWR Stress Corrosion Cracking Program
- Closed-Cycle Cooling Water System Program
- External Surfaces Monitoring Program
- One-Time Inspection Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-24.

3.3.1.25 RHR Service Water System

Materials

The materials of construction for the RHR Service Water System components and commodity groups are:

- Carbon steel
- Cast austenitic stainless steel
- Stainless steel

Environments

The RHR Service Water System components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water
- Soil

Aging Effects Requiring Management

The following aging effects, associated with the RHR Service Water System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the RHR Service Water System components and commodity groups:

- Bolting Integrity Program
- Buried Piping and Tanks Inspection Program
- External Surfaces Monitoring Program
- Flow Accelerated Corrosion Program
- Open Cycle Cooling Water System Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-25.

3.3.1.26 River Water Supply System

Materials

The materials of construction for the River Water Supply System components and commodity groups are:

- Carbon steel
- Cast austenitic stainless steel
- Cast iron
- Stainless steel

Environments

The River Water Supply System components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water
- Soil

Aging Effects Requiring Management

The following aging effects, associated with the River Water Supply System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the River Water Supply System components and commodity groups:

- Bolting Integrity Program
- Buried Piping and Tanks Inspection Program
- External Surfaces Monitoring Program
- Open-Cycle Cooling Water System Program
- Selective Leaching of Materials Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-26.

3.3.1.27 Safety Related Air System

Materials

The materials of construction for the Safety Related Air System components and commodity groups are:

- Aluminum alloy
- Brass
- Bronze
- Carbon steel
- Copper
- Stainless steel
- Zinc

Environments

The Safety Related Air System components and commodity groups are exposed to the following environments:

- Air/gas
- Gas – instrument air
- Raw water

Aging Effects Requiring Management

The following aging effects, associated with the Safety Related Air System components and commodity groups, require management:

- Heat transfer degradation
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Safety Related Air System components and commodity groups:

- Bolting Integrity Program
- Compressed Air Monitoring Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Open Cycle Cooling Water System Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-27.

3.3.1.28 Solid Radwaste

Materials

The materials of construction for the Solid Radwaste components and commodity groups are:

- Bronze
- Carbon steel
- Stainless steel

Environments

The Solid Radwaste components and commodity groups are exposed to the following environments:

- Air/gas
- Fuel oil
- Raw water
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Solid Radwaste components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Solid and Liquid Radwaste components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Fuel Oil Chemistry Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- One-Time Inspection Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-28.

3.3.1.29 Standby Diesel Generators

Materials

The materials of construction for the Standby Diesel Generators components and commodity groups are:

- Admiralty brass
- Aluminum alloy
- Bronze
- Carbon steel
- Cast austenitic stainless steel
- Cast iron
- Copper alloy
- Copper alloy (greater than 15% zinc)
- Glass
- Stainless steel

Environments

The Standby Diesel Generators components and commodity groups are exposed to the following environments:

- Air/gas
- Atmosphere/weather
- Condensation
- Fuel oil

- Lube oil
- Raw water
- Soil
- Treated water
- Treated water (closed cycle cooling water)

Aging Effects Requiring Management

The following aging effects, associated with the Standby Diesel Generators components and commodity groups, require management:

- Heat transfer degradation
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Standby Diesel Generators components and commodity groups:

- Bolting Integrity Program
- Buried Piping and Tanks Inspection Program
- Closed Cycle Cooling Water System Program
- External Surfaces Monitoring Program
- Fuel Oil Chemistry Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Open Cycle Cooling Water System Program
- Selective Leaching of Materials Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-29.

3.3.1.30 Standby Liquid Control System

Materials

The materials of construction for the Standby Liquid Control System components and commodity groups are:

- Carbon steel
- Glass

- Stainless steel

Environments

The Standby Liquid Control System components and commodity groups are exposed to the following environments:

- Air/gas
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Standby Liquid Control System components and commodity groups, require management:

- Cracking
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Standby Liquid Control System components and commodity groups:

- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program
- Bolting Integrity Program
- External Surfaces Monitoring Program
- One-Time Inspection Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-30.

3.3.1.31 Turbine Building Sampling System

Materials

The materials of construction for the Turbine Building Sampling System components and commodity groups are:

- Brass
- Bronze
- Carbon steel
- Cast iron
- Glass
- Stainless steel

Environments

The Turbine Building Sampling System components and commodity groups are exposed to the following environments:

- Air/gas
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Turbine Building Sampling System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Turbine Building Sampling System components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- One-Time Inspection Program
- Selective Leaching of Materials Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-31.

3.3.1.32 Well Water System

Materials

The materials of construction for the Well Water System components and commodity groups are:

- Bronze
- Carbon steel
- Cast iron
- Copper
- Glass
- Polyethylene
- PVC/plastic
- Stainless steel

Environments

The Well Water System components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Well Water System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Well Water System components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Selective Leaching of Materials Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-32.

3.3.1.33 Zinc Injection System

Materials

The materials of construction for the Zinc Injection System components and commodity groups are:

- Carbon steel
- Stainless steel

Environments

The Zinc Injection System components and commodity groups are exposed to the following environments:

- Air/gas
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Zinc Injection System components and commodity groups, require management:

- Cracking
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Zinc Injection System components and commodity groups:

- Bolting Integrity Program
- One-Time Inspection Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.3.2-33.

3.3.2 FURTHER EVALUATION OF AGING MANAGEMENT AS RECOMMENDED BY NUREG-1801

NUREG-1801 Volume 1 Tables provide the basis for identifying those programs that warrant further evaluation by the reviewer in the license renewal application. For the Auxiliary Systems, the following sections are numbered in accordance with the discussions in NUREG-1800 and explain the DAEC approach to those areas requiring further discussion. [Reference 3.3-2])

3.3.2.2.1 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). This TLAA is addressed separately in Section 4.3, “Metal Fatigue Analysis” or Section 4.7, “Other Plant-Specific Time-Limited Aging Analyses” of NUREG-1800.

At Duane Arnold, the evaluation of this TLAA is addressed separately in LRA Subsection 4.3

3.3.2.2.2 Reduction of Heat Transfer Due to Fouling

Reduction of heat transfer due to fouling could occur for stainless steel heat exchanger tubes exposed to treated water.

At DAEC, there are no stainless steel heat exchanger tubes exposed to treated water in the auxiliary systems with an intended function of heat transfer.

3.3.2.2.3 Cracking Due to Stress Corrosion Cracking

1. Cracking Due to Stress Corrosion Cracking could occur in Stainless Steel Piping, Piping Components, and Piping Elements of the BWR Standby Liquid Control System Exposed to Sodium Pentaborate Solution greater than 60°C (>140°F).

   At Duane Arnold, cracking due to SCC in the SLC system is managed by the ASME Section XI In-service Inspection, IWB, IWC, and IWD Program and the Water Chemistry Program.

2. Cracking Due to Stress Corrosion Cracking in Stainless Steel or Stainless Steel Clad Heat Exchanger Components Exposed to Treated Water >140°F.

At Duane Arnold, stainless steel piping and components exposed to treated water > 140°F are being managed for cracking due to stress corrosion cracking by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of low or stagnant flow.

3. Cracking due to SCC could occur in stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust.

   At DAEC, the stainless steel diesel exhaust components exposed to diesel exhaust are normally in the standby mode of operation and do not have temperatures >140° F.

<u>3.3.2.2.4 Cracking Due to Stress Corrosion Cracking and Cyclic Loading</u>

1. Cracking Due to Stress Corrosion Cracking and Cyclic Loading in Stainless Steel Pressurized Water Reactor Non-Regenerative Heat Exchanger Components Exposed to Treated Borated Water >140°F.

   Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

2. Cracking Due to Stress Corrosion Cracking and Cyclic Loading in Stainless Steel Pressurized Water Reactor Regenerative Heat Exchanger Components Exposed to Treated Borated Water >140°F.

   Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3. Cracking Due to Stress Corrosion Cracking and Cyclic Loading in Stainless Steel Pump Casing for the Pressurized Water Reactor High Pressure Pumps in the Chemical and Volume Control System.

   Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

<u>3.3.2.2.5 Hardening and Loss of Strength Due to Elastomer Degradation</u>

1. Hardening and Loss of Strength Due to Elastomer Degradation could occur in Elastomer Seals and Components of Heating and Ventilation Systems Exposed to Air – Indoor Uncontrolled (Internal/External).

   Hardening and loss of strength could occur due to elastomer degradation in elastomer flexible connections of auxiliary systems and other systems exposed to air – indoor uncontrolled. At DAEC, temperatures do not exceed 95°F in applicable areas.

2. Hardening and Loss of Strength Due to Elastomer Degradation could occur in Elastomer Linings of the Filters, Valves, and Ion Exchangers in Spent Fuel Pool Cooling and Cleanup Systems (BWR and PWR) Exposed to Treated Water or Treated Borated Water.

   For the auxiliary systems at Duane Arnold, no credit is taken for any elastomer linings to prevent loss of material from the underlying carbon steel material. The material is identified as carbon steel for the aging management review.

3.3.2.2.6 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion

Reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur in the neutron-absorbing sheets of BWR and PWR spent fuel storage racks exposed to treated water or to treated borated water.

Duane Arnold has Boral in both styles of fuel racks, aluminum and stainless steel. Loss of material and cracking are aging effects requiring management for Boral spent fuel storage racks exposed to a treated water environment.

The AMR evaluation reviewed the current industry and plant specific operating experience for Boral and determined that negligible adverse operating experience has been recorded.

The NRC concluded that degradation of neutron absorption performance has not been observed in materials other than Boraflex for any operating reactors in the United States.

Reduction of neutron-absorbing capacity is insignificant and requires no aging management. The potential for aging effects due to sustained irradiation of Boral was previously evaluated by the staff (BNL-NUREG-25582, dated January 1979; NUREG-1787, VC Summer SER, paragraph 3.5.2.4.2, page 3-408) and determined to be insignificant. DAEC plant operating experience with Boral coupons inspected in 2005 is consistent with the staff's conclusion and an aging management program is not required for this effect.

The aging effect of loss of material and cracking will be managed by Water Chemistry.

3.3.2.2.7 Loss of Material Due to General, Pitting, and Crevice Corrosion

1. Loss of material due to general, pitting, and crevice corrosion could occur in steel piping, piping components, and piping elements, including the tubing, valves, and tanks in the reactor coolant pump oil collection system, exposed to lubricating oil (as part of the fire protection system).

   At Duane Arnold, steel components exposed to lubricating oil are managed for loss of material due to general, crevice, pitting, microbiological influenced corrosion by the Lubricating Oil Analysis Program. The Lubricating Oil Analysis Program includes periodic sampling and Analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program. Selected components, including a sample of components where potential water pooling will occur are inspected to ensure corrosion is not occurring.

   Duane Arnold is a BWR with an inert containment atmosphere and as a result has no reactor coolant pump oil collection system.

2. Loss of Material Due to General, Pitting, and Crevice Corrosion could occur in Steel Piping, Piping Components, and Piping Elements for BWR Reactor Water Cleanup and Shutdown Cooling Systems Exposed to Treated Water.

   At Duane Arnold, steel piping and components exposed to treated water are managed for loss of material due to general, crevice, and pitting corrosion by the

Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of stagnant flow.

3. Loss of Material Due to General (Steel only), Pitting, and Crevice Corrosion could occur for Steel and Stainless Steel Diesel Exhaust Piping, Piping Components and Piping Elements Exposed to Diesel Exhaust.

   At Duane Arnold, loss of material due to general , pitting and crevice corrosion for carbon steel diesel exhaust piping and components exposed to diesel exhaust is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program will manage the aging effect of loss of material such that the intended function of the components will not be affected.

<u>3.3.2.2.8 Loss of Material Due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion (MIC)</u>

Loss of material due to general, pitting, crevice corrosion, and microbiologically-influenced corrosion (MIC) could occur for steel (with or without coating or wrapping) piping, piping components, and piping elements buried in soil.

At Duane Arnold, loss of material due to general , pitting, crevice corrosion and MIC for steel components with an external environment of soil are being managed by the Buried Piping and Tanks Inspection Program. The Buried Piping and Tanks Inspection Program will manage the aging effect of loss of material such that the intended function of the components will not be affected.

<u>3.3.2.2.9 Loss of Material Due to General, Pitting, Crevice, Microbiologically-Influenced Corrosion (MIC) and Fouling</u>

1. Loss of Material Due to General, Pitting, Crevice, Microbiologically-Influenced Corrosion, and Fouling could occur for Steel Piping, Piping Components, and Piping Elements Exposed to Fuel Oil.

   At Duane Arnold, carbon steel piping, piping components, piping elements, and tanks exposed to fuel oil are managed for loss of material due to general, crevice, pitting, and microbiologically influenced corrosion by the Fuel Oil Chemistry Program. The effectiveness of the Fuel Oil Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program. The program includes periodic sampling and analysis of fuel oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion.

2. Loss of Material Due to General, Pitting, Crevice, Microbiologically-Influenced Corrosion, and Fouling could occur for Steel Heat Exchanger Components Exposed to Lubricating Oil.

   At Duane Arnold, steel heat exchanger components exposed to lubricating oil are managed for loss of material due to general, crevice, pitting, and microbiologically influenced corrosion by the Lubricating Oil Analysis Program. The Lubricating Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program. Selected components, including a sample of components where potential water pooling will occur are inspected to ensure corrosion is not occurring.

3.3.2.2.10 Loss of Material Due to Pitting and Crevice Corrosion

1. Loss of material due to pitting and crevice corrosion could occur in BWR and PWR steel piping with elastomer lining or stainless steel cladding that are exposed to treated water and treated borated water if the cladding or lining is degraded.

   For the auxiliary systems at DAEC, no credit is taken for elastomer linings or stainless steel cladding to prevent loss of material from the underlying carbon steel material when exposed to treated water; the material is identified as carbon steel for the aging management review. The carbon steel piping and components exposed to treated water are managed for loss of material due to crevice and pitting corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of stagnant flow.

2. Loss of material due to pitting and crevice corrosion could occur for stainless steel and aluminum piping, piping components, piping elements, and for stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water.

   At Duane Arnold, stainless steel piping and components exposed to treated water are managed for loss of material due to crevice and pitting corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of stagnant flow.

   The auxiliary systems at DAEC have no aluminum components exposed to a treated water environment.

   The auxiliary systems at DAEC have steel with stainless steel cladding components exposed to a treated water environment.

3. Loss of Material Due to Pitting and Crevice Corrosion could occur for Copper Alloy Heating, Ventilation, and Air Conditioning Piping, Piping Components, and Piping Elements Exposed to Condensation (External).

   At Duane Arnold, copper alloy piping, piping components, and piping elements exposed to condensation are managed for loss of material due to crevice and pitting corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The program will visually inspect to ensure that existing environmental conditions are not causing metal degradation and that the components' intended functions are maintained during the period of extended operation.

4. Loss of Material Due to Pitting and Crevice Corrosion could occur for Copper Alloy Piping, Piping Components, and Piping Elements Exposed to Lubricating Oil.

   At Duane Arnold, copper alloy piping and components exposed to lubricating oil are managed for loss of material due to microbiological influenced corrosion by the Lubricating Oil Analysis Program. The Lubricating Oil Analysis Program includes periodic sampling and Analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program. Selected components, including a sample of components where potential water pooling could occur are inspected to ensure corrosion is not occurring.

5. Loss of Material Due to Pitting and Crevice Corrosion could occur for Stainless Steel and Aluminum Heating, Ventilation And Air Conditioning Piping, Piping Components, and Piping Elements Exposed to Condensation (Internal).

   At Duane Arnold stainless steel HVAC components exposed to internal condensation are managed for loss of material due to crevice and pitting corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The program will visually inspect to ensure that existing environmental conditions are not causing metal degradation and that the components intended functions are maintained during the period of extended operation.

   Aluminum piping elements exposed to condensation are managed for loss of material due to crevice and pitting corrosion by the Compressed Air Program. The effects of corrosion and the presence of contaminants are monitored by visual inspection and periodic system and component tests, including leak rate tests on the system and individual components. The tests verify proper operation by comparing measured values of performance with specified performance limits which assure that the component’s intended function is maintained during the period of extended operation.

6. Loss of Material Due to Pitting and Crevice Corrosion could occur for Copper Alloy Fire Protection Piping, Piping Components, and Piping Elements Exposed to Condensation (Internal).

   The fire protection system at DAEC have no copper alloy components exposed to a internal condensation environment.

7. Loss of Material Due to Pitting and Crevice Corrosion could occur for Stainless Steel Piping, Piping Components, and Piping Elements Exposed to Soil.

   The auxiliary systems at DAEC have no stainless steel components exposed to a soil environment.

8. Loss of Material Due to Pitting and Crevice Corrosion could occur for Stainless Steel Piping, Piping Components, and Piping Elements in Standby Liquid Control System Exposed to Sodium Pentaborate Solution.

   At Duane Arnold, stainless steel piping, piping components and piping elements exposed to sodium pentaborate solution is managed for loss of material due to crevice and pitting corrosion by the Water Chemistry System. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of stagnant flow.

3.3.2.2.11 Loss of Material Due to Pitting, Crevice, and Galvanic Corrosion

Loss of material due to pitting, crevice, and galvanic corrosion could occur for copper alloy piping, piping components, and piping elements exposed to treated water.

At Duane Arnold copper alloy piping, piping components, and piping elements are managed for crevice and pitting corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry is verified using the One Time Inspection program. Selected components, including a sample of components where the flow of water is low or stagnant conditions exist, are inspected to determine whether an aging effect is not occurring or is progressing very slowly such that their intended function will be maintained during the period of extended operation.

3.3.2.2.12 Loss of Material Due to Pitting, Crevice, and Microbiologically-Influenced Corrosion

1. Loss of Material Due to Pitting, Crevice and Microbiologically-Influenced Corrosion could occur in Stainless Steel, Aluminum, and Copper Alloy Piping, Piping Components, and Piping Elements Exposed to Fuel Oil.

   At Duane Arnold, stainless steel piping, piping components, and piping elements exposed to fuel oil are managed for loss of material due to crevice, pitting, and microbiologically influenced corrosion by the Fuel Oil Chemistry Program. Copper alloy piping, piping components, and piping elements exposed to fuel oil are managed for loss of material due to crevice, pitting and microbiologically influenced corrosion by the Fuel Oil Chemistry Program. The effectiveness of the Fuel Oil Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program. The program includes periodic sampling and analysis of fuel oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion.

2. Loss of Material Due to Pitting, Crevice and Microbiologically-Influenced Corrosion could occur in Stainless Steel, Piping, Piping Components, and Piping Elements Exposed to Lubricating Oil.

   At Duane Arnold, stainless steel piping and components exposed to lubricating oil are managed for loss of material due to pitting, crevice, and microbiologically influenced corrosion by the Lubricating Oil Analysis Program. The Lubricating Oil Analysis Program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program. Selected components, including a sample of components where potential water pooling will occur are inspected to ensure corrosion is not occurring.

3.3.2.2.13 Loss of Material Due to Wear

The GALL Report recommends further evaluation of programs to manage the loss of material due to wear of the elastomer seals and components of the ventilation systems.

In the DAEC auxiliary systems, this specific aging effect for elastomers is not applicable. Wear is the loss of surface layers due to relative motion between two surfaces. In the auxiliary systems, this specific aging effect is not applicable because the heating, ventilation, and air conditioning elastomer coated fiberglass duct flexible connections are fixed at both ends, precluding wear. There is no plant specific operating experience supporting wear of HVAC elastomers at DAEC.

3.3.2.2.14 Loss of Material Due to Cladding Breach

Not applicable for Duane Arnold. Only applicable to pressurized water reactors.

3.1.2.2.15 Quality Assurance for Aging Management of Nonsafety-Related Components

The applicant's aging management programs for license renewal should contain the elements of corrective actions, the confirmation process, and administrative controls. Safety-related components are covered by 10 CFR Part 50, Appendix B, which is adequate to address these program elements. However, Appendix B does not apply to nonsafety-related components that are subject to an AMR for license renewal.

See LRA Appendix B Subsection B.1.3 for discussion of the Duane Arnold quality assurance procedures and administrative controls for aging management programs.

3.3.3 TIME-LIMITED AGING ANALYSIS

The only time-limited aging analyses (TLAAs) identified below are associated with the Mechanical Auxiliary Systems components and commodity groups is metal fatigue (LRA Subsection 4.3).

3.3.4 CONCLUSION

The Auxiliary System components and commodity groups that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Auxiliary Systems components are identified in the summaries in LRA Subsection 3.3.2 above.

A description of these aging management programs is provided in LRA 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 LRA Appendix B, the effects of aging associated with the Auxiliary System components and commodity groups will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

3.3.5 REFERENCES

3.3-1 NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Revision 1, Nuclear Regulatory Commission, September 2005.

3.3-2 NUREG 1800, Standard Review Plan for License Renewal Applications for Nuclear Power Plants, Revision 1, Nuclear Regulatory Commission, September 2005.

TABLE 3.3-1
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-1	Steel cranes – structural girders exposed to air – indoor uncontrolled (external)	Cumulative fatigue damage	TLAA to be evaluated for structural girders of cranes. See Standard Review Plan, Section 4.7 for generic guidance for meeting the requirements of 10 CFR 54.21(c)(1)	Yes, TLAA	Fatigue is a TLAA. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.1
3.3.1-2	Steel and stainless steel piping, piping components, piping elements, and heat exchanger components exposed to air – indoor uncontrolled, treated borated water or treated water	Cumulative fatigue damage	TLAA evaluated in accordance with 10 CFR 54.21(c)(1)	Yes, TLAA	Fatigue is a TLAA. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.1
3.3.1-3	Stainless steel heat exchanger tubes exposed to treated water	Reduction of heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not applicable at DAEC for the auxiliary systems, Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.2
3.3.1-4	Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution >60°C (>140°F)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.3, Item 1
3.3.1-5	Stainless steel and stainless clad steel heat exchanger components exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking	Plant-specific	Yes, plant- specific	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.3, Item 2
3.3.1-6	Stainless steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust	Cracking due to stress corrosion cracking	Plant-specific	Yes, plant- specific	Not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.3, Item 3

**TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS**

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-7	Pressurized water reactor only				
3.3.1-8	Pressurized water reactor only				
3.3.1-9	Pressurized water reactor only				
3.3.1-10	High-strength steel closure bolting exposed to air with steam or water leakage	Cracking due to stress corrosion cracking, cyclic loading	Bolting Integrity The AMP is to be augmented by appropriate inspection to detect cracking if the bolts are not otherwise replaced during maintenance.	Yes, if bolts are not replaced during maintenance	Not applicable at DAEC. High strength steel bolting is not used in Auxiliary Systems.
3.3.1-11	Elastomer seals and components exposed to air – indoor uncontrolled (internal / external)	Hardening and loss of strength due to elastomer degradation	Plant-specific	Yes, plant-specific	Not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.5, Item 1
3.3.1-12	Elastomer lining exposed to treated water or treated borated water	Hardening and loss of strength due to elastomer degradation	A plant-specific aging management program that determines and assesses the qualified life of the linings in the environment is to be evaluated	Yes, plant-specific	Not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.5, Item 2
3.3.1-13	Boral, boron steel spent fuel storage racks neutron absorbing sheets exposed to treated water or treated borated water	Reduction in neutron absorbing capacity and loss of material due to general corrosion	Plant-specific	Yes, plant-specific	Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.6

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-14	Steel piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.7, Item 1
3.3.1-15	Steel reactor coolant pump oil collection system piping, tubing, and valve bodies exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.7, Item 1
3.3.1-16	Steel reactor coolant pump oil collection system tank exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection to evaluate the thickness of the lower portion of the tank.	Yes, detection of aging effects is to be evaluated	Not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.7, Item 1
3.3.1-17	Steel piping, piping components, and piping elements exposed to treated water	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.7, Item 2
3.3.1-18	Stainless steel and steel diesel engine exhaust piping, piping components, and piping elements exposed to diesel exhaust	Loss of material due to general (steel only), pitting, and crevice corrosion	Plant-specific	Yes, plant specific	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.7, Item 3
3.3.1-19	Steel (with or without coating or wrapping) piping, piping components, and piping elements exposed to soil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion	Buried Piping and Tanks Surveillance or Buried Piping and Tanks Inspection	No Yes, detection of aging effects and operating experience are to be further evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.8

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-20	Steel piping, piping components, piping elements, and tanks exposed to fuel oil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion and fouling	Fuel Oil Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.9, Item 1
3.3.1-21	Steel heat exchanger components exposed to lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion and fouling	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.9, Item 2
3.3.1-22	Steel with elastomer lining or stainless steel cladding piping, piping components, and piping elements exposed to treated water or treated borated water	Loss of material due to pitting and crevice corrosion (only for steel after lining / cladding degradation)	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.10, Item 1
3.3.1-23	Stainless steel and steel with stainless steel cladding heat exchanger components exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.10, Item 2
3.3.1-24	Stainless steel and aluminum piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.10, Item 2
3.3.1-25	Copper alloy HVAC piping, piping components, and piping elements exposed to condensation (external)	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated	Yes, plant-specific	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.10, Item 3

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-26	Copper alloy piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.10, Item 4
3.3.1-27	Stainless steel HVAC ducting and aluminum HVAC piping, piping components, and piping elements exposed to condensation	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated	Yes, plant-specific	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.10, Item 5
3.3.1-28	Copper alloy fire protection piping, piping components, and piping elements exposed to condensation	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated	Yes, plant-specific	Not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.10, Item 6
3.3.1-29	Stainless steel piping, piping components, and piping elements exposed to soil	Loss of material due to pitting and crevice corrosion	A plant-specific aging management program is to be evaluated	Yes, plant-specific	Not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.10, Item 7
3.3.1-30	Stainless steel piping, piping components, and piping elements exposed to sodium pentaborate solution	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.10, Item 8
3.3.1-31	Copper alloy piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.11
3.3.1-32	Stainless steel, aluminum and copper alloy piping, piping components, and piping elements exposed to fuel oil	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Fuel Oil Chemistry and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.12, Item 1

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-33	Stainless steel piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging effects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.12, Item 2
3.3.1-34	Elastomer seals and components exposed to air – indoor uncontrolled (internal or external)	Loss of material due to wear	Plant-specific	Yes, plant-specific	Not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.3.2, NUREG-1800 Section 3.3.2.2.13
3.3.1-35	Pressurized water reactor only				
3.3.1-36	Boraflex spent fuel storage racks neutron absorbing sheets exposed to treated water	Reduction in neutron absorbing capacity due to boraflex degradation	Boraflex Monitoring	No	Not applicable at DAEC. DAEC has no boraflex spent fuel storage racks.
3.3.1-37	Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking, intergranular stress corrosion cracking	BWR Reactor Water Cleanup System	No	Consistent with NUREG-1801. Cracking of stainless steel piping, piping components, and piping elements exposed to treated water is managed by the BWR Reactor Water Cleanup System Program at DAEC.
3.3.1-38	Stainless steel piping, piping components, and piping elements exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking	BWR Stress Corrosion Cracking and Water Chemistry	No	Consistent with NUREG-1801. Cracking of stainless steel piping, piping components, and piping elements exposed to treated water is managed by the BWR Stress Corrosion Cracking and Water Chemistry Programs at DAEC.

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-39	Stainless steel BWR spent fuel storage racks exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking	Water Chemistry	No	Not applicable. DAEC spent fuel storage racks are exposed to treated water with temperatures of less than 140 °F.
3.3.1-40	Steel tanks in diesel fuel oil system exposed to air – outdoor (external)	Loss of material due to general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	Not applicable. DAEC has no steel fuel oil tanks exposed to out door air. The fuel oil tanks are buried and managed by the Buried Piping & Tanks Inspection Program.
3.3.1-41	High-strength steel closure bolting exposed to air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Not applicable at DAEC. The auxiliary systems have no high strength steel closure bolting exposed to air with steam or water leakage.
3.3.1-42	Steel closure bolting exposed to air with steam or water leakage	Loss of material due to general corrosion	Bolting Integrity	No	Not applicable at DAEC. The auxiliary systems have no steel closure bolting exposed to air with steam or water leakage.
3.3.1-43	Steel bolting and closure bolting exposed to air – indoor uncontrolled (external) or air – outdoor (external)	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Consistent with NUREG-1801. Loss of material of steel bolting exposed to indoor and outdoor air is managed by the Bolting Integrity Program at DAEC. Crevice and Pitting are not an applicable internal aging mechanism due to not having a concentration of contaminates or aggressive environments at DAEC.

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-44	Steel compressed air system closure bolting exposed to condensation	Loss of material due to general, pitting, and crevice corrosion	Bolting Integrity	No	Not applicable at DAEC. The auxiliary systems have no steel compressed air system closure bolting exposed to condensation (wet air/gas).
3.3.1-45	Steel closure bolting exposed to air – indoor uncontrolled (external)	Loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Consistent with NUREG-1801. Loss of material of steel bolting exposed to indoor air is managed by the Bolting Integrity Program at DAEC.
3.3.1-46	Stainless steel and stainless clad steel piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water >60°C (>140°F)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	Not applicable at DAEC. The auxiliary systems have no stainless steel components exposed to CCW >140°F.
3.3.1-47	Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to general, pitting, and crevice corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801. Loss of material of steel piping, piping components, piping elements, tanks and heat exchangers exposed to treated water is managed by the Closed-Cycle Cooling Water System Program at DAEC.

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-48	Steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801. Loss of material of steel piping, piping components, and piping elements exposed to treated water is managed by the Closed-Cycle Cooling Water System Program at DAEC.
3.3.1-49	Stainless steel, steel with stainless steel cladding heat exchanger components exposed to closed cycle cooling water	Loss of material due to microbiologically influenced corrosion	Closed-Cycle Cooling Water System	No	Not applicable at DAEC. DAEC does not have plant specific OE that supports MIC in a treated water environment.
3.3.1-50	Stainless steel piping, piping components, and piping elements exposed to closed cycle cooling water	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801. Loss of material of stainless steel piping, piping components, and piping elements exposed to treated water is managed by the Closed-Cycle Cooling Water System Program at DAEC.
3.3.1-51	Copper alloy piping, piping components, piping elements, and heat exchanger components exposed to closed cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Consistent with NUREG-1801. Loss of material of copper alloy piping, piping components, piping elements, and heat exchanger components exposed to treated water is managed by the Closed-Cycle Cooling Water System Program at DAEC.

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-52	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed cycle cooling water	Reduction in heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Not applicable at DAEC. DAEC does not have plant specific OE that supports heat transfer degradation in a treated water environment.
3.3.1-53	Steel compressed air system piping, piping components, and piping elements exposed to condensation (internal)	Loss of material due to general and pitting corrosion	Compressed Air Monitoring	No	Loss of material of steel piping, piping components, and piping elements exposed to internal air (wet air/gas) is managed by the Compressed Air Monitoring and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Programs at DAEC.
3.3.1-54	Stainless steel compressed air system piping, piping components, and piping elements exposed to internal condensation	Loss of material due to crevice and pitting corrosion	Compressed Air Monitoring	No	Loss of material of stainless steel piping, piping components, and piping elements exposed to internal air (wet air/gas) is managed by the Compressed Air Monitoring and the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Programs at DAEC.
3.3.1-55	Steel ducting closure bolting exposed to air – indoor uncontrolled (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. Loss of material of steel ducting bolting exposed to indoor air is managed by the External Surfaces Monitoring Program at DAEC.

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-56	Steel HVAC ducting and components external surfaces exposed to air – indoor uncontrolled (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. Loss of material of steel ducting and components exposed to external air is managed by the External Surfaces Monitoring Program at DAEC.
3.3.1-57	Steel piping and components external surfaces exposed to air – indoor uncontrolled (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. Loss of material of steel piping and components exposed to external air is managed by the External Surfaces Monitoring Program at DAEC.
3.3.1-58	Steel external surfaces exposed to air – indoor uncontrolled (external), and condensation (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. Loss of material of steel external surfaces exposed to air and condensation (wet air/gas) is managed by the External Surfaces Monitoring Program at DAEC.
3.3.1-59	Steel heat exchanger components exposed to air – indoor uncontrolled (external) or air – outdoor (external)	Loss of material due to general, pitting, and crevice corrosion	External Surfaces Monitoring	No	Loss of material of steel heat exchangers exposed to indoor air is managed by the External Surfaces Monitoring Program at DAEC. Crevice and Pitting are not applicable aging mechanism due to not having a concentration of contaminates or aggressive environment. DAEC have no steel heat exchangers in outdoor air.

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-60	Steel piping, piping components, and piping elements exposed to air – outdoor (external)	Loss of material due to general, pitting, and crevice corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. Loss of material of steel piping, piping components, and piping elements exposed to outdoor air is managed by the External Surfaces Monitoring Program at DAEC.
3.3.1-61	Elastomer fire barrier penetration seals exposed to air – outdoor or air indoor – uncontrolled	Increased hardness, shrinkage, and loss of strength due to weathering	Fire Protection	No	Not applicable to the Auxiliary Systems at DAEC. Increased hardness, shrinkage and loss of strength of elastomers exposed to indoor and outdoor air is managed by the Fire Protection and the Structures Monitoring Programs at DAEC. (in Section 3.5)
3.3.1-62	Aluminum piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion	Fire Protection	No	Not applicable at DAEC. The auxiliary systems have no aluminum components exposed to raw water at DAEC.
3.3.1-63	Steel fire rated doors exposed to air – outdoor or air – indoor uncontrolled	Loss of material due to wear	Fire Protection	No	Not applicable to the Auxiliary Systems at DAEC. Wear of steel fire doors exposed to air is managed by the Fire Protection Program at DAEC. (in Section 3.5)

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-64	Steel piping, piping components, and piping elements exposed to fuel oil	Loss of material due to general, pitting, and crevice corrosion	Fire Protection and Fuel Oil Chemistry	No	Loss of material of steel piping, piping components, and piping elements exposed to fuel oil is managed by the Fuel Oil Chemistry and One Time Inspection Programs at DAEC.
3.3.1-65	Reinforced concrete structural fire barriers – walls, ceilings, and floors exposed to air – indoor uncontrolled	Concrete cracking and spalling due to aggressive chemical attack, and reaction with aggregates	Fire Protection and Structures Monitoring Program	No	Not applicable to the Auxiliary Systems at DAEC however, cracking and spalling, aggressive chemical of reinforced concrete structural fire barriers exposed to indoor air is managed by the Fire Protection and Structural Monitoring Programs at DAEC. (in Section 3.5)
3.3.1-66	Reinforced concrete structural fire barriers – walls, ceilings, and floors exposed to air – outdoor	Concrete cracking and spalling due to freeze thaw, aggressive chemical attack, and reaction with aggregates	Fire Protection and Structures Monitoring Program	No	Cracking and spalling of reinforced concrete structural fire barriers exposed to outdoor air is managed by the Structural Monitoring Programs at DAEC.
3.3.1-67	Reinforced concrete structural fire barriers – walls, ceilings, and floors exposed to air – outdoor or air – indoor uncontrolled	Loss of material due to corrosion of embedded steel	Fire Protection and Structures Monitoring Program	No	Not applicable to the Auxiliary Systems at DAEC however, loss of material of reinforced concrete structural fire barriers exposed to air is managed by the Fire Protection and Structural Monitoring Programs at DAEC. (in Section 3.5)

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-68	Steel piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion and fouling	Fire Water System	No	Consistent with NUREG-1801. Loss of material of steel piping, piping components, and piping elements exposed to raw water is managed by the Fire Water System at DAEC.
3.3.1-69	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion and fouling	Fire Water System	No	Consistent with NUREG-1801. Loss of material of stainless steel piping, piping components, and piping elements exposed to raw water is managed by the Fire Water System at DAEC.
3.3.1-70	Cooper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion and fouling	Fire Water System	No	Consistent with NUREG-1801. Loss of material of copper alloy piping, piping components, and piping elements exposed to raw water is managed by the Fire Water System at DAEC.
3.3.1-71	Steel piping, piping components, and piping elements exposed to moist air or condensation (internal)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Consistent with NUREG-1801. Loss of material of steel piping, piping components, and piping elements exposed to wet air/gas is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program at DAEC.

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-72	Steel HVAC ducting and components internal surfaces exposed to condensation (internal)	Loss of material due to general, pitting, crevice, and (for drip pans and drain lines) microbiologically influenced corrosion	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	No	Consistent with NUREG-1801. Loss of material of steel ducting and components exposed to condensation is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program at DAEC.
3.3.1-73	Steel crane structural girders in load handling system exposed to air – indoor uncontrolled (external)	Loss of material due to general corrosion	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	Loss of material or steel crane structural girders are being managed by the Structural Monitoring Program at DAEC. (in Section 3.5)
3.3.1-74	Steel cranes – rails exposed to air – indoor uncontrolled (external)	Loss of material due to wear	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	No	Not applicable to the Auxiliary Systems at DAEC however, wear of crane rails exposed to air are managed by the Overhead Handling Systems Program at DAEC.
3.3.1-75	Elastomer seals and components exposed to raw water	Hardening and loss of strength due to elastomer degradation; loss of material due to erosion	Open-Cycle Cooling Water System	No	Not applicable to DAEC. The auxiliary systems have no elastomers exposed to a raw water environment at DAEC.
3.3.1-76	Steel piping, piping components, and piping elements (without lining / coating or with degraded lining / coating) exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion, fouling, and lining / coating degradation	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. Loss of material of steel piping, piping components, and piping elements exposed to raw water are managed by the Open-Cycle Cooling Water System Program.

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-77	Steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically influenced corrosion and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. Loss of material of steel heat exchanger components exposed to raw water are managed by the Open-Cycle Cooling Water System Program.
3.3.1-78	Stainless steel, nickel alloy, and copper alloy piping , piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice, corrosion	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. Loss of material of stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water are managed by the Open-Cycle Cooling Water System Program. Loss of material of nickel alloy components is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program at DAEC.
3.3.1-79	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice, corrosion and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. Loss of material of stainless steel piping, piping components, and piping elements exposed to raw water are managed by the Open-Cycle Cooling Water System Program at DAEC.

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-80	Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. Loss of material of stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water are managed by the Open-Cycle Cooling Water System Program at DAEC.
3.3.1-81	Copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. Loss of material of copper alloy piping, piping components, and piping elements exposed to raw water are managed by the Open-Cycle Cooling Water System Program at DAEC.
3.3.1-82	Copper alloy heat exchanger components exposed to raw water	Loss of material due to pitting, crevice, galvanic, and microbiologically influenced corrosion and fouling,	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. Loss of material of copper alloy heat exchanger components exposed to raw water are managed by the Open-Cycle Cooling Water System Program at DAEC.
3.3.1-83	Stainless steel and copper alloy heat exchanger tubes exposed to raw water	Reduction in heat transfer due to fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. Reduction in heat transfer of stainless steel and copper alloy tubes exposed to raw water are managed by the Open-Cycle Cooling Water System Program at DAEC.

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-84	Copper alloy >15% Zn piping, piping components, piping elements, and heat exchanger components exposed to raw water, treated water, or closed cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Consistent with NUREG-1801. Selective leaching of copper alloy >15% ZN components exposed to raw water and treated water are managed by the Selective Leaching of Materials Program at DAEC.
3.3.1-85	Gray cast iron piping, piping components, and piping elements exposed to soil, raw water, treated water, or closed cycle cooling water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Consistent with NUREG-1801. Selective leaching of cast iron components exposed to raw water, soil, treated water are managed by the Selective Leaching of Materials Program at DAEC.
3.3.1-86	Structural steel (new fuel storage rack assembly) exposed to air – indoor uncontrolled (external)	Loss of material due to general, pitting, and crevice corrosion	Structures Monitoring Program	No	Consistent with NUREG-1801. The steel new fuel storage racks in air are managed by the Structures Monitoring Program at DAEC.
3.3.1-87	Pressurized water reactor only				
3.3.1-88	Pressurized water reactor only				
3.3.1-89	Pressurized water reactor only				
3.3.1-90	Pressurized water reactor only				
3.3.1-91	Pressurized water reactor only				

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-92	Galvanized steel piping, piping components, and piping elements exposed to air – indoor uncontrolled	None	None	NA – no aging effect management or aging management program	Consistent with NUREG-1801. The auxiliary systems have no aging effects for galvanized components exposed to air-indoor uncontrolled at DAEC.
3.3.1-93	Glass piping elements exposed to air, air – indoor uncontrolled (external), fuel oil, lubricating oil, raw water, treated water, and treated borated water	None	None	NA – no aging effect management or aging management program	Consistent with NUREG-1801. The auxiliary systems have no aging effects for glass components exposed to air, oil, raw water or treated water at DAEC.
3.3.1-94	Stainless steel and nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external)	None	None	NA – no aging effect management or aging management program	Consistent with NUREG-1801. The auxiliary systems have no aging effects for stainless steel and nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external) at DAEC
3.3.1-95	Steel and aluminum piping, piping components, and piping elements exposed to air – indoor uncontrolled (external)	None	None	NA – no aging effect management or aging management program	Consistent with NUREG-1801. The auxiliary systems have no aging effects for steel >212°F and aluminum piping, piping components, and piping elements exposed to air-indoor uncontrolled at DAEC
3.3.1-96	Steel and stainless steel piping, piping components, and piping elements exposed to concrete	None	None	NA – no aging effect management or aging management program	Consistent with NUREG-1801. For the Auxiliary Systems, components exposed to concrete have no aging effects at DAEC.

TABLE 3.3-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VII OF NUREG-1801
AUXILIARY SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.3.1-97	Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas	None	None	NA – no aging effect management or aging management program	Consistent with NUREG-1801. The auxiliary systems have no aging effects for steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas at DAEC
3.3.1-98	Steel, stainless steel and copper alloy piping, piping components, and piping elements exposed to dried air	None	None	NA – no aging effect management or aging management program	Consistent with NUREG-1801. The auxiliary systems have no aging effects for steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to dried air at DAEC.
3.3.1-99	Pressurized water reactor only				

TABLE 3.3.2-1
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
AUXILIARY HEATING BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water or steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-40 (S-13)	3.4.1-6	208, E
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
Filter, screens, strainer	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	208, E
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-33 (S-09)	3.4.1-4	208, E
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water or steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-7 (S-18)	3.4.1-5	208, 219, E

TABLE 3.3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
AUXILIARY HEATING BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation (level gauge)	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water or steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.A-5 (SP-61)	3.4.1-15	208, E
		Glass	Air/gas (external)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
			Treated water or steam (internal)	None	None	VII.J-13 (AP-51)	3.3.1-94	A
Instrumentation (flow element)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water or steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-29 (SP-16)	3.4.1-16	208, E
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-23 (A-23)	3.3.1-71	202, A

TABLE 3.3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
AUXILIARY HEATING BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Carbon steel	Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38	3.3.1-76	202, 208, E
			Treated water (internal)	Loss of material	Flow-Accelerated Corrosion Program	VIII.E-35 (S-16)	3.4.1-29	A
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-33 (S-09)	3.4.1-4	202, 208, E
			Treated water or steam (internal)	Loss of material	Flow-Accelerated Corrosion Program	VIII.E-35 (S-16)	3.4.1-29	A
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-33 (S-09)	3.4.1-4	202, 208, E
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water or steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-29 (SP-16)	3.4.1-16	208, E
Separators, degasifiers	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water or steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-33 (S-09)	3.4.1-4	208, E

TABLE 3.3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
AUXILIARY HEATING BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Thermowell	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water or steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-33 (S-09)	3.4.1-4	208, E
Valve, damper	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	208, E
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.A-5 (SP-61)	3.4.1-15	208, E
			Treated water or steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.A-5 (SP-61)	3.4.1-15	208, E
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-23 (A-23)	3.3.1-71	A

TABLE 3.3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
AUXILIARY HEATING BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Carbon steel	Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	208, E
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-33 (S-09)	3.4.1-4	208, E
			Treated water or steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-33 (S-09)	3.4.1-4	208, E
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water or steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-33 (S-09)	3.4.1-4	208, E
					Selective Leaching of Materials Program	VIII.E-23 (SP-27)	3.4.1-36	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-29 (SP-16)	3.4.1-16	208, E

TABLE 3.3.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
AUXILIARY HEATING BOILER

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Stainless steel	Treated water or steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-29 (SP-16)	3.4.1-16	208, E

TABLE 3.3.2-2
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
BUILDING SUMPS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of Material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	202, E
		Cast iron	Air/gas (external)	Loss of Material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of Material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E
					Selective Leaching of Materials Program	VII.C1-11 (A-51)	3.3.1-85	A

TABLE 3.3.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
BUILDING SUMPS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	PVC/ plastic	Air/gas (external)	None	None			234, H
			Raw water (internal)	None	None			234, H
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of Material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, E
Valve, damper	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E
					Selective Leaching of Materials Program	VII.C1-11 (A-51)	3.3.1-85	A

TABLE 3.3.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
BUILDING SUMPS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Ductile iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E
	Leakage boundary (spatial)	Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of Material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	E

TABLE 3.3.2-3
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CHLORINATION AND ACID FEED SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	202, E
		PVC / plastic	Air/gas (external)	None	None			234, H
			Chemical other than boric acid (internal)	None	None			234, H
			Raw water (internal)	None	None			234, H

**TABLE 3.3.2-3 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CHLORINATION AND ACID FEED SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Chemical other than boric acid (internal)	None	None			218, I
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, E
Pressure vessels	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, E

TABLE 3.3.2-3 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CHLORINATION AND ACID FEED SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Ductile iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E
		PVC / plastic	Air/gas (external)	None	None			234, H
			Chemical other than boric acid (internal)	None	None			234, H
Valve, damper	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	E
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	202, E
		Cast austenitic stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

TABLE 3.3.2-3 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CHLORINATION AND ACID FEED SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Cast austenitic stainless steel (continued)	Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, E
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E
					Selective Leaching of Materials Program	VII.C1-11 (A-51)	3.3.1-85	A
		PVC / plastic	Air/gas (external)	None	None			234, H
			Raw water (internal)	None	None			234, H
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Chemical other than boric acid (internal)	None	None			218, I
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, E

TABLE 3.3.2-4
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CIRCULATING WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.x-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (A-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Flow-Accelerated Corrosion Program			222, H
					Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A
						VII.C1-5 (A-64)	3.3.1-77	202, C
		Glass	Air/gas (external)	None	None	VII.J-8 (AP-14)	3.3.1-14	A
			Raw water (internal)	None	None	VII.J-11 (AP-50)	3.3.1-33	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A

TABLE 3.3.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CIRCULATING WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.x-1 Item	Notes
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A
		Ductile iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A
Valve, damper	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
	Pressure boundary	Carbon steel	Atmosphere/ weather (external)	Loss of material	External Surfaces Monitoring Program	VII.I-9 (A-78)	3.3.1-58	A
	Pressure boundary Leakage boundary (spatial)	Carbon steel	Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A

TABLE 3.3.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CIRCULATING WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.x-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A
					Selective Leaching of Materials Program	VII.C1-11 (A-51)	3.3.1-85	A
		Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-9 (A-44)	3.3.1-81	A
		PVC / plastic	Air/gas (external)	None	None			234, H
			Raw water (internal)	None	None			234, H
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	A, 202

TABLE 3.3.2-5
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTAINMENT ATMOSPHERE CONTROL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
	Pressure boundary	Carbon steel	Air/gas (internal)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Air/gas (internal)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
	Structural integrity (attached)	Carbon steel	Dried air/gas (internal)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F

TABLE 3.3.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTAINMENT ATMOSPHERE CONTROL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Filter, screens, strainer	Filter Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Air/gas (internal)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
Flow orifice	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Dried air/gas (internal)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Dried air/gas (internal)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Structural integrity (attached) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Dried air/gas (internal)	None	None	VII.J-23 (AP-6)	3.3.1-97	A

**TABLE 3.3.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTAINMENT ATMOSPHERE CONTROL SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Structural integrity (attached) Leakage boundary (spatial)	Carbon steel	Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G23 (A-23)	3.3.1-71	202, A
	Leakage boundary (spatial)	Carbon steel	Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	220, E
		Copper	Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	220, E
	Leakage boundary (spatial) Pressure boundary	Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
	Pressure boundary	Copper	Air/gas (internal)	None	None	VII.J-3 (AP-8)	3.3.1-98	A

**TABLE 3.3.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTAINMENT ATMOSPHERE CONTROL SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary Structural integrity (attached)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Dried air/gas (internal)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
	Pressure boundary	Stainless steel	Air/gas (internal)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
Valve, damper	Pressure boundary	Aluminum alloy	Air/gas (external)	None	None	VII.J-1 (AP-36)	3.3.1-95	A
			Air/gas (internal)	None	None			228, G
	Leakage boundary (spatial) Structural integrity (attached) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Dried air/gas (internal)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
	Leakage boundary (spatial)	Carbon steel	Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	220, E

TABLE 3.3.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTAINMENT ATMOSPHERE CONTROL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Carbon steel	Air/gas (internal)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
	Pressure boundary Structural integrity (attached)	Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
	Pressure boundary	Copper alloy	Air/gas (internal)	None	None	VII.J-3 (AP-8)	3.3.1-98	A
	Structural integrity (attached)	Copper alloy	Dried air/gas (internal)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
	Pressure boundary Structural integrity (attached)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
	Pressure boundary	Stainless steel	Air/gas (internal)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
	Pressure boundary Structural integrity (attached)	Stainless steel	Dried air/gas (internal)	None	None	VII.J-19 (AP-22)	3.3.1-97	A

TABLE 3.3.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTAINMENT ATMOSPHERE CONTROL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Structural Integrity (Attached)	Stainless steel	Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.D-4 (A-81)	3.3.1-54	208, A

**TABLE 3.3.2-6
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.F1-20 (A-25)	3.3.1-47	A
	Pressure boundary	Carbon steel	Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.F1-19 (AP-30)	3.3.1-14	202, A
Blower, compressor, fan, vacuum pump	Pressure boundary	Carbon steel	Air (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	203, A
			Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.F1-2 (A-10)	3.3.1-56	A
		Cast iron	Air (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	203, A
			Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.F1-2 (A-10)	3.3.1-56	A
		Galvanized carbon steel	Air (internal)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A

TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Drain pans	Leakage boundary (spatial)	Galvanized carbon steel	Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F1-3 (A-08)	3.3.1-72	A
Ductwork	Pressure boundary	Galvanized carbon steel	Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	203, A
			Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.F1-2 (A-10)	3.3.1-56	A
Elastomers	Pressure boundary	Neoprene	Air/gas (internal)	None	None			212, I
			Air/gas (external)	None	None			212, I
Electrical resistance heater, heat trace	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	None	None			231, I
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F1-3 (A-08)	3.3.1-72	202, A
			Steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.C-3 (S-04)	3.4.1-2	E

TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Electrical resistance heater, heat trace (continued)	Leakage boundary (spatial	Carbon steel	Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	E
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Pressure boundary Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.F1-2 (A-10)	3.3.1-56	A
						VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.F1-20 (A-25)	3.3.1-47	A
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	E

TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Filter, screens, strainer (continued)	Leakage boundary (spatial)	Carbon steel	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F1-3 (A-08)	3.3.1-72	202, A
			Steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.C-3 (S-04)	3.4.1-2	E
	Pressure boundary	Carbon steel	Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	203, A
			Air/gas (internal)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.F1-19 (AP-30)	3.3.1-14	202, A
Flow elements	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F1-3 (A-08)	3.3.1-72	202, A

**TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow elements (continued)	Pressure boundary	Stainless steel	Air/gas (internal)	None	None	VII.J-15 (AP-17)	3.3.1-94	236, A
			Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Flow gauge	Pressure boundary	Glass	Air/gas (external)	None	None	VII.J-7 (AP-48)	3.3.1-93	A
			Air/gas (internal)	None	None	VII.J-7 (AP-48)	3.3.1-93	A
Heat exchanger, condenser, cooler, fan coil	Heat transfer	Aluminum alloy	Air/gas (external)	None	None	VII.J-1 (AP-36)	3.3.1-95	C
	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.F1-2 (A-10)	3.3.1-56	A
						VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.F1-11 (A-63)	3.3.1-48	A
	Pressure boundary	Carbon steel	Air/gas (external)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
			Air/gas (internal)	None	None	VII.J-23 (AP-6)	3.3.1-97	A

TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil (continued)	Pressure boundary	Carbon steel	Lube oil (external)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.F1-19 (AP-30)	3.3.1-14	202, C
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.F1-19 (AP-30)	3.3.1-14	202, C
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-5 (A-64)	3.3.1-77	A
			Treated water (external)	Loss of material	Closed-Cycle Cooling Water System Program	VII.F1-11 (A-63)	3.3.1-48	A
	Pressure boundary	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-5 (A-64)	3.3.1-77	A
					Selective Leaching of Materials Program	VII.C1-11 (A-51)	3.3.1-85	C

TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil (continued)	Pressure boundary	Cast iron	Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.F1-11 (A-63)	3.3.1-48	219, A
					Selective Leaching of Materials Program	VII.F1-18 (AP-31)	3.3.1-85	C
	Heat transfer Leakage boundary (spatial) Pressure boundary	Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.F1-8 (AP-34)	3.3.1-51	219, A
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F1-16 (A-46)	3.3.1-25	E
	Heat transfer Pressure boundary	Copper	Air/gas (external)	None	None	VII.J-4 (AP-9)	3.3.1-97	C
			Lube oil (external)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program			225, H
			Raw water (internal)	Heat transfer degradation	Open-Cycle Cooling Water System Program	VII.C1-6 (A-72)	3.3.1-83	A
				Loss of material	Open-Cycle Cooling Water System Program	VII.C1-3 (A-65)	3.3.1-82	219, A

TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil (continued)	Pressure boundary	Copper alloy	Air/gas (external)	None	None	VII.J-4 (AP-9)	3.3.1-97	C
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-3 (A-65)	3.3.1-82	A
			Treated water (external)	Loss of material	Closed-Cycle Cooling Water System Program	VII.F1-8 (AP-34)	3.3.1-51	219, A
	Leakage boundary (spatial) Pressure boundary	Galvanized carbon steel	Air/gas (internal)	None	None	VII.J-6 (AP-13)	3.3.1-92	C
			Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
Instrumentation, transmitter/ element (pressure transducer, Flow element)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C2-11 (AP-60)	3.3.1-46	E
				Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C2-10 (A-52)	3.3.1-50	E
	Pressure boundary	Stainless steel	Air/gas (internal)	None	None	VII.J-19 (AP-22)	3.3.1-97	A

TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Level gauge	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F1-16 (A-46)	3.3.1-25	202, E
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Air/gas (internal)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.F1-20 (A-25)	3.3.1-47	A
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A—35)	3.3.1-17	E
	Pressure boundary	Carbon steel	Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	203, A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.F1-19 (AP-30)	3.3.1-14	202, A

TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary	Carbon steel	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-23 (A-23)	3.3.1-71	202, A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
	Leakage boundary (spatial)	Carbon steel	Steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.C-3 (S-04)	3.4.1-2	E
	Leakage boundary (spatial) Pressure boundary	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.F1-20 (A-25)	3.3.1-47	A
					Selective Leaching of Materials Program	VII.F1-18 (AP-31)	3.3.1-85	A
	Pressure boundary	Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Air/gas (internal)	None	None	VIII.J-4 (AP-9)	3.3.1-97	A
	Leakage boundary (spatial)	Glass	Air/gas (external)	None	None	VIII.J-8 (AP-14)	3.3.1-98	A
			Wet air/gas (internal)	None	None	VIII.J-11 (AP-50)	3.3.1-93	A

TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VIII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E4-14 (A-58)	3.3.1-24	E
					One-Time Inspection Program Water Chemistry Program	VII.E4-14 (A-58)	3.3.1-24	A
Pumps, positive pressure devices (except blowers)	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.F1-19 (AP-30)	3.3.1-14	202, A
	Leakage boundary (spatial)	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F1-3 (A-08)	3.3.1-72	C
					Selective Leaching of Materials Program	VII.C1-11 (A-51)	3.3.1-85	A

**TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pumps, positive pressure devices (except blowers) (continued)	Leakage boundary (spatial)	Cast iron	Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.F1-20 (A-25)	3.3.1-47	A
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	E
					Selective Leaching of Materials Program	VII.F1-18 (AP-31)	3.3.1-85	A
	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-10 (A-52)	3.3.1-50	A
Valve, damper	Leakage boundary (spatial) Pressure boundary	Brass	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
	Leakage boundary (spatial)	Brass	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F1-16 (AP-46)	3.3.1-25	202, E
			Steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program			228, H

TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Brass	Air/gas (internal)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-10 (AP-47)	3.3.1-26	202, 225, A
	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.A4-7 (AP-64)	3.3.1-25	219, E
	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.F1-2 (A-10)	3.3.1-56	A
						VII.I-8 (A-77)	3.3.1-58	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F1-3 (A-08)	3.3.1-72	C
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F1-3 (A-08)	3.3.1-72	C

TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial) Pressure boundary	Carbon steel	Treated water (internal)	Loss Of material	Closed-Cycle Cooling Water System Program	VII.F1-20 (A-25)	3.3.1-47	202, A
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	202, E
					One-Time Inspection Program Water Chemistry Program	VII.E3-18 (A-35)	3.3.1-17	A
	Pressure boundary	Carbon steel	Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	203, A
			Air/gas (internal)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
			Lube oil (internal)	None	None			227, 232, I
	Leakage boundary (spatial)	Carbon steel	Steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.C-3 (S-04)	3.4.1-2	E

TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial) Pressure boundary	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E4-17 (A-35)	3.3.1-17	E
					One-Time Inspection Program Water Chemistry Program	VII.E3-18 (A-35)	3.3.1-17	A
					Selective Leaching of Materials Program	VII.F1-18 (AP-31)	3.3.1-85	A
	Leakage boundary (spatial)	Cast iron	Steam (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.C-3 (S-04)	3.4.1-2	E
					Selective Leaching of Materials Program	VII.F1-18 (AP-31)	3.3.1-85	A
	Pressure boundary	Copper alloy	Air/gas (internal)	None	None	VIII.I-2 (SP-6)	3.4.1-41	236, A
			Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A

TABLE 3.3.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Galvanized carbon steel	Air/gas (internal)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E4-14 (A-58)	3.3.1-24	E
					One-Time Inspection Program Water Chemistry Program	VIII.C-1 (SP-16)	3.4.1-16	A
	Pressure boundary	Stainless steel	Air/gas (internal)	None	None	VII.J-19 (AP-22)	3.3.1-97	A

TABLE 3.3.2-7
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL ROD DRIVE SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Piping, piping components and piping elements	Pressure boundary	Steel, stainless steel	Reactor Coolant (internal)	Cumulative fatigue damage/fatigue	TLAA	IV.C1-15 (R-220)	3.1.1-3	A
Accumulator, pulsation damper, low pressure tank	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
Control rod drive mechanism	Pressure boundary	Carbon steel	air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Dried air/gas (internal)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
Elastomers	Pressure boundary	Rubber	Dried air/gas (external)	None	None			212, I
			Treated water (internal)	None	None			212, I

**TABLE 3.3.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL ROD DRIVE SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	V.E-4 (EP-25)	3.2.1-23	203, A
				Loss of preload	Bolting Integrity Program	V.E-5 (EP-24)	3.2.1-24	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Filter Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
	Leakage boundary (spatial)	Carbon steel	Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	202, A
	Filter Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A

TABLE 3.3.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL ROD DRIVE SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow elements	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
Level elements	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
Level switches	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.C-6 (E-31)	3.2.1-15	A
Pipe Class 1, pipe fittings, tubing	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.C-6 (E-31)	3.2.1-15	A

TABLE 3.3.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL ROD DRIVE SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe Class 1, pipe fittings, tubing (continued)	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.C-4 (E-33)	3.2.1-3	A
	Pressure boundary	Stainless steel	Treated water (internal)	Cracking	BWR Control Rod Drive Return Line Nozzle Program	IV.A1-2 (R-66)	3.1.1-38	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	202, A
	Leakage boundary (spatial)	Carbon steel	Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	202, A

TABLE 3.3.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL ROD DRIVE SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
	Pressure boundary	Stainless steel	Dried air/gas (internal)	None	None	VII.J-29 (AP-22)	3.3.1-97	A
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
Thermowell	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A

**TABLE 3.3.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL ROD DRIVE SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve Class 1	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	A
Valve, damper	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.E-7 (E-44)	3.2.1-31	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-33 (E-08)	3.2.1-14	202, A
	Leakage boundary (spatial)	Carbon steel	Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	V.D2-30 (EP-46)	3.2.1-16	202, A
		Cast austenitic stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A

TABLE 3.3.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL ROD DRIVE SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	V.D2-28 (EP-32)	3.2.1-5	A
	Pressure boundary	Stainless steel	Dried air/gas (internal)	None	None	VII.J-19 (AP-22)	3.3.1-97	A

TABLE 3.3.2-8
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
DRYWELL SUMPS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	V.E-4 (EP-25)	3.2.1-23	203, A
						VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	V.E-5 (EP-24)	3.2.1-24	A
						VII.I-5 (AP-26)	3.3.1-45	A
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E

TABLE 3.3.2-8 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
DRYWELL SUMPS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation, transmitter/ element (Flow Element)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, E
Pipe Class 1, pipe fittings, tubing	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.C-1 (E-35)	3.2.1-31	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.C-5 (E-22)	3.2.1-35	E
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	202, E
Valve Class 1	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.C-1 (E-35)	3.2.1-31	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.C-5 (E-22)	3.2.1-35	E

TABLE 3.3.2-8 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
DRYWELL SUMPS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, E

TABLE 3.3.2-9
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
ELECTRICAL MANHOLE SUMP PUMP

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	202, E
		PVC / plastic	Air/gas (external)	None	None			234, H
			Raw water (internal)	None	None			234, H
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E

TABLE 3.3.2-9 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
ELECTRICAL MANHOLE SUMP PUMP

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper	Leakage boundary (spatial)	Brass	Air/gas (external)	None	None	VIII.I-2	3.4.1-41	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	E

TABLE 3.3.2-10
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
EMERGENCY SERVICE WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
			Raw water (external)	Loss of material	Bolting Integrity Program	VII.C1-15 (A-54)	3.3.1-79	202, 210, E
				Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A
	Filter	Stainless steel	Raw water (external)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A
Instrumentation (flow gauges)	Pressure Boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A
		Glass	Air/gas (external)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
			Raw water (internal)	None	None	VII.J-11 (AP-50)	3.3.1-98	A

TABLE 3.3.2-10 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
EMERGENCY SERVICE WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation (flow elements)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A
	Leakage boundary (spatial)	Carbon steel	Raw water (internal)	Loss of material	Flow Accelerated Corrosion Program	VII.C1-19 (A-38)	3.3.1-76	202, E
	Pressure boundary	Carbon steel	Soil (external)	Loss of material	Buried Piping and Tanks Inspection Program	VII.C1-18 (A-01)	3.3.1-19	A
		Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-9 (A-44)	3.3.1-81	202, A

TABLE 3.3.2-10 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
EMERGENCY SERVICE WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A
Pumps, positive pressure devices (except blowers)	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (external)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A
		Cast austenitic stainless steel	Raw water (external)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A
Valve, damper	Pressure boundary	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-9 (A-44)	3.3.1-81	A
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A

**TABLE 3.3.2-10 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
EMERGENCY SERVICE WATER SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A
					Selective Leaching of Materials Program	VII.C1-11 (A-51)	3.3.1-85	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A

TABLE 3.3.2-11
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
	Pressure boundary	Carbon steel	Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.G-21 (A-28)	3.3.1-64	202, B
					One-Time Inspection Program	VII.G-21 (A-28)	3.3.1-64	202, E
			Gas-carbon dioxide (internal)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
	Leakage boundary (spatial)	Carbon steel	Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
	Pressure boundary	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-23 (A-23)	3.3.1-71	202, A
					Selective Leaching of Materials Program	VII.G-14 (A-51)	3.3.1-85	A

TABLE 3.3.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank (continued)	Pressure boundary	Ductile iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-23 (A-23)	3.3.1-71	202, A
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
					External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
			Raw water (external)	Loss of material	Bolting Integrity Program	VII.G-24 (A-33)	3.3.1-68	202, 210, E
				Loss of preload	Bolting Integrity Program			207, G
			Soil (external)	Loss of material	Bolting Integrity Program	VII.G-25 (A-01)	3.3.1-19	210, E
				Loss of preload	Bolting Integrity Program			207, G
Filter, screens, strainer	Leakage boundary (spatial) Pressure boundary	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A

TABLE 3.3.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Filter, screens, strainer (continued)	Leakage boundary (spatial) Pressure boundary	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	236, A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-12 (A-45)	3.3.1-70	A
	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
					Selective Leaching of Materials Program	VII.G-14 (A-51)	3.3.1-69	A
		Galvanized carbon steel	Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Air/gas (internal)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-20 (AP-2)	3.3.1-95	A
	Filter Pressure boundary	Stainless steel	Raw water (internal)	Loss of material	Fire Water System Program	VII.G-19 (A-55)	3.3.1-69	202, A

**TABLE 3.3.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil	Heat transfer Pressure boundary	Admiralty brass	Lube oil (external)	Loss of material	Lube Oil Analysis Program One-Time Inspection Program	VII.G-11 (AP-47)	3.3.1-26	210, C
					Selective Leaching Inspection Program			207, J
			Raw water (internal)	Heat transfer degradation	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-6 (A-72)	3.3.1-83	E
				Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-3 (A-65)	3.3.1-82	219, E
					Selective Leaching of Materials Program	VII.C1-4 (A-66)	3.3.1-84	A
			Treated water (external)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C2-4 (AP-12)	3.3.1-51	227, 219, E
					Selective Leaching of Materials Program	VII.C2-6 (AP-43)	3.3.1-84	C

**TABLE 3.3.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil (continued)	Heat transfer Pressure boundary	Admiralty brass	Treated Water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C2-4 (AP-12)	3.3.1-51	219, 227, E
					Selective Leaching of Materials Program	VII.C2-6 (AP-43)	3.3.1-84	C
	Pressure boundary	Brass	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	C
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-3 (A-65)	3.3.1-82	219, E
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Lube oil (internal)	Loss of material	Lube Oil Analysis Program One-Time Inspection Program	VII.G-22 (AP-30)	3.3.1-14	C
					Selective Leaching of Materials			207, J
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C2-1 (A-63)	3.3.1-48	E
					Selective Leaching of Materials Program	VII.G-16 (AP-31)	3.3.1-85	C

TABLE 3.3.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation (flow gauges, flow alarms)	Leakage boundary (spatial) Pressure boundary	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-12 (A-45)	3.3.1-70	A
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
	Pressure boundary	Cast iron	Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-23 (A-23)	3.3.1-71	202, A
					Selective Leaching of Materials Program	VII.G-14 (A-51)	3.3.1-85	A
	Leakage boundary (spatial)	Cast iron	Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
					Selective Leaching of Materials Program	VII.G-14 (A-51)	3.3.1-85	A
		Glass	Air/gas (external)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
			Raw water (internal)	None	None	VII.J-11 (AP-50)	3.3.1-93	A
Instrumentation (flow element)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-19 (A-55)	3.3.1-69	202, A

TABLE 3.3.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk	Pressure boundary Spray	Brass	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Plant indoor air (internal)	None	None	VIII.I-2 (SP-6)	3.4.1-41	236, A
	Pressure boundary	Brass	Raw water (internal)	Loss of material	Fire Water System Program	VII.G-12 (A-45)	3.3.1-70	A
	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	202, A
					Flow-Accelerated Corrosion Program			222, H
	Pressure boundary	Carbon steel	Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-23 (A-23)	3.3.1-71	202, A
			Compressed air (internal)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
			Gas-carbon dioxide (internal)	None	None	VII.J-23 (AP-6)	3.3.1-97	A

**TABLE 3.3.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary	Carbon steel	Air/gas (internal)	None	None	VII.J-20 (AP-2)	3.3.1-95	236, A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-2 (A-27)	3.3.1-18	A
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-9 (A-78)	3.3.1-58	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-23 (A-23)	3.3.1-71	202, A
					Selective Leaching of Materials Program	VII.G-14 (A-51)	3.3.1-85	205, A
			Soil (external)	Loss of material	Buried Piping and Tanks Inspection Program	VII.G-25 (A-01)	3.3.1-19	A
					Selective Leaching of Materials Program	VII.G-15 (A-02)	3.3.1-85	A

TABLE 3.3.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary	Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Fuel oil (internal)	Loss of material	Fire Protection Program	VII.G-10 (AP-44)	3.3.1-32	202, 225, E
					Fuel Oil Chemistry Program	VII.G-10 (AP-44)	3.3.1-32	202, B 225
					One-Time Inspection Program	VII.G-10 (AP-44)	3.3.1-32	202, 225 A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-12 (A-45)	3.3.1-70	A
		Ductile iron	Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
			Soil (external)	Loss of material	Buried Piping and Tanks Inspection Program	VII.G-25 (A-01)	3.3.1-19	A
		Galvanized carbon steel	Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Gas carbon dioxide (internal)	None	None	VII.J-23 (AP-6)	3.3.1-97	A
			Air/gas (internal)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	202, A

TABLE 3.3.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Air/gas (internal)	None	None	VII.J-15 (AP-20)	3.3.1-94	236, A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-19 (A-55)	3.3.1-69	202, A
Pumps, positive pressure devices (except blowers)	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (external)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
	Leakage boundary (spatial) Pressure boundary	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
					Selective Leaching of Materials Program	VII.G-14 (A-51)	3.3.1-85	A
	Pressure boundary	Cast iron	Raw water (external)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	202, A
					Selective Leaching of Materials Program	VII.G-14 (A-51)	3.3.1-85	A

TABLE 3.3.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper	Leakage boundary (spatial) Pressure boundary	Brass	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
	Pressure boundary	Brass	Air/gas (internal)	None	None	VII.J-3 (AP-8)	3.3.1-98	A
		Brass	Gas-carbon dioxide (internal)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
	Leakage boundary (spatial)	Brass	Raw water (internal)	Loss of material	Fire Water System Program	VII.G-12 (A-45)	3.3.1-70	A
	Leakage boundary (spatial) Pressure boundary	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Air/gas (internal)	None	None	VIII.I-2 (SP-6)	3.4.1-41	236, A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-12 (A-45)	3.3.1-70	A

TABLE 3.3.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Bronze	Fuel oil (internal)	Loss of material	Fire Protection Program	VII.G-10 (AP-44)	3.3.1-32	225, E
					Fuel Oil Chemistry Program	VII.G-10 (AP-44)	3.3.1-32	225, B
					One-Time Inspection Program	VII.G-10 (AP-44)	3.3.1-32	225, A
			Gas-carbon dioxide (internal)	None	None	VII.J-4 (AP-9)	3.3.1-97	A
	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
	Pressure boundary	Carbon steel	Air/gas (internal)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Piping & Ductwork	VII.G-23 (A-23)	3.3.1-71	202, A
	Pressure boundary	Carbon steel	Gas-carbon dioxide (internal)	None	None	VII.J-23 (AP-6)	3.3.1-97	A

TABLE 3.3.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial) Pressure boundary	Carbon steel	Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
					Selective Leaching of Materials Program	VII.G-14 (A-51)	3.3.1-85	A
	Pressure boundary	Cast iron	Soil (external)	Loss of material	Buried Piping and Tanks Inspection Program	VII.G-25 (A-01)	3.3.1-19	A
					Selective Leaching of Materials Program	VII.G-15 (A-02)	3.3.1-85	A
	Pressure boundary	Ductile iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Air/gas (internal)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
			Raw water (internal)	Loss of material	Fire Water System Program	VII.G-24 (A-33)	3.3.1-68	A
	Fire barrier Pressure boundary	Galvanized carbon steel	Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	C
			Air/gas (internal)	None	None	VII.J-6 (AP-13)	3.3.1-92	C

TABLE 3.3.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FIRE PROTECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Fire barrier Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
	Fire barrier	Stainless steel	Air/gas (internal)	None	None	VII.J-15 (AP-17)	3.3.1-94	236, A
	Pressure boundary	Stainless steel	Air/gas (internal)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
			Fuel oil (internal)	Loss of material	Fire Protection Program	VII.G-17 (AP-54)	3.3.1-32	E
					Fuel Oil Chemistry Program	VII.G-17 (AP-54)	3.3.1-32	B
					One-Time Inspection Program	VII.G-17 (AP-54)	3.3.1-32	A
			Gas-carbon dioxide (internal)	None	None	VII.J-19 (AP-22)	3.3.1-97	A
	Leakage boundary (spatial) Pressure boundary	Stainless steel	Raw water (internal)	Loss of material	Fire Water System Program	VII.G-19 (A-55)	3.3.1-69	202, A

TABLE 3.3.2-12
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FUEL POOL COOLING AND CLEANUP SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-18 (A-35)	3.3.1-17	202, C
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-18 (A-35)	3.3.1-17	202, A
	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.A4-11 (A-58)	3.3.1-24	A

TABLE 3.3.2-12 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
FUEL POOL COOLING AND CLEANUP SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-18 (A-35)	3.3.1-17	A
					Selective Leaching of Materials Program	VII.A4-10 (AP-31)	3.3.1-85	A
Valve, damper	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-18 (A-35)	3.3.1-17	202, A
	Leakage boundary (spatial)	Cast austenitic stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.A4-11 (A-58)	3.3.1-24	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.A4-11 (A-58)	3.3.1-24	A

TABLE 3.3.2-13
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
GENERAL SERVICE WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
Filter, screens, strainer	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	208, E
Heat exchanger, Condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F2-3 (A-08)	3.3.1.72	202, 210, C
Instrumentation (flow indicator)	Leakage boundary (spatial)	Brass	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	208, E

TABLE 3.3.2-13 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
GENERAL SERVICE WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation (flow gauges)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	208, E
		Glass	Air/gas (external)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
			Raw water (internal)	None	None	VII.J-11 (AP-50)	3.3.1-93	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Flow Accelerated Corrosion Program			222, H
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	202, 208, E
		Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	208, E

TABLE 3.3.2-13 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
GENERAL SERVICE WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	PVC/ plastic	Air/gas (external)	None	None			234, H
			Raw water (internal)	None	None			234, H
		Rubber	Air/gas (external)	None	None			235, H
			Raw water (internal)	None	None			235, H
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, 208, E
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	208, E
Thermowell	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	208, E

TABLE 3.3.2-13 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
GENERAL SERVICE WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Thermowell (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, 208, E
Valve, damper	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	202, 208, E
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	202, 208, E
		Cast austenitic stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, 208, E

TABLE 3.3.2-13 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
GENERAL SERVICE WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	208, E
					Selective Leaching of Materials Program	VII.C1-11 (A-51)	3.3.1-85	A
		Nickel	Air/gas (external)	None	None	VII.J-14 (AP-16)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-13 (AP-53)	3.3.1-78	202, 208, E
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, 208, E

TABLE 3.3.2-14
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HYDROGEN WATER CHEMISTRY SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	207, C
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	C
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-4 (S-21)	3.4.1-16	A

**TABLE 3.3.2-14 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HYDROGEN WATER CHEMISTRY SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil (continued)	Leakage boundary (spatial)	Stainless steel	Treated water (internal)	Loss of material	Closed Cycle Cooling Water System Program	VII.C2-10 (A-52)	3.3.1-50	207, C
Instrumentation, Transmitter/ element (sensing elements, flow elements, temperature elements)	Leakage Boundary (Spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	C
				Loss of Material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	C
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	202, A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

TABLE 3.3.2-14 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
HYDROGEN WATER CHEMISTRY SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Stainless steel	Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
Pressure vessels	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
Valve, damper	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
		Stainless steel	Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A

TABLE 3.3.2-15
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
INSTRUMENT AIR SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Blower, compressor, fan, vacuum pump	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.D2-16 (E-29)	3.2.1.32	C
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
	Pressure boundary	Carbon steel	Dried air (internal)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
	Leakage boundary (spatial)	Carbon steel	Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	220, E

**TABLE 3.3.2-15 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
INSTRUMENT AIR SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continue)	Leakage boundary (spatial)	Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	202, 220, E
Valve, damper	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Dried air (internal)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, 220, E

TABLE 3.3.2-16
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
INTAKE AND TRAVELING SCREENS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Raw water (external)	Loss of material	Bolting Integrity Program	VII.C1-15 (A-54)	3.3.1-79	202, 210, E
				Loss of preload	Bolting Integrity Program			207, F
			Wet air/gas (external)	Loss of material	Bolting Integrity Program	VII.C1-15 (A-54)	3.3.1-79	202, 210, E
				Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A
	Filter	Stainless steel	Raw water (external)	Loss of material	External Surfaces Monitoring Program	VII.C1-15 (A-54)	3.3.1-79	202, 207, E
			Wet air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.C1-15 (A-54)	3.3.1-79	202, 207, E

TABLE 3.3.2-16 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
INTAKE AND TRAVELING SCREENS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation transmitter/ element (flow element)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A
	Leakage boundary (spatial)	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A
					Selective Leaching of Materials Program	VII.C1-11 (A-51)	3.3.1-85	A
	Pressure boundary	Carbon steel	Wet air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.C1-19 (A-38)	3.3.1-76	E
		Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-9 (A-44)	3.3.1-81	A

TABLE 3.3.2-16 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
INTAKE AND TRAVELING SCREENS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Spray	PVC/ plastic	Raw water (internal)	None	None			234, H
			Wet air/gas (external)	None	None			234, H
	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	A
Pumps, positive pressure devices (except blowers)	Pressure boundary	Ductile iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A
Structures, buildings (traveling screen units)	Structural support	Carbon steel	Raw water (external)	Loss of material	External Surfaces Monitoring Program	VII.C1-19 (A-38)	3.3.1-76	202, 207, 210, E
			Wet air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.C1-19 (A-38)	3.3.1-76	202, 210, E
Valve, damper	Leakage boundary (spatial) Pressure boundary	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-9 (A-44)	3.3.1-81	A

**TABLE 3.3.2-16 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
INTAKE AND TRAVELING SCREENS**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial) Pressure boundary	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A
					Selective Leaching of Materials Program	VII.C1-11 (A-51)	3.3.1-85	A
	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	A

TABLE 3.3.2-17
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
OFFGAS EXHAUST SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Ductwork	Pressure boundary	Galvanized carbon steel	Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Air/gas (internal)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F2-1 (A-09)	3.3.1-27	E
Fastener, bolting, washers, nuts	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Mechanical function, coupling, gear box, governor	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F2-1 (A-09)	3.3.1-27	E

TABLE 3.3.2-17 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
OFFGAS EXHAUST SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-3 (S-04)	3.4.1-2	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-6 (S-09)	3.4.1-4	202, A
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17	3.3.1-94	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.D2-35 (E-14)	3.2.1-8	E
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-1 (SP-16)	3.4.1-16	A
Valve, damper	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-6 (S-09)	3.4.1-4	A

TABLE 3.3.2-17 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
OFFGAS EXHAUST SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.D2-35 (E-14)	3.2.1-8	E
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-1 (SP-16)	3.4.1-16	A

TABLE 3.3.2-18
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PLANT VENTILATION

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Blower, compressor, fan, vacuum pump	Pressure boundary Structure	Carbon steel	Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.B-1 (E-25)	3.2.1-32	A
			Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.F2-2 (A-10)	3.3.1-56	A
Damper	Pressure boundary Structural support	Galvanized carbon steel	Air/gas (internal	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
Drain pans	Leakage boundary (spatial)	Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-9 (AP-78)	3.3.1-28	202, 210, E
Ductwork	Pressure boundary	Galvanized carbon steel	Air/gas (internal)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A

TABLE 3.3.2-18(continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PLANT VENTILATION

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
					External Surfaces Monitoring Program	VII.F2-4 (A-105)	3.3.1-55	A
						VII.F4-3 (A-105)	3.3.1-55	A
						VII.I-7 (A-105)	3.3.1-55	A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
Filter, screens, strainer	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-24 (A-33)	3.3.1-68	220, E
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	E
	Filter	Galvanized carbon steel	Air/gas (internal)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A

TABLE 3.3.2-18(continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PLANT VENTILATION

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow elements	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	E
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F2-3 (A-08)	3.3.1-72	202, A
		Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-9 (AP-64)	3.3.1-31	219, E
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Flow Accelerated Corrosion Program			222, H
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-24 (A-33)	3.3.1-68	220, E

TABLE 3.3.2-18(continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PLANT VENTILATION

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Carbon steel	Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	E
	Pressure boundary	Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-9 (AP-64)	3.3.1-31	219, E
	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-16 (A-60)	3.3.1-37	E
				Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-15 (A-58)	3.3.1-24	E
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-24 (A-33)	3.3.1-68	220, E

TABLE 3.3.2-18(continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PLANT VENTILATION

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pumps, positive pressure devices (except blowers) (continued)	Leakage boundary (spatial)	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	E
				Loss of material	Selective Leaching of Materials Program	VII.F2-16 (AP-31)	3.3.1-85	A
Valve, damper	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-9 (AP-64)	3.3.1-31	219, E
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-24 (A-33)	3.3.1-68	220, E
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	E

TABLE 3.3.2-18(continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PLANT VENTILATION

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	E
				Loss of material	Selective Leaching of Materials Program	VII.F2-16 (AP-31)	3.3.1-85	A
		Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-9 (AP-64)	3.3.1-31	219, E

TABLE 3.3.2-19
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
POST ACCIDENT SAMPLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-4 (AP-12)	3.3.1-51	A
Pipe Class 1, pipe fittings, tubing	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Air/gas (internal)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
	Leakage boundary (spatial)	Stainless steel	Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A

TABLE 3.3.2-19 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
POST ACCIDENT SAMPLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Separators, degasifiers	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Air/gas (internal)	None	None	VII.H-15 (AP-17)	3.3.1-94	A
Valve Class 1	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
		Stainless steel	Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
Valve, damper	Leakage boundary (spatial)	Cast austenitic stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Air/gas (internal)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
	Leakage boundary (spatial) Pressure boundary Structural Support	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Air/gas (internal)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

TABLE 3.3.2-20
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, 220, E
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-3 (A-65)	3.3.1-82	202, 220, E
					Flow Accelerated Corrosion Program			222, H

**TABLE 3.3.2-20 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT HEATING, VENTILATION, AND AIR CONDITIONING**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil (continued)	Leakage boundary (spatial)	Copper-nickel	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Flow Accelerated Corrosion Program			222, H
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-3 (A-65)	3.3.1-82	219, 220, E
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, 220, E
Instrumentation, indication/ recorder	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	220, E
		Glass	Air/gas (external)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
			Raw water (internal)	None	None	VII.J-11 (AP-50)	3.3.1-93	A

TABLE 3.3.2-20 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe Class 1, pipe fittings, tubing	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.C-1 (E-35)	3.2.1-31	A
			Raw water (internal)	Loss of material	Flow Accelerated Corrosion Program			222, H
					Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.C-5 (E-22)	3.2.1-35	220, E
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	202, 220, E
					Flow Accelerated Corrosion Program			222, H
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	220, E

**TABLE 3.3.2-20 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT HEATING, VENTILATION, AND AIR CONDITIONING**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Thermowell	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	220, E
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	220, E
Valve Class 1	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	V.C-1 (E-35)	3.2.1-31	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.C-5 (E-22)	3.2.1-35	220, E
Valve, damper	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	220, E

TABLE 3.3.2-20 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	220, E
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, 220, E

TABLE 3.3.2-21
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING AND RADWASTE BUILDING SAMPLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Aluminum alloy	Air/gas (external)	None	None	VII.J-1 (AP-36)	3.3.1-95	A
			Air/gas (internal)	None	None	VII.J-1 (AP-36)	3.3.1-95	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-4 (S-21)	3.4.1-16	A
Instrumentation, controller (flow indicating controllers)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A
Instrumentation, indication/ recorder (level gauge)	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-5 (SP-61)	3.4.1-15	A

TABLE 3.3.2-21 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING AND RADWASTE BUILDING SAMPLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation, indication/ recorder (flow gauges)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-7 (S-09)	3.4.1-4	202, A
		Glass	Air/gas (external)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
			Treated water (internal)	None	None	VII.J-13 (AP-51)	3.3.1-93	A
		PVC/plastic	Air/gas (external)	None	None			234, J
			Treated water (internal)	None	None			234, J
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A

TABLE 3.3.2-21 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING AND RADWASTE BUILDING SAMPLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Stainless steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A
Valve, damper	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-5 (SP-61)	3.4.1-15	A
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-7 (S-09)	3.4.1-4	202, A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A

TABLE 3.3.2-22
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING CLOSED COOLING WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-14 (A-25)	3.3.1-47	202, A
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-5 (A-64)	3.3.1-77	219, E
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-1 (A-63)	3.3.1-48	A
		Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	C
			Lube oil (internal)	None	None			232, I

**TABLE 3.3.2-22 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING CLOSED COOLING WATER SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG -1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	C
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	E
Instrumentation (flow gauges, level gauge)	Leakage boundary (spatial)	Glass	Air/gas (external)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
			Treated water (internal)	None	None	VII.J-13 (AP-51)	3.3.1-93	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-14 (A-25)	3.3.1-47	A
						VII.C2-1 (A-63)	3.3.1-48	C
	Leakage boundary (spatial)	Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-4 (AP-12)	3.3.1-51	219, A

TABLE 3.3.2-22 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING CLOSED COOLING WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG -1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-10 (A-52)	3.3.1-50	A
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Ductile iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-14 (A-25)	3.3.1-47	A
Thermowell	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-14 (A-25)	3.3.1-47	A
Valve, damper	Leakage boundary (spatial)	Brass or bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-4 (AP-12)	3.3.1-51	219, A
	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-14 (A-25)	3.3.1-47	A

**TABLE 3.3.2-22 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING CLOSED COOLING WATER SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG -1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-14 (A-25)	3.3.1-47	A
					Selective Leaching of Materials Program	VII.C2-8 (A-50)	3.3.1-85	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-10 (A-52)	3.3.1-50	A

TABLE 3.3.2-23
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	208, E
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F2-1 (A-09)	3.3.1-27	E
Drip pans	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.I-8 (A-77)	3.3.1-58	208, E
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F2-3 (A-08)	3.3.1-72	A
Ductwork	Pressure boundary	Galvanized carbon steel	Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Air/gas (internal)	None	None	VII.J-6 (AP-13)	3.3.1-92	A

**TABLE 3.3.2-23 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING HEATING, VENTILATION, AND AIR CONDITIONING**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F2-3 (A-08)	3.3.1-72	A
	Heat transfer Pressure boundary	Copper	Air/gas (external)	Heat transfer degradation	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F2-14	3.3.1-25	202, C
				Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F2-14	3.3.1-25	C

TABLE 3.3.2-23 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil (continued)	Heat transfer Pressure boundary	Copper	Raw water (internal)	Heat transfer degradation	Open-Cycle Cooling Water System Program	VII.C1-6 (A-65)	3.3.1-83	A
				Loss of material	Open-Cycle Cooling Water System Program	VII.C1-3 (A-65)	3.3.1-82	219, A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-9 (AP-64)	3.3.1-31	208, 219, E
	Leakage boundary (spatial)	Galvanized carbon steel	Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Air/gas (internal)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Glycol corrosion inhibited treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-9 (AP-64)	3.3.1-31	208, 219, E
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A

TABLE 3.3.2-23 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Carbon steel	Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	208, E
					Flow-Accelerated Corrosion Program			222, H
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	202, 208, E
		Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Glycol corrosion inhibited treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-9 (AP-64)	3.3.1-31	208, 219, E
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	208, 220, E
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-9 (AP-64)	3.3.1-31	208, 219, E

**TABLE 3.3.2-23 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING HEATING, VENTILATION, AND AIR CONDITIONING**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Air/gas (internal)	None	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F2-1 (A-09)	3.3.1-27	E
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, 208, E
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Glycol corrosion inhibited treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	208, E
					Selective Leaching of Materials Program	VII.E3-12 (AP-31)	3.3.1-85	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	208, E
					Selective Leaching of Materials Program	VII.E3-12 (AP-31)	3.3.1-85	A

TABLE 3.3.2-23 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Separators, degasifiers	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F2-1 (A-09)	3.3.1-27	E
Valve, damper	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Glycol corrosion inhibited treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-9 (AP-64)	3.3.1-31	208, 219, E
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	208, 220, E
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-9 (AP-64)	3.3.1-31	208, 219, E
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	208, 220, E

TABLE 3.3.2-23 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Carbon steel	Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	208, E
		Cast austenitic stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, 208, E
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	208, 220, E
					Selective Leaching of Materials Program	VII.C1-11 (A-51)	3.3.1-85	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	208, E
					Selective Leaching of Materials Program	VII.E3-12 (AP-31)	3.3.1-85	A

TABLE 3.3.2-23 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING HEATING, VENTILATION, AND AIR CONDITIONING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Air/gas (internal)	None	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F2-1 (A-09)	3.3.1-27	E
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, 208, 220, E

TABLE 3.3.2-24
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR WATER CLEANUP SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Piping, piping components and piping elements	Pressure boundary	Steel, stainless steel	Reactor Coolant (internal)	Cumulative fatigue damage/fatigue	TLAA	IV.C1-15 (R-220)	3.1.1-3	A
			Treated water (internal)	Cumulative fatigue damage/fatigue	TLAA	VII.E3-14 (A-62)	3.3.1-2	A
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F

TABLE 3.3.2-24 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR WATER CLEANUP SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Filter, screens, strainer	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-15 (A-58)	3.3.1-24	A
Flow element Class 1	Pressure boundary Throttle	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	BWR Stress Corrosion Cracking Program Water Chemistry Control Program	IV.C1-9 (R-20)	3.1.1-41	A
Flow element Class 1	Pressure boundary Throttle	Stainless steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Control Program	IV.C1-14 (RP-27)	3.1.1-15	A
Flow elements	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	BWR Reactor Water Cleanup System Program	VII.E3-16 (A-60)	3.3.1-37	B
				Loss of material	One-Time Inspection Program Water Chemistry Control Program	VII.E3-15 (A-58)	3.3.1-24	A

TABLE 3.3.2-24 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR WATER CLEANUP SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow orifices	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Control Program	VII.E3-15 (A-58)	3.3.1-24	A
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.E3-4 (A-63)	3.3.1-48	219, A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VII.E3-3 (A-71)	3.3.1-5	E
				Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-10 (A-52)	3.3.1-50	D
					One-Time Inspection Program Water Chemistry Program	VII.E3-15 (A-58)	3.3.1-24	D

TABLE 3.3.2-24 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR WATER CLEANUP SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Manifold instrument supply	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of Material	One-Time Inspection Program Water Chemistry Program	VII.E3-15 (A-58)	3.3.1-24	A
Pipe Class 1, pipe fittings, tubing	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16	3.1.1-13	C
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	ASME Section XI – IWB, IWC, and IWD Inservice Inspection Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
					BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.C1-9 (R-20)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (R-27)	3.1.1-15	A

**TABLE 3.3.2-24 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR WATER CLEANUP SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-18 (A-35)	3.3.1-17	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	BWR Reactor Water Cleanup System	VII.E3-16 (A-60)	3.3.1-37	B
				Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-15 (A-58)	3.3.1-24	A
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Cast austenitic stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-15 (A-58)	3.3.1-24	A
Valve Class 1	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C

TABLE 3.3.2-24 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR WATER CLEANUP SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve Class 1 (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	ASME Section XI – IWB, IWC, and IWD Inservice Inspection Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
					BWR Stress Corrosion Cracking Program Water Chemistry Program	IV.C1-9 (R-20)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (R-27)	3.1.1-15	A
Valve, damper	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-18 (A-35)	3.3.1-17	A

TABLE 3.3.2-24 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR WATER CLEANUP SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	BWR Reactor Water Cleanup System	VII.E3-16 (A-60)	3.3.1-37	B
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-15 (A-58)	3.3.1-24	A

TABLE 3.3.2-25
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RHR SERVICE WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
			Raw water (external)	Loss of material	Bolting Integrity Program	VII.C1-19 (A-38)	3.3.1-76	210, E
				Loss of preload	Bolting Integrity Program			207, G
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
			Raw water (external)	Loss of material	Bolting Integrity Program	VII.C1-15 (A-54)	3.3.1-79	202, 210, E
				Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A
Instrumentation (flow element)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (AP-54)	3.3.1-79	202, A

TABLE 3.3.2-25 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RHR SERVICE WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation (flow element) (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A
					Flow Accelerated Corrosion Program			222, H
	Pressure boundary	Carbon steel	Soil (external)	Loss of material	Buried Piping and Tanks Inspection Program	VII.C1-18 (A-01)	3.3.1-19	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A
Pumps, positive pressure devices (except blowers)	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (external)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A

TABLE 3.3.2-25 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RHR SERVICE WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pumps, positive pressure devices (except blowers) (continued)	Pressure boundary	Carbon steel	Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A
		Cast austenitic stainless steel	Raw water (external)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A
Thermowell	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A
Valve, damper	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A
	Pressure boundary Pressure relief	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A

TABLE 3.3.2-26
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RIVER WATER SUPPLY SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
			Raw water (external)	Loss of material	Bolting Integrity Program	VII.C1-19 (A-38)	3.3.1-76	210, E
				Loss of preload	Bolting Integrity Program			207, G
		Stainless steel	Raw water (external)	Loss of material	Bolting Integrity Program	VII.C1-15 (A-54)	3.3.1-79	202, 210, E
				Loss of preload	Bolting Integrity Program			207, F
Instrumentation (flow elements)	Pressure boundary Structural integrity (attached) Throttle	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A

TABLE 3.3.2-26 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RIVER WATER SUPPLY SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A
	Pressure boundary	Carbon steel	Soil (external)	Loss of material	Buried Piping and Tanks Inspection Program	VII.C1-18 (A-01)	3.3.1-19	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A
Pumps, positive pressure devices (except blowers)	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (external)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A
Pumps, positive pressure devices (except blowers) (continued)	Pressure boundary	Cast austenitic stainless steel	Raw water (external)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A

TABLE 3.3.2-26 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
RIVER WATER SUPPLY SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	202, A
	Pressure boundary	Cast austenitic stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A
	Pressure boundary Structural integrity (attached)	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-19 (A-38)	3.3.1-76	A
					Selective Leaching of Materials Program	VII.C1-11 (A-51)	3.3.1-85	A
	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-15 (A-54)	3.3.1-79	202, A

TABLE 3.3.2-27
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SAFETY RELATED AIR SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.D-3 (A-80)	3.3.1-57	A
			Air/gas (internal)	None	None	VII.J-22 (AP-4)	3.3.1-98	A
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Pressure boundary	Aluminum alloy	Air/gas (external)	None	None	VII.J-1 (AP-36)	3.3.1-95	A
			Air/gas (internal)	None	None	VII.J-2 (AP-37)	3.3.1-97	A
		Zinc	Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Air/gas (internal)	None	None	VII.J-22 (AP-4)	3.3.1-98	A

TABLE 3.3.2-27 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SAFETY RELATED AIR SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
	Pressure boundary Heat transfer	Stainless steel	Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.D-4 (AP-81)	3.3.1-54	E
			Raw water (external)	Heat transfer degradation	Open Cycle Cooling Water System Program	V.D2-12 (E-21)	3.2.1-39	A
				Loss of material	Open Cycle Cooling Water System Program	V.D2-6 (E-20)	3.2.1-39	A
	Pressure boundary	Stainless steel	Raw water (internal)	Loss of material	Open Cycle Cooling Water System Program	V.D2-6 (E-20)	3.2.1-39	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Pressure boundary	Copper	Air/gas (external)	None	None	VII.I-2 (SP-6)	3.4.1-41	A
			Air/gas (internal)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Air/gas (internal)	None	None	VII.J-3 (AP-8)	3.3.1-98	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Air/gas (internal)	Loss of material	Compressed Air Monitoring Program	VII.D-4 (AP-81)	3.3.1-54	A
			Air/gas (internal)	None	None	VII.J-18 (AP-20)	3.3.1-98	A

TABLE 3.3.2-27 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SAFETY RELATED AIR SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper	Pressure boundary	Aluminum alloy	Air/gas (external)	None	None	V.F-2 (EP-3)	3.2.1-50	A
			Air/gas (internal)	Loss of material	Compressed Air Monitoring Program	VII.F2-12 (AP-74)	3.3.1-27	E
			Air/gas (internal)	None	None	VII.J-2 (AP-37)	3.3.1-97	A
	Leakage boundary (spatial) Pressure boundary	Brass	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Air/gas (internal)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
	Pressure boundary	Brass	Air/gas (internal)	None	None	VII.J-3 (AP-8)	3.3.1-98	A
	Pressure boundary	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Air/gas (internal)	None	None	VII.J-3 (AP-8)	3.3.1-98	A
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.D-3 (A-80)	3.3.1-57	A
			Air/gas (internal)	Loss of material	Compressed Air Monitoring Program	VII.D-2 (A-26)	3.3.1-53	202, A
			Air/gas (internal)	None	None	VII.J-22 (AP-4)	3.3.1-98	A

TABLE 3.3.2-27 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SAFETY RELATED AIR SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Air/gas (internal)	None	None	VII.J-18 (AP-20)	3.3.1-98	A
		Zinc	Air/gas (external)	None	None	VII.J-6 (AP-13)	3.3.1-92	A
			Air/gas (internal)	None	None	VII.J-22 (AP-4)	3.3.1-98	A

TABLE 3.3.2-28
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SOLID RADWASTE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	E
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-18)	3.3.1-94	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-15 (A-58)	3.3.1-24	E
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F

TABLE 3.3.2-28 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SOLID RADWASTE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Filter, screens, strainer	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H1-10 (A-30)	3.3.1-20	230, B
					One-Time Inspection Program	VII.H1-10 (A-30)	3.3.1-20	230, A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-15 (A-58)	3.3.1-24	E
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H1-10 (A-30)	3.3.1-20	202, 230, B
					One-Time Inspection Program	VII.H1-10 (A-30)	3.3.1-20	202, 230, A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	202, E

TABLE 3.3.2-28 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SOLID RADWASTE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Carbon steel	Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	202, E
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, E
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-15 (A-58)	3.3.1-79	E
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H1-10 (A-30)	3.3.1-20	230, B
					One-Time Inspection Program	VII.H1-10 (A-30)	3.3.1-20	230, A

TABLE 3.3.2-28 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SOLID RADWASTE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pumps, positive pressure devices (except blowers) (continued)	Leakage boundary (spatial)	Carbon steel	Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	E
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-15 (A-58)	3.3.1-24	E
Valve, damper	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H1-3 (AP-44)	3.3.1-32	225, B
					One-Time Inspection Program	VII.H1-3 (AP-44)	3.3.1-32	225, A

TABLE 3.3.2-28 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SOLID RADWASTE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H1-10 (A-30)	3.3.1-20	230, B
					One-Time Inspection Program	VII.H1-10 (A-30)	3.3.1-20	230, A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	E
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-18 (A-35)	3.3.1-17	E
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-15 (A-58)	3.3.1-24	E

TABLE 3.3.2-29
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H2-24 (A-30)	3.3.1-20	B
					One-Time Inspection Program	VII.H2-24 (A-30)	3.3.1-20	A
	Pressure boundary	Carbon steel	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-20 (AP-30)	3.3.1-14	202, A
			Soil (external)	Loss of material	Buried Piping and Tanks Inspection Program	VII.H1-9 (A-01)	3.3.1-19	A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.H2-23 (A-25)	3.3.1-47	202, A

TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Electrical resistance heater, heat trace	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-20 (AP-30)	3.3.1-14	202, A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.H2-23 (A-25)	3.3.1-47	A
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
			Air/gas (external)	Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Filter Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H2-24 (A-30)	3.3.1-20	230, B
					One-Time Inspection Program	VII.H2-24 (A-30)	3.3.1-20	230, A

TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Filter, screens, strainer (continued)	Filter Structural integrity (attached)	Carbon steel	Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.B-1 (E-25)	3.2.1-32	C
	Filter Pressure boundary	Carbon steel	Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-20 (AP-30)	3.3.1-14	202, A
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	A
					Selective Leaching of Materials Program	VII.H2-14 (AP-51)	3.3.1-85	A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H2-24 (A-30)	3.3.1-20	230, B
					One-Time Inspection Program	VII.H2-24 (A-30)	3.3.1-20	230, A
					Selective Leaching of Materials Program			207, G

TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Filter, screens, strainer (continued)	Filter Pressure boundary	Cast iron	Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-20 (AP-30)	3.3.1-14	202, A
					Selective Leaching of Materials Program			207, G
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.D-4 (AP-31)	3.3.1-54	E
Heat exchanger, condenser, cooler, fan coil	Heat transfer Pressure boundary	Admiralty brass	Lube oil (external)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-10 (AP-47)	3.3.1-26	C
					Selective Leaching of Materials Program			224, G
				Heat transfer degradation	None			227, I

TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil (continued)	Pressure boundary Heat transfer	Admiralty brass	Raw water (internal)	Heat transfer degradation	Open-Cycle Cooling Water System Program	VII.C1-6 (A-72)	3.3.1-83	A
				Loss of material	Open-Cycle Cooling Water System Program	VII.C1-3 (A-65)	3.3.1-82	219, A
				Loss of material	Selective Leaching of Materials Program	VII.C1-4 (A-66)	3.3.1-84	A
			Treated water (external)	Loss of material	Closed-Cycle Cooling Water System Program	VII.F1-8 (AP-34)	3.3.1-51	219, A
					Selective Leaching of Materials Program	VII.F1-9 (AP-65)	3.3.1-84	A
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.H2-3 (AP-41)	3.3.1-59	233, A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-5 (AP-39)	3.3.1-21	202, 226, A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-1 (A-63)	3.3.1-48	A
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.H2-3 (AP-41)	3.3.1-59	233, A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-5 (A-64)	3.3.1-77	219, A
					Selective Leaching of Materials Program	VII.H2-14 (A-51)	3.3.1-85	210, C

TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil (continued)	Heat transfer Pressure boundary	Copper alloy >15% zinc	Lube oil (external)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program			207, G
					Selective Leaching of Materials Program			207, G
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.C1-3 (A69)	3.3.1-82	219, A
					Selective Leaching of Materials Program	VII.C1-4 (A-66)	3.3.1-84	A
		Copper alloy >15% zinc	Treated water (external)	Loss of material	Closed-Cycle Cooling Water System Program	VII.F1-8 (AP-34)	3.3.1-51	219, A
					Selective Leaching of Materials Program	VII.F1-9 (AP-65)	3.3.1-84	219, A
Instrumentation (level controller)	Pressure boundary	Aluminum alloy	Air/gas (external)	None	None	VII.J-1 (AP-36)	3.3.1-95	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program			202, 223, J
		Glass	Air/gas (external)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
			Lube oil (internal)	None	None	VII.J-10 (AP-15)	3.3.1-93	A

TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation (level indicators)	Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-20 (AP-30)	3.3.1-14	202, A
	Pressure boundary Structural integrity (attached)	Glass	Air/gas (external)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
	Structural integrity (attached)	Glass	Fuel oil (internal)	None	None	VII.J-9 (AP-49)	3.3.1-93	A
			Lube oil (internal)	None	None	VII.J-10 (AP-15)	3.3.1-93	A
	Pressure boundary	Glass	Treated water (internal)	None	None	VII.J-13 (AP-51)	3.3.1-93	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Structural integrity (attached)	Aluminum alloy	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.F4-10 (AP-74)	3.3.1-27	A
			Atmosphere/ weather (external)	None	None			207, G

TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Structural integrity (attached)	Carbon steel	Atmosphere/ weather (external)	Loss of material	External Surfaces Monitoring Program	VII.H1-8 (A-24)	3.3.1-60	A
	Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.B-1 (E-25)	3.2.1-32	C
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	A
	Pressure boundary	Carbon steel	Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H2-24 (A-30)	3.3.1-20	202, 230, B
					One-Time Inspection Program	VII.H2-24 (A-30)	3.3.1-20	202, 230 A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-20 (AP-30)	3.3.1-14	202, A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.H2-22 (A-38)	3.3.1-76	202, A
			Soil (external)	Loss of material	Buried Piping and Tanks Inspection Program	VII.H1-9 (A-01)	3.3.1-19	A

**TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary	Carbon steel	Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.H2-23 (A-25)	3.3.1-47	202, A
			Wet air/gas (internal) (diesel exhaust)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-2 (A-27)	3.3.1-18	207, E, H
		Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-9 (AP-78)	3.3.1-28	A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H2-9 (AP-44)	3.3.1-32	225, B
					One-Time Inspection Program	VII.H2-9 (AP-44)	3.3.1-32	225, A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-10 (AP-47)	3.3.1-26	202, 225, A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.H2-8 (AP-12)	3.3.1-51	219, A

TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary	Stainless steel	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.D-4 (AP-81)	3.3.1-54	E
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H1-6 (AP-54)	3.3.1-32	B
					One-Time Inspection Program	VII.H1-6 (AP-54)	3.3.1-32	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-17 (AP-59)	3.3.1-33	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.H2-18 (AP-55)	3.3.1-80	202, A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-10 (A-52)	3.3.1-50	A
			Wet air/gas (internal) (diesel exhaust)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-2 (A-27)	3.3.1-18	E

TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial) Structural integrity (attached)	Stainless steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E3-15 (A-58)	3.3.1-24	A
	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
	Pressure boundary	Stainless steel	Air/gas (internal)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
Pumps, positive pressure devices (except blowers)	Pressure boundary	Carbon steel	Fuel oil (external)	Loss of material	Fuel Oil Chemistry Program	VII.H2-24 (A-30)	3.3.1-20	230, B
					One-Time Inspection Program	VII.H2-24 (A-30)	3.3.1-20	230, A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H2-24 (A-30)	3.3.1-20	230, B
					One-Time Inspection Program	VII.H2-24 (A-30)	3.3.1-20	230, A

TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pumps, positive pressure devices (except blowers) (continued)	Pressure boundary	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H1-10 (A-30)	3.3.1-20	230, B
					One-Time Inspection Program	VII.H1-10 (A-30)	3.3.1-20	230, A
					Selective Leaching of Materials Program			207, H
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-20 (AP-30)	3.3.1-14	202, A
					Selective Leaching of Materials Program			207, H
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.H2-23 (A-25)	3.3.1-47	A
					Selective Leaching of Materials Program	VII.C2-8 (A-50)	3.3.1-85	A

**TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H2-9 (AP-44)	3.3.1-32	202, 225, B
					One-Time Inspection Program	VII.H2-9 (AP-44)	3.3.1-32	202, 225 A
	Pressure boundary	Bronze	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.G-9 (AP-78)	3.3.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-10 (AP-47)	3.3.1-26	202, 225, A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.H2-8 (AP-12)	3.3.1-51	219, A
	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H2-24 (A-30)	3.3.1-20	230, B
					One-Time Inspection Program	VII.H2-24 (A-30)	3.3.1-20	230, A

TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary Structural integrity (attached)	Carbon steel	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	A
			Atmosphere/ weather (external)	Loss of material	External Surfaces Monitoring Program	VII.H1-8 (A-24)	3.3.1-60	A
	Pressure boundary	Carbon steel	Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	V.B-1 (E-25)	3.2.1-32	C
			Fuel oil (external)	Loss of material	Fuel Oil Chemistry Program	VII.H2-24 (A-30)	3.3.1-20	230, B
					One-Time Inspection Program	VII.H2-24 (A-30)	3.3.1-20	230, A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-20 (AP-30)	3.3.1-14	202, A
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.H2-23 (A-25)	3.3.1-47	A

TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Cast austenitic stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.D-4 (AP-81)	3.3.1-54	E
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H2-24 (A-30)	3.3.1-20	230, B
					One-Time Inspection Program	VII.H2-24 (A-30)	3.3.1-20	230, A
					Selective Leaching of Materials Program			207, G
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-20 (AP-30)	3.3.1-14	202, A
					Selective Leaching of Materials Program			207, G
			Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.H2-23 (A-25)	3.3.1-47	A
					Selective Leaching of Materials Program	VII.C2-8 (A-50)	3.3.1-85	A

TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial) Pressure boundary Structural integrity (attached)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
	Pressure boundary	Stainless steel	Wet air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.D-4 (AP-81)	3.3.1-54	E
			Fuel oil (internal)	Loss of material	Fuel Oil Chemistry Program	VII.H1-6 (AP-54)	3.3.1-32	B
					One-Time Inspection Program	VII.H1-6 (AP-54)	3.3.1-32	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VII.H2-17 (AP-59)	3.3.1-33	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VII.H2-18 (AP-55)	3.3.1-80	202, A

**TABLE 3.3.2-29 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY DIESEL GENERATORS**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Stainless steel	Treated water (internal)	Loss of material	Closed-Cycle Cooling Water System Program	VII.C2-10 (A-52)	3.3.1-50	A
	Leakage boundary (spatial) Structural integrity (attached)	Stainless steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A

TABLE 3.3.2-30
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY LIQUID CONTROL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Piping, piping components and piping elements	Pressure boundary	Stainless steel	Reactor coolant (internal)	Cumulative fatigue damage/fatigue	TLAA	IV.C1-15 (R-220)	3.1.1-3	A
Accumulator, pulsation damper, low pressure tank	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	203, A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-40 (S-13)	3.4.1-6	202, A
	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-40 (S-13)	3.4.1-6	A
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
				Loss of preload	Bolting Integrity Program	IV.C1-10 (R-27)	3.1.1-52	A
						VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F

**TABLE 3.3.2-30 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY LIQUID CONTROL SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation, indication/ recorder (level gauge)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E2-1 (AP-73)	3.3.1-30	A
		Glass	Air/gas (external)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
			Treated water (internal)	None	None	VII.J-13 (AP-51)	3.3.1-93	A
Pipe Class 1, pipe fittings, tubing	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A

TABLE 3.3.2-30 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY LIQUID CONTROL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E2-1 (AP-73)	3.3.1-30	A
Pumps, positive pressure devices (except blowers)	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E2-1 (AP-73)	3.3.1-30	A
Valve Class 1	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A

TABLE 3.3.2-30 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
STANDBY LIQUID CONTROL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VII.E2-1 (AP-73)	3.3.1-30	A

TABLE 3.3.2-31
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE BUILDING SAMPLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VIII.H-4 (S-34)	3.4.1-22	203, A
			Air/gas (external)	Loss of preload	Bolting Integrity Program	VIII.H-5 (S-33)	3.4.1-22	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-5 (SP-61)	3.4.1-15	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-4 (S-21)	3.4.1-16	A

TABLE 3.3.2-31 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE BUILDING SAMPLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation, indication/ recorder (level gauge)	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-5 (SP-61)	3.4.1-15	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-7 (S-09)	3.4.1-4	202, A
		Glass	Air/gas (external)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
			Treated water (internal)	None	None	VII.J-13 (AP-51)	3.3.1-93	A

**TABLE 3.3.2-31 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE BUILDING SAMPLING SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A
Valve, damper	Leakage boundary (spatial)	Brass	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-5 (SP-61)	3.4.1-15	A
		Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-5 (SP-61)	3.4.1-15	A

TABLE 3.3.2-31 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE BUILDING SAMPLING SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-7 (S-09)	3.4.1-4	202, A
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-7 (S-09)	3.4.1-4	202, A
					Selective Leaching of Materials Program	VIII.E-23 (SP-27)	3.4.1-36	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A

TABLE 3.3.2-32
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
WELL WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial)	Polyethylene	Air/gas (external)	None	None			234, J
			Treated water (internal)	None	None			234, J
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-15 (A-58	3.3.1-24	E
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VII.I-4 (AP-27)	3.3.1-43	203, A
			Air/gas (external)	Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	220, E

TABLE 3.3.2-32 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
WELL WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Filter, screens, strainer (continued)	Leakage boundary (spatial)	PVC/ plastic	Air/gas (external)	None	None			234, J
			Raw water (internal)	None	None			234, J
Instrumentation (flow indicators)	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	220, E
		Glass	Air/gas (external)	None	None	VII.J-8 (AP-14)	3.3.1-93	A
			Raw water (internal)	None	None	VII.J-11 (AP-50)	3.3.1-93	A
Instrumentation (flow elements)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	220, E

TABLE 3.3.2-32 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
WELL WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation (flow elements) (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, 220, E
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-42	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	220, E
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	202, 220, E
		Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	220, E

**TABLE 3.3.2-32 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
WELL WATER SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	PVC/ plastic	Air/gas (external)	None	None			234, H
			Treated water (internal)	None	None			234, H
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	220, E
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-15 (A-58	3.3.1-81	E
Valve, damper	Leakage boundary (spatial)	Bronze	Air/gas (external)	None	None	VIII.I-2 (SP-1)	3.4.1-41	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-9 (A-44)	3.3.1-81	220, E
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A

TABLE 3.3.2-32 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
WELL WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Carbon steel	Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	202, 220, E
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VII.I-8 (A-77)	3.3.1-58	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-19 (A-38)	3.3.1-76	220, E
					Selective Leaching of Materials Program	VII.C1-11 (A-51)	3.3.1-85	A
		PVC/ plastic	Air/gas (external)	None	None			234, J
			Treated water (internal)	None	None			234, J
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	220, E
			Treated water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.E3-15 (A-58)	3.3.1-81	220, E

TABLE 3.3.2-33
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
ZINC INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of preload	Bolting Integrity Program	VII.I-5 (AP-26)	3.3.1-45	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A
Instrumentation, transmitter/ element (flow elements)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A

TABLE 3.3.2-33 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
ZINC INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	None	None			231, I
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-7 (S-09)	3.4.1-4	202, A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A
Pressure vessels	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	None	None			231, I
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-7 (S-09)	3.4.1-4	A

TABLE 3.3.2-33 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
ZINC INJECTION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	None	None			231, I
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-7 (S-09)	3.4.1-4	A
		Stainless steel	Air/gas (external)	None	None	VII.J-15 (AP-17)	3.3.1-94	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A

NOTES FOR TABLES 3.3.2-1 THROUGH 3.3.2-33

A. Consistent with NUREG-1801 item for component, material, environment, and aging effect. Aging management program is consistent with NUREG-1801 aging management program.

B. Consistent with NUREG-1801 item for component, material, environment, and aging effect. Aging management program takes some exceptions to NUREG-1801 aging management program.

C. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. Aging management program is consistent with NUREG-1801 aging management program.

D. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. Aging management program takes some exceptions to NUREG-1801 aging management program.

E. Consistent with NUREG-1801 item for material, environment, and aging effect, but a different aging management program is credited, or a plant-specific aging management program.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material, and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes:

201. Not Used
202. Aging mechanism is in addition to aging mechanisms in NUREG-1801. This may include galvanic corrosion, MIC and/or selective leaching.
203. Crevice and pitting corrosion is not applicable for an air/gas environment for carbon steel components due to not being exposed to a concentration of contaminates or aggressive environments.
204. Not Used
205. Components with a “wet air/gas” environment are analyzed in the same manner as raw water for conservatism.
206. Not Used
207. Material/environment combination and/or aging effect/mechanism not identified in NUREG-1801. The aging management program(s) referenced are appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.
208. Program is different than identified in NUREG-1801. The aging management program(s) referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.
209. Not Used
210. Component is different, but consistent with NUREG-1801 for material, environment, and aging effect. The aging management program(s) referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.
211. Not Used
212. These elastomers (neoprene, rubber, etc.) components are indoors and not subject to ultraviolet or ozone, nor are they in locations that are subject to radiation exposure. These locations are also not subject to temperatures where change in material properties or cracking could occur (>95^{o}F). Therefore, no aging management is required.
213. Not Used
214. Not Used
215. Not Used
216. Not Used
217. Not Used
218. Material science evaluation for this material in this environment results in no aging effects requiring management.
219. Galvanic corrosion is not applicable to the components since it is not in contact with metal higher in the galvanic series.

220. Well Water is Raw Water that comes from wells. Well Water does not contain (mussels, clams, bryozoa, etc) or silting. Therefore, Loss of Material due to macrofouling and/or lining/coating degradation are not potential aging effects.

221. Duane Arnold does not have operating experience supporting microbiologically-influenced corrosion in treated water and/or oil systems. Therefore, microbiologically-influenced corrosion is not an applicable aging mechanism.

222. As described in the plant operating experience database, erosion has occurred on some components. Loss of material due to erosion for these components in managed by the Flow Accelerated Corrosion Program.

223. The component and material are different, but consistent with NUREG-1801 for environment and aging effect. The aging management program referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects are effectively managed through the period of extended operation.

224. The component and environment are different, but consistent with NUREG-1801 for material and aging effect. The aging management program referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects are effectively managed through the period of extended operation.

225. Crevice and pitting corrosion are not applicable aging mechanisms for copper alloy components with less than 15% zinc and aluminum bronze components with less than 8% aluminum in fuel oil and lube oil environments at Duane Arnold.

226. Loss of material due to macro-fouling is not a potential aging effect for this lube oil heat exchanger.

227. Duane Arnold does not have operating experience that supports heat transfer degradation due to fouling in treated water and lube oil environments. Therefore, fouling is not a potential aging effect.

228. The material and environment are different, but consistent with NUREG-1801 for component and aging effect. The aging management program referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects are effectively managed through the period of extended operation.

229. Not Used

230. Loss of material due to fouling does not apply to carbon steel components exposed to fuel oil that are not tanks and do not have a potential for particulate fouling (sediment, silt, dust, and corrosion products).

231. Loss of material due to corrosion is not an applicable aging effect due to system temperatures are greater than 212^{o}F.

232. The component does not have the potential for water contamination.

233. The component is not located in an aggressive environment.

234. Non-metallic (fiberglass, PVC, CPVC) in this environment was evaluated and contained no aging effects.

235. Non-metallic elastomers (rubber) in this environment was evaluated and contains no aging effects.

236. Ducting, piping, piping components, piping elements or valves having air-indoor uncontrolled for both their internal and external environments have the same aging effects on both internal/external surfaces.

237. DAEC has plant specific OE for cracking of small bore piping. Therefore, Program XI.M35 is not applicable to DAEC. At DAEC small bore piping is included in the ASME Section XI, ISI Program.

3.4 AGING MANAGEMENT OF STEAM AND POWER CONVERSION SYSTEMS

This section provides the results of the aging management review for those components and commodity groups identified in LRA Subsection 2.3.4, Scoping and Screening Results: Steam and Power Conversion Systems, as being subject to aging management review. The systems, or portions of systems, which are addressed in this section, are described in the indicated sections.

- Subsection 2.3.4.1 – Condensate and Demineralized Water System
- Subsection 2.3.4.2 – Condensate and Feedwater System
- Subsection 2.3.4.3 – Condenser and Condenser Air Removal System
- Subsection 2.3.4.4 – Main Steam Isolation and Automatic Depressurization System
- Subsection 2.3.4.5 – Turbine

Table 3.4-1, Summary of Aging Management Evaluations in Chapter VIII of NUREG-1801 [Reference 3.4-1] for Power and Stean Conversion Systems, provides the summary of the programs evaluated in NUREG-1801 for the Steam and Power Conversion Systems component groups that are relied on for license renewal. This table uses the format described in Section 3.0. Note that this table only includes those component groups that are applicable to a boiling water reactor.

3.4.1 RESULTS SUMMARY

The materials that specific components and commodity groups are fabricated from, the environments to which components and commodity groups are exposed, the potential aging effects requiring management, and the aging management programs used to manage these aging effects are provided for each of the Steam and Power Conversion Systems in the following subsections: The corresponding tables summarize the results of the aging management review for systems in the Steam and Power Conversion Systems group:

- Condensate and Demineralized Water System - Subsection 3.4.1.1 and Table 3.4.2-1
- Condensate and Feedwater System - Subsection 3.4.1.2 and Table 3.4.2-2
- Condenser and Condenser Air Removal System - Subsection 3.4.1.3 and Table 3.4.2-3
- Main Steam Isolation and Automatic Depressurization System – Subsection 3.4.1.4 and Table 3.4.2-4
- Turbine - Subsection 3.4.1.5 and Table 3.4.2-5

3.4.1.1 Condensate and Demineralized Water System

Materials

The materials of construction for the Condensate and Demineralized Water System components and commodity groups are:

- Carbon steel
- Cast iron
- CPVC
- Glass
- Stainless steel

Environments

The Condensate and Demineralized Water System components and commodity groups are exposed to the following environments:

- Air/gas
- Atmosphere/weather
- Soil
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Condensate and Demineralized Water System components and commodity groups, require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Condensate and Demineralized Water System components and commodity groups:

- Aboveground Steel Tanks Program
- Bolting Integrity Program
- Buried Piping and Tanks Inspection Program
- External Surfaces Monitoring Program
- Flow Accelerated Corrosion Program
- One-Time Inspection Program
- Selective Leaching of Materials Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.4.2-1.

3.4.1.2 Condensate and Feedwater System

Materials

The materials of construction for the Condensate and Feedwater System components and commodity groups are:

- Carbon steel
- Cast iron
- Copper
- Copper alloy
- Glass
- Low alloy steel
- Stainless steel

Environments

The Condensate and Feedwater System components and commodity groups are exposed to the following environments:

- Air/gas
- Lube oil
- Raw water
- Steam
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Condensate and Feedwater System components and commodity groups require management:

- Cracking
- Cumulative fatigue damage/fatigue
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Condensate and Feedwater System components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Flow Accelerated Corrosion Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program

- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Selective Leaching of Materials Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.4.2-2.

3.4.1.3 Condenser and Condenser Air Removal System

Materials

The materials of construction for the Condenser and Condenser Air Removal System components and commodity groups are:

- Carbon steel
- Copper alloy
- Glass
- Stainless steel

Environments

The Condenser and Condenser Air Removal System components and commodity groups are exposed to the following environments:

- Air/gas
- Raw water
- Steam
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Condenser and Condenser Air Removal System components and commodity groups require management:

- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Condenser and Condenser Air Removal System components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Flow Accelerated Corrosion Program

- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- One-Time Inspection Program
- Open Cycle Cooling Water System Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.4.2-3.

3.4.1.4 Main Steam Isolation and Automatic Depressurization System

Materials

The materials of construction for the Main Steam Isolation and Automatic Depressurization System components and commodity groups are:

- Aluminum alloy
- Carbon steel
- Cast austenitic stainless steel
- Copper alloy
- Stainless steel

Environments

The Main Steam Isolation and Automatic Depressurization System components and commodity groups are exposed to the following environments:

- Air/gas
- Steam
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Main Steam Isolation and Automatic Depressurization System components and commodity groups, require management:

- Cracking
- Cumulative fatigue damage/fatigue
- Loss of material
- Loss of preload
- Reduction in fracture toughness

Aging Management Programs

The following aging management programs manage the aging effects for the Main Steam Isolation and Automatic Depressurization System components and commodity groups:

- ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program
- Bolting Integrity Program
- External Surfaces Monitoring Program
- Flow-Accelerated Corrosion Program
- One-Time Inspection Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.4.2-4

3.4.1.5 Turbine

Materials

The materials of construction for the Turbine components and commodity groups are:

- Aluminum alloy
- Brass
- Carbon steel
- Cast austenitic stainless steel
- Cast iron
- Copper
- Copper alloy
- Glass
- Stainless steel

Environments

The Turbine components and commodity groups are exposed to the following environments:

- Air/gas
- Lube oil
- Raw water
- Steam
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Turbine components and commodity groups require management:

- Cracking
- Loss of material
- Loss of preload

Aging Management Programs

The following aging management programs manage the aging effects for the Turbine components and commodity groups:

- Bolting Integrity Program
- External Surfaces Monitoring Program
- Flow Accelerated Corrosion Program
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program
- Lubricating Oil Analysis Program
- One-Time Inspection Program
- Selective Leaching of Materials Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.4.2-5.

3.4.2 FURTHER EVALUATION OF AGING MANAGEMENT AS RECOMMENDED BY NUREG-1801

NUREG-1801 Volume 1 Tables provide the basis for identifying those programs that warrant further evaluation by the reviewer in the license renewal application. For the Steam and Power Conversion Systems, those programs are addressed in the following sections. (The following subsections are numbered to correspond to the appropriate section of NUREG-1800 [Reference 3.4-2])

3.4.2.2.1 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). This TLAA is addressed separately in Section 4.3, "Metal Fatigue Analysis" of NUREG-1800.

At Duane Arnold, the evaluation of this TLAA is addressed separately in LRA Subsection 4.3.

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

1. Loss of material due to general, pitting and crevice corrosion could occur for steel piping, piping components, piping elements, tanks and heat exchanger

components exposed to treated water and for steel piping, piping components, and piping elements exposed to steam.

At Duane Arnold, carbon steel and cast iron piping and components exposed to treated water and steam are managed for loss of material due to general, crevice, and pitting corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of stagnant flow.

2. Loss of material due to general, pitting and crevice corrosion could occur for steel piping, piping components, and piping elements exposed to lubricating oil.

   At Duane Arnold, carbon steel components exposed to lubricating oil are managed for loss of material due to general, crevice, microbiological influenced corrosion by the Lubricating Oil Analysis Program. The Lubricating Oil Analysis Program includes periodic sampling and Analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program. Selected components, including a sample of components where potential water pooling will occur are inspected to ensure corrosion is not occurring.

3.4.2.2.3 Loss of Material due to General, Pitting, Crevice, and Microbiologically-Influenced Corrosion (MIC), and Fouling

Loss of material due to general, pitting, crevice, and MIC, and fouling could occur in steel piping, piping components, and piping elements exposed to raw water.

At Duane Arnold, loss of material due to general, pitting, crevice, and MIC, and fouling for carbon steel heat exchanger components exposed to raw water is an aging effect requiring management at DAEC and is managed by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The aging management program for Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is used to assure that through visual inspections that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions.

3.4.2.2.4 Reduction of Heat Transfer Due to Fouling

1. Reduction of heat transfer due to fouling could occur for stainless steel and copper alloy heat exchanger tubes exposed to treated water.

   At Duane Arnold, the steam and power conversion systems have no stainless steel or copper alloy heat exchanger tubes in a treated water environment with an intended function of heat transfer and associated aging effect of fouling.

2. Reduction of heat transfer due to fouling could occur for steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil.

   The steam and power conversion systems at DAEC have no heat exchanger tubes in a lubricating oil environment with an intended function of heat transfer and associated aging affect of fouling.

3.4.2.2.5 Loss of Material Due to General, Pitting, Crevice and Microbiologically-Influenced Corrosion

1. Loss of material due to general, pitting and crevice corrosion, and MIC could occur in steel (with or without coating or wrapping) piping, piping components, piping elements and tanks exposed to soil.

   The steam and power conversion systems at DAEC have no carbon steel components that are exposed to soil.

2. Loss of material due to general, pitting and crevice corrosion, and MIC could occur in steel heat exchanger components exposed to lubricating oil.

   Loss of material due to general, pitting, crevice corrosion and MIC for carbon steel heat exchanger components exposed to lubricating oil is an aging effect requiring management in the steam and power conversion systems at DAEC and is managed by the Lubricating Oil Analysis Program. This program includes periodic sampling and analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The One-Time Inspection Program will use representative samples to confirm that the Lubricating Oil Analysis Program has been effective at managing aging effects for components crediting this program.

3.4.2.2.6 Cracking Due to Stress Corrosion Cracking

Cracking due to SCC could occur in the stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water greater than 60°C (>140°F), and for stainless steel piping, piping components, and piping elements exposed to steam.

At Duane Arnold, stainless steel piping and components exposed to steam and treated water > 140°F are being managed for cracking due to stress corrosion cracking by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of low or stagnant flow and areas of high concentrations of impurities.

3.4.2.2.7 Loss of Material Due to Pitting and Crevice Corrosion

1. Loss of material due to pitting and crevice corrosion could occur in stainless steel, aluminum, and copper alloy piping, piping components and piping elements and for stainless steel tanks and heat exchanger components exposed to treated water.

   At Duane Arnold, aluminum alloy, copper, copper alloy, and stainless steel piping components exposed to treated water are managed for loss of material due to pitting and crevice corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry Program will be confirmed by the One-Time Inspection Program through an inspection of a representative sample of components crediting this program, including susceptible locations, such as areas of low or stagnant flow and areas of high concentrations of impurities.

   At Duane Arnold the stainless steel and copper alloy components exposed to treated water or steam are being managed for crevice and pitting corrosion by the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program. The aging management program for Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is used to assure that through visual inspections that existing environmental conditions are not causing material degradation that could result in a loss of component intended functions.

2. Loss of material due to pitting and crevice corrosion could occur for stainless steel piping, piping components, and piping elements exposed to soil.

   At Duane Arnold, stainless steel piping exposed to soil is managed for loss of material due to pitting and crevice corrosion by the Buried Piping and Tanks Inspection Program. Plant inspection frequency and operating experience validate that the Buried Piping and Tanks Inspection Program is working to manage loss of material. At any time when underground components are uncovered (whether anticipated or unplanned) and there are any indications of degradation, corrosion, damage, etc., the appropriate personnel shall be notified to inspect the condition of the equipment.

3. Loss of material due to pitting and crevice corrosion could occur for copper alloy piping, piping components, and piping elements exposed to lubricating oil.

   At DAEC the Turbine copper alloy piping and components exposed to lube oil are being managed for MIC, by the Lubrication Oil Analysis Program. Crevice and Pitting Corrosion is not a potential aging effect since component's material is not Brass/Bronze >15% Zn or Aluminum Bronze >8% Al. The effectiveness of Lubrication Oil Analysis Program is verified using the One Time Inspection program. Selected components, including a sample of components where the potential of water pooling will occur are inspected to ensure corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

<u>3.4.2.2.8 Loss of material due to pitting, crevice, and MIC could occur in stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil.</u>

At Duane Arnold, stainless steel piping and components exposed to lubricating oil are managed for loss of material due to pitting, crevice, and microbiological influenced corrosion by the Lubricating Oil Analysis Program. The Lubricating Oil Analysis Program includes periodic sampling and Analysis of lubricating oil to maintain contaminants within acceptable limits, thereby preserving an environment that is not conducive to corrosion. The effectiveness of the Lubricating Oil Analysis Program will be confirmed by the One-Time Inspection Program. Selected components, including a sample of components where potential water pooling will occur are inspected to ensure corrosion is not occurring.

<u>3.4.2.2.9 Loss of material due to general, pitting, crevice, and galvanic corrosion can occur for steel heat exchanger components exposed to treated water.</u>

Loss of material due to general, pitting, crevice, and galvanic corrosion can occur for steel heat exchanger components exposed to treated water. The existing aging management program relies on monitoring and control of water chemistry to manage the effects of loss of material due to general, pitting, and crevice corrosion. However, control of water chemistry does not preclude loss of material due to general, pitting, and crevice corrosion at locations of stagnant flow conditions. Therefore, the effectiveness of the water chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to verify the effectiveness of the water chemistry control program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

At Duane Arnold the steel heat exchanger components exposed to treated water are being managed for general, pitting and crevice corrosion by the Water Chemistry Program. The effectiveness of the Water Chemistry is verified using the One Time Inspection Program. Selected components, including a sample of components where the flow of water is low or stagnant conditions exist and areas where high concentrations of impurities at crevices are inspected to determine whether an aging effect is not occurring or is progressing very slowly such that the components intended function will be maintained during the period of extended operation.

3.4.2.2.10 Quality Assurance for Aging Management of Nonsafety-Related Components

Acceptance criteria are described in Branch Technical Position IQMB-1 (Appendix A.2 of NUREG-1800.)

See LRA Appendix B Subsection B.1.3 for discussion of the Duane Arnold quality assurance procedures and administrative controls for aging management programs.

3.4.3 TIME-LIMITED AGING ANALYSIS

The time-limited aging analyses (TLAAs) identified below are associated with the Steam and Power Conversion System components and commodity groups is metal fatigue (LRA Subsection 4.3).

3.4.4 CONCLUSION

The Steam and Power Conversion System components and commodity groups that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Steam and Power Conversion System components and commodity groups are identified in the summaries in LRA Subsection 3.4.2 above.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the Steam and Power Conversion System components and commodity groups will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

3.4.5 REFERENCES

3.4-1 NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Revision 1, Nuclear Regulatory Commission, September 2005.

3.4-2 NUREG 1800, Standard Review Plan for License Renewal Applications for Nuclear Power Plants, Revision 1, Nuclear Regulatory Commission, September 2005.

3.4-3 NRC Generic Letter 89-13

**TABLE 3.4-1
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VIII OF NUREG-1801
STEAM AND POWER CONVERSION SYSTEMS**

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1-1	Steel piping, piping components, and piping elements exposed to steam or treated water	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Fatigue is a TLAA. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.1
3.4.1-2	Steel piping, piping components, and piping elements exposed to steam	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.2, Item 1
3.4.1-3	Pressurized water reactor only				
3.4.1-4	Steel piping, piping components, and piping elements exposed to treated water	Loss of material due to general, pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.2, Item 1
3.4.1-5	Steel heat exchanger components exposed to treated water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.2, Item 1 and Section 3.4.2.2.9.
3.4.1-6	Steel and stainless steel tanks exposed to treated water	Loss of material due to general (steel only), pitting, and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.2, Item 1 and Section 3.4.2.2.7 Item 1

TABLE 3.4-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VIII OF NUREG-1801
STEAM AND POWER CONVERSION SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1-7	Steel piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to general, pitting, and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.2, Item 2
3.4.1-8	Steel piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion and fouling	Plant- specific	Yes, plant-specific	Not applicable to DAEC. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.3
3.4.1-9	Stainless steel, and copper alloy heat exchanger tubes exposed to treated water	Reduction in heat transfer due to fouling	Water Chemistry and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Not applicable to DAEC. Item not used in Steam and Power Conversion System. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.4, Item 1
3.4.1-10	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to lubricating oil	Reduction in heat transfer due to fouling	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Not applicable to DAEC. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.4, Item 2

TABLE 3.4-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VIII OF NUREG-1801
STEAM AND POWER CONVERSION SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1-11	Buried steel piping, piping components, piping elements, and tanks (with or without coating or wrapping) exposed to soil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion	Buried Piping and Tanks Surveillance Or Buried Piping and Tanks Inspection	No Yes, detection of aging elects and operating effects are to be further evaluated	Not applicable to DAEC. The steam and power conversion systems have no steel components exposed to soil. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.5, Item 1
3.4.1-12	Steel heat exchanger components exposed to lubricating oil	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.5, Item 2
3.4.1-13	Stainless steel piping, piping components, and piping elements exposed to steam	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.6
3.4.1-14	Stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water >60°C (>140°F)	Cracking due to stress corrosion cracking	Water Chemistry and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.6

TABLE 3.4-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VIII OF NUREG-1801
STEAM AND POWER CONVERSION SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1-15	Aluminum and copper alloy piping, piping components, and piping elements exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.7, Item 1
3.4.1-16	Stainless steel piping, piping components, piping elements, tanks, and heat exchanger components exposed to treated water	Loss of material due to pitting and crevice corrosion	Water Chemistry and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.7, Item 1
3.4.1-17	Stainless steel piping, piping components, and piping elements exposed to soil	Loss of material due to pitting and crevice corrosion	Plant-specific	Yes, plant-specific	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.7, Item 2
3.4.1-18	Copper alloy piping, piping components, and piping elements exposed to lubricating oil	Loss of material due to pitting and crevice corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.7, Item 3
3.4.1-19	Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to lubricating oil	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Lubricating Oil Analysis and One-Time Inspection	Yes, detection of aging elects is to be evaluated	Consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.4.2, NUREG-1800 Section 3.4.2.2.8

TABLE 3.4-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VIII OF NUREG-1801
STEAM AND POWER CONVERSION SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1-20	Steel tanks exposed to air – outdoor (external)	Loss of material/ general, pitting, and crevice corrosion	Aboveground Steel Tanks	No	Consistent with NUREG-1801. The loss of material in carbon steel exposed to atmosphere/weather is managed by the Aboveground Steel Tanks Program.
3.4.1-21	High-strength steel closure bolting exposed to air with steam or water leakage	Cracking due to cyclic loading, stress corrosion cracking	Bolting Integrity	No	Not applicable. The steam and power conversion systems have no high strength steel closure bolting exposed to air with steam or water at DAEC.
3.4.1-22	Steel bolting and closure bolting exposed to air with steam or water leakage, air – outdoor (external), or air – indoor uncontrolled (external)	Loss of material due to general, pitting, crevice corrosion; loss of preload due to thermal effects, gasket creep, and self-loosening	Bolting Integrity	No	Consistent with NUREG-1801. The loss of material and loss of preload in steel bolting exposed to air with steam or water or air indoor or outdoor is managed by the Bolting Integrity Program at DAEC.
3.4.1-23	Stainless steel piping, piping components, and piping elements exposed to closed-cycle cooling water >60°C (>140°F)	Cracking due to stress corrosion cracking	Closed-Cycle Cooling Water System	No	Not applicable. The steam and power conversion systems have no stainless steel components exposed to CCW > 146°F at DAEC.
3.4.1-24	Steel heat exchanger components exposed to closed-cycle cooling water	Loss of material due to general, pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable. The steam and power conversion systems have no steel heat exchanger components exposed to closed cooling at DAEC.

TABLE 3.4-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VIII OF NUREG-1801
STEAM AND POWER CONVERSION SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1-25	Stainless steel piping, piping components, piping elements, and heat exchanger components exposed to closed-cycle cooling water	Loss of material due to pitting and crevice corrosion	Closed-Cycle Cooling Water System	No	Not applicable. The steam and power conversion systems have no stainless steel components exposed to closed cycle cooling water at DAEC.
3.4.1-26	Copper alloy piping, piping components, and piping elements exposed to closed-cycle cooling water	Loss of material due to pitting, crevice, and galvanic corrosion	Closed-Cycle Cooling Water System	No	Not applicable. The steam and power conversion systems have no copper alloy components exposed to closed cycle cooling water at DAEC.
3.4.1-27	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to closed-cycle cooling water	Reduction in heat transfer due to fouling	Closed-Cycle Cooling Water System	No	Not applicable. The steam and power conversion systems have no steel, stainless steel or copper alloy components exposed to closed cycle cooling at DAEC.
3.4.1-28	Steel external surfaces exposed to air – indoor uncontrolled (external), condensation (external), or air – outdoor (external)	Loss of material due to general corrosion	External Surfaces Monitoring	No	Consistent with NUREG-1801. Carbon steel exposed to external air is managed by the External Surfaces Program.
3.4.1-29	Steel piping, piping components, and piping elements exposed to steam or treated water	Wall thinning due to flow-accelerated corrosion	Flow-Accelerated Corrosion	No	Consistent with NUREG-1801. The loss of material of carbon steel in treated water or steam is managed by the Flow-Accelerated Corrosion (FAC) Program.

TABLE 3.4-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VIII OF NUREG-1801
STEAM AND POWER CONVERSION SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1-30	Steel piping, piping components, and piping elements exposed to air – outdoor (internal) or condensation (internal)	Loss of material due to general, pitting, and crevice corrosion	Inspection of Internal surfaces in Miscellaneous Piping and Ducting Components	No	Not applicable. The steam and power conversion systems have no steel piping components exposed to outdoor air or condensation at DAEC.
3.4.1-31	Steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically influenced corrosion and fouling	Open-Cycle Cooling Water System	No	Consistent with NUREG-1801. Loss of material of steel exchanger components exposed to raw water is managed by the Open-Cycle Cooling Watery System Program.
3.4.1-32	Stainless steel and copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Open-Cycle Cooling Water System	No	Not applicable. The steam and power conversion systems have no stainless steel or copper alloy components exposed to raw water at DAEC.
3.4.1-33	Stainless steel heat exchanger components exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion and fouling	Open-Cycle Cooling Water System	No	Not applicable. The steam and power conversion systems have no stainless steel heat exchanger components exposed to raw water systems at DAEC.
3.4.1-34	Steel, stainless steel, and copper alloy heat exchanger tubes exposed to raw water	Reduction in heat transfer due to fouling	Open-Cycle Cooling Water System	No	Not applicable. The steam and power conversion systems have no steel, stainless steel, or copper alloy heat exchanger tubes exposed to raw water at DAEC.

TABLE 3.4-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VIII OF NUREG-1801
STEAM AND POWER CONVERSION SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1-35	Copper alloy >15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water, raw water, or treated water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Not applicable. The steam and power conversion systems have no copper alloy > 15% Zn piping, piping components, and piping elements exposed to closed cycle cooling water, raw water, or treated water at DAEC.
3.4.1-36	Gray cast iron piping, piping components, and piping elements exposed to soil, treated water, or raw water	Loss of material due to selective leaching	Selective Leaching of Materials	No	Consistent with NUREG-1801. Loss of material of cast iron components exposed to treated water are managed by the Selective Leaching of Materials Program.
3.4.1-37	Steel, stainless steel, and nickel based alloy piping, piping components, and piping elements exposed to steam	Loss of material due to pitting and crevice corrosion	Water Chemistry	No	Consistent with NUREG-1801. Loss of material of carbon steel, stainless steel or nickel exposed to steam are managed by the Water Chemistry Program.
3.4.1-38	Pressurized water reactor only				
3.4.1-39	Pressurized water reactor only				
3.4.1-40	Glass piping elements exposed to air, lubricating oil, raw water, and treated water	None	None	NA – no aging effect management or aging management program	Consistent with NUREG-1801. Glass components exposed to air, oil, raw water or treated water have no aging effect and therefore have no aging management program.

TABLE 3.4-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VIII OF NUREG-1801
STEAM AND POWER CONVERSION SYSTEMS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.4.1-41	Stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external)	None	None	NA – no aging effect management or aging management program	Consistent with NUREG-1801. The steam and power conversion systems have no aging effects for stainless steel, copper alloy, and nickel alloy piping, piping components, and piping elements exposed to air – indoor uncontrolled (external) at DAEC.
3.4.1-42	Steel piping, piping components, and piping elements exposed to air – indoor controlled (external)	None	None	NA – no aging effect management or aging management program	Not applicable. The steam and power conversion systems have no steel piping, piping components, and piping elements exposed to air-indoor controlled (external) at DAEC.
3.4.1-43	Steel and stainless steel piping, piping components, and piping elements exposed to concrete	None	None	NA – no aging effect management or aging management program	Not applicable. The steam and power conversion systems have no steel and stainless steel piping, piping components, and piping elements exposed to concrete at DAEC.
3.4.1-44	Steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas	None	None	NA – no aging effect management or aging management program	Consistent with NUREG-1801. The steam and power conversion systems have no aging effects for steel, stainless steel, aluminum, and copper alloy piping, piping components, and piping elements exposed to gas at DAEC.

TABLE 3.4.2-1
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND DEMINERALIZED WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Atmosphere/ weather (external)	Loss of material	Aboveground Steel Tanks Program	VIII.E-39 (S-31)	3.4.1-20	203, A
		Carbon steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-40 (S-13)	3.4.1-6	202, A
	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Atmosphere/ weather (external)	None	None			233, G
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-40 (S-13)	3.4.1-6	A
Demineralizer ion exchanger	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A

**TABLE 3.4.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND DEMINERALIZED WATER SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Eductor	Leakage boundary (spatial)	Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A
					Selective Leaching of Materials Program	VIII.E-23 (SP-27)	3.4.1-36	A
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VIII.H-4 (S-34)	3.4.1-22	A
				Loss of preload	Bolting Integrity Program	VIII.H-5 (S-33)	3.4.1-22	A
	Pressure boundary	Carbon steel	Atmosphere/ weather (external)	Loss of material	Bolting Integrity Program	VIII.H-1 (S-32)	3.4.1-22	203, A
				Loss of preload	Bolting Integrity Program			207, G
	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
	Pressure boundary	Stainless steel	Atmosphere/ weather (external)	Loss of preload	Bolting Integrity Program			207, F

TABLE 3.4.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND DEMINERALIZED WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Filter, screens, strainer	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
Flow elements	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
Flow gauge	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A

TABLE 3.4.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND DEMINERALIZED WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow gauge (continued)	Leakage boundary (spatial)	Glass	Air/gas (external)	None	None	VIII.I-5 (SP-9)	3.4.1-40	A
			Treated water (internal)	None	None	VIII.I-8 (SP-35)	3.4.1-40	A
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
Flow orifice	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-7 (S-18)	3.4.1-5	219, A
Level gauge	Leakage boundary (spatial)	Glass	Air/gas (external)	None	None	VIII.I-5 (SP-9)	3.4.1-40	A
			Treated water (internal)	None	None	VIII.I-8 (SP-35)	3.4.1-40	A

TABLE 3.4.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND DEMINERALIZED WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	Flow-Accelerated Corrosion Program	VIII.E-35 (S-16)	3.4.1-29	A
					One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A
		CPVC	Air/gas (external)	None	None			212, I
			Treated water (internal)	None	None			218, I
	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Atmosphere/ weather (external)	None	None			233, G
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
	Pressure boundary	Stainless steel	Soil (external)	Loss of material	Buried Piping & Tanks Inspection Program	VIII.E-28 (SP-37)	3.4.1-17	202, E

**TABLE 3.4.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND DEMINERALIZED WATER SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A
Thermowell	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
Valve, damper	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	202, A
		CPVC	Air/gas (external)	None	None			218, J
			Treated water (internal)	None	None			218, J

TABLE 3.4.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND DEMINERALIZED WATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Atmosphere/ weather (external)	None	None			233, G
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A

TABLE 3.4.2-2
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND FEEDWATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	Nureg-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Piping, piping components and piping elements (feedwater)	Pressure boundary	Steel	Reactor Coolant (internal)	Cumulative fatigue damage/fatigue	TLAA	IV.C1-15 (R-220)	3.1.1-3	A
		Steel, stainless steel	Treated water (internal)	Cumulative fatigue damage/fatigue	TLAA	VIII.D2-6 (S-11)	3.4.1-1	A
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.D2-5 (SP-25)	3.4.1-7	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-40 (S-13)	3.4.1-6	A
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-40 (S-13)	3.4.1-6	A

**TABLE 3.4.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND FEEDWATER SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	Nureg-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VIII.H-4 (S-34)	3.4.1-22	203, A
				Loss of preload	Bolting Integrity Program	VIII.H-5 (S-33)	3.4.1-22	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-7 (S-09)	3.4.1-4	A
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A

TABLE 3.4.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND FEEDWATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	Nureg-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow elements	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A
			Treated water or steam (internal)	Cracking	One-Time Inspection Program	VIII.C-2 (SP-17)	3.4.1-14	A
					Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program	VIII.C-1 (SP-16),	3.4.1-16	A
					Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A

TABLE 3.4.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND FEEDWATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	Nureg-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow gauge	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.D2-5 (SP-25)	3.4.1-7	202, A
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A
		Glass	Air/gas (external)	None	None	VIII.I-5 (SP-9)	3.4.1-40	A
			Lube oil (internal)	None	None	VIII.I-6 (SP-10)	3.4.1-40	A
			Treated water or steam (internal)	None	None	VIII.I-8 (SP-35)	3.4.1-40	A
Flow orifice	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-7 (S-09)	3.4.1-4	A
						VIII.E-33 (S-09)	3.4.1-4	A

TABLE 3.4.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND FEEDWATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	Nureg-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow orifice (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.D2-5 (SP-25)	3.4.1-7	202, C
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-6 (S-24)	3.4.1-31	208, E
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-3 (S-04)	3.4.1-2	C

**TABLE 3.4.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND FEEDWATER SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	Nureg-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-7 (S-18)	3.4.1-5	219, A
Level gauge	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.D2-5 (SP-25)	3.4.1-7	202, A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.D2-7 (S-09)	3.4.1-4	A
		Glass	Air/gas (external)	None	None	VIII.I-5 (SP-9)	3.4.1-40	A
			Lube oil (internal)	None	None	VIII.I-6 (SP-10)	3.4.1-40	A
			Treated water (internal)	None	None	VIII.I-8 (SP-35)	3.4.1-40	A

TABLE 3.4.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND FEEDWATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	Nureg-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe Class 1, pipe fittings, tubing	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Treated water (internal)	Loss of material	Flow-Accelerated Corrosion Program	IV.C1-7 (R-23)	3.1.1-45	A
					One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.D2-5 (SP-25)	3.4.1-7	202, A
	Leakage boundary (spatial) Structural Integrity (attached)	Carbon steel	Treated water (internal)	Loss of material	Flow-Accelerated Corrosion Program	VIII.D2-8 (S-16)	3.4.1-29	A
						VIII.E-35 (S-16)	3.4.1-29	A
	Leakage boundary (spatial)	Carbon steel	Treated water (internal)	Loss of material	Flow-Accelerated Corrosion Program			222, H

TABLE 3.4.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND FEEDWATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	Nureg-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial) Structural integrity (attached)	Carbon steel	Treated water (internal)	Loss of material	One-Time Inspection Program	VIII.D2-7 (S-09	3.4.1-4	A
					Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A
	Leakage boundary (spatial)	Carbon steel	Treated water or steam (internal)	Loss of material	Flow-Accelerated Corrosion Program	VIII.C-5 (S-15)	3.4.1-29	A
						VIII.D2-8 (S-16)	3.4.1-29	A
						VIII.E-35 (S-16)	3.4.1-29	A
	Leakage boundary (spatial) Pressure boundary	Carbon steel	Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-3 (S-04	3.4.1-2	A
						VIII.D2-7 (S-09)	3.4.1-4	A
						VIII.E-33 (S-09)	3.4.1-4	A

TABLE 3.4.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND FEEDWATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	Nureg-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water or steam (internal)	Loss of material;	One-Time Inspection Program Water Chemistry Program	VIII.A-5 (SP-61)	3.4.1-15	A
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water or steam (internal)	Cracking	One-Time Inspection Program	VIII.C-2 (SP-17)	3.4.1-14	A
					Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-1 (SP-16)	3.4.1-16	A
						VIII.D2-4 (SP-16)	3.4.1-16	A
						VIII.E-29 (SP-16)	3.4.1-16	A
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.D2-5 (SP-25)	3.4.1-7	202, A

TABLE 3.4.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND FEEDWATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	Nureg-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pumps, positive pressure devices (except blowers) (continued)	Leakage boundary (spatial)	Carbon steel	Treated water (internal)	Loss of material	One-Time Inspection Program	VIII.D2-7 (S-09)	3.4.1-4	A
					Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A
					Selective Leaching Inspection Program	VIII.E-23 (SP-27)	3.4.1-36	C
Valve Class 1	Pressure Boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C
Valve, damper	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.D2-5 (SP-25)	3.4.1-7	202, A

TABLE 3.4.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND FEEDWATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	Nureg-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial) Pressure boundary	Carbon steel	Treated water (internal)	Loss of material	One-Time Inspection Program	VIII.D2-7 (S-09)	3.4.1-4	202, A
					Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	202, A
	Leakage boundary (spatial)	Carbon steel	Treated water or steam (internal)	Loss of material	One-Time Inspection Program	VIII.C-3 (S-04)	3.4.1-2	202, A
					Water Chemistry Program	VIII.D2-7 (S-09)	3.4.1-4	202, A
						VIII.E-33 (S-09)	3.4.1-4	202, A
	Leakage boundary (spatial)	Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Lube oil (internal)	None	None			232, I
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-5 (SP-61)	3.4.1-15	A
	Leakage boundary (spatial)	Low-alloy steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program	VIII.D2-7 (S-09)	3.3.1-4	A
					Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A

TABLE 3.4.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND FEEDWATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	Nureg-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Low-alloy steel	Treated water or steam (internal)	Loss of material	One-Time Inspection Program	VIII.C-3 (S-04)	3.4.1-2	A
					Water Chemistry Program	VIII.D2-7 (S-09)	3.4.1-4	A
						VIII.E-33 (S-09)	3.4.1-4	A
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Cracking	One-Time Inspection Program	VIII.C-2 (SP-17)	3.4.1-14	A
					Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
			Treated water (internal)	Loss of material	One-Time Inspection Program	VIII.C-1 (SP-16)	3.4.1-16	A
					Water Chemistry Program	VIII.D2-4 (SP-16)	3.4.1-16	A
						VIII.E-29 (SP-16)	3.4.1-16	A

TABLE 3.4.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSATE AND FEEDWATER SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	Nureg-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Stainless steel	Treated water or steam (internal)	Cracking	One-Time Inspection Program	VIII.C-2 (SP-17)	3.4.1-14	A
					Water Chemistry Program	VIII.E-31 (SP-19)	3.4.1-14	A
				Loss of material	One-Time Inspection Program	VIII.C-1 (SP-16)	3.4.1-16	A
					Water Chemistry Program	VIII.D2-4 (SP-16),	3.4.1-16	A
						VIII.E-29 (SP-16)	3.4.1-16	A

TABLE 3.4.2-3
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSER AND CONDENSER AIR REMOVAL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-40 (S-13)	3.4.1-6	A
Expansion joint	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-1 (SP-16)	3.4.1-16	A
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VIII.H-4 (S-34)	3.4.1-22	203, A
				Loss of preload	Bolting Integrity Program	VIII.H-5 (S-33)	3.4.1-22	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-3 (S-04)	3.4.1-2	A

TABLE 3.4.2-3 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSER AND CONDENSER AIR REMOVAL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow elements	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Raw water (internal)	Loss of material	Open-Cycle Cooling Water System Program	VIII.E-6 (S-24)	3.4.1-31	219, A
			Treated water or steam (internal)	Loss of material	Flow-Accelerated Corrosion Program	VIII.E-35 (S-16)	3.4.1-29	C
					One-Time Inspection Program Water Chemistry Program	VIII.E-7 (S-18)	3.4.1-5	219, A
Level gauge	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A

TABLE 3.4.2-3 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSER AND CONDENSER AIR REMOVAL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Level gauge	Leakage boundary (spatial)	Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-5 (SP-61)	3.4.1-15	A
		Glass	Air/gas (external)	None	None	VIII.I-5 (SP-9)	3.4.1-40	A
			Treated water (internal)	None	None	VIII.I-8 (SP-35)	3.4.1-40	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Air/gas (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.H2-21 (A-23)	3.3.1-71	A
			Steam (internal)	Loss of material	Flow-Accelerated Corrosion Program	VIII.C-5 (S-15)	3.4.1-29	A
					One-Time Inspection Program Water Chemistry Program	VIII.C-3 (S-04)	3.4.1-2	A

TABLE 3.4.2-3 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSER AND CONDENSER AIR REMOVAL SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Carbon steel	Treated water (internal)	Loss of material	Flow-Accelerated Corrosion Program	VIII.E-35 (S-16)	3.4.1-29	A
					One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-6 (S-09)	3.4.1-4	A
						VIII.E-33 (S-09)	3.4.1-4	A
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-1 (SP-16)	3.4.1-16	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-1 (SP-16)	3.4.1-16	A
						VIII.E-29 (SP-16)	3.4.1-16	A

**TABLE 3.4.2-3 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSER AND CONDENSER AIR REMOVAL SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A
Valve, damper	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-6 (S-09)	3.4.1-4	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	202, A
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program	VIII.C-6 (S-09)	3.4.1-4	A
					Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A

**TABLE 3.4.2-3 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONDENSER AND CONDENSER AIR REMOVAL SYSTEM**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Air/gas (internal)	None	None	VIII.I-12 (SP-15)	3.4.1-44	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
			Treated water or steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.C-1 (SP-16),	3.4.1-16	A
						VIII.E-29 (SP-16)	3.4.1-16	A

TABLE 3.4.2-4
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MAIN STEAM ISOLATION AND AUTOMATIC DEPRESSURIZATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Piping, piping components and piping elements (main steam)	Pressure boundary	Steel, stainless steel	Reactor Coolant (internal)	Cumulative fatigue damage/fatigue	TLAA	IV.C1-15 (R-220)	3.1.1-3	A
			Steam (internal)	Cumulative fatigue damage/fatigue	TLAA	VIII.B2-5 (S-08)	3.4.1-1	A
Accumulator, pulsation damper, low pressure tank	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Dried air/gas (internal)	None	None	VIII.I-15 (SP-4)	3.4.1-44	A
Fastener, bolting, washers, nuts	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VIII.H-4 (S-34)	3.4.1-22	203, A
				Loss of preload	Bolting Integrity Program	VIII.H-5 (S-33)	3.4.1-22	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F

TABLE 3.4.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MAIN STEAM ISOLATION AND AUTOMATIC DEPRESSURIZATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow element Class 1	Throttle	Cast Austenitic stainless steel	Steam (external)	Cracking	One-Time Inspection	IV.C1-9 (R20)	3.1.1-41	E
					Water Chemistry Program	IV.C1-9 (R20)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
				Reduction of fracture toughness	One-Time Inspection Program	IV.C1-2 (R-52)	3.1.1-57	E
			Steam (internal)	Cracking	One-Time Inspection	IV.C1-9 (R-20)	3.1.1-41	E
					Water Chemistry Program	IV.C1-9 (R-20)	3.1.1-41	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
				Reduction of fracture toughness	One-Time Inspection Program	IV.C1-2 (R-52)	3.1.1-57	E

TABLE 3.4.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MAIN STEAM ISOLATION AND AUTOMATIC DEPRESSURIZATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Flow orifice	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Steam (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.B2-1 (SP-45)	3.4.1-13	A
				Loss of material	One-Time Inspection Program	VIII.B2-2 (SP-46)	3.4.1-37	E
					Water Chemistry Program	VIII.B2-2 (SP-46)	3.4.1-37	A
Flow orifice Class 1	Pressure boundary	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A

TABLE 3.4.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MAIN STEAM ISOLATION AND AUTOMATIC DEPRESSURIZATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe Class 1, pipe fittings, tubing	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Steam (internal)	Loss of material	Flow-Accelerated Corrosion Program	IV.C1-7 (R-23)	3.1.1-45	A
					One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	C
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water or steam (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A
				Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A

TABLE 3.4.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MAIN STEAM ISOLATION AND AUTOMATIC DEPRESSURIZATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Steam (internal)	Loss of material	Flow-Accelerated Corrosion Program	VIII.B2-4 (S-15)	3.4.1-29	A
					One-Time Inspection Program	VIII.B2-3 (S-05)	3.4.1-37	202, E
					Water Chemistry Program	VIII.B2-3 (S-05)	3.4.1-37	202, A
	Pressure boundary	Carbon steel	Dried air/gas (internal)	None	None	VIII.I-15 (SP-4)	3.4.1-44	A
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Dried air/gas (internal)	None	None	VIII.I-12 (SP-15)	3.4.1-44	A
			Steam (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.B2-1 (SP-45)	3.4.1-13	A
				Loss of material	One-Time Inspection Program	VIII.B2-2 (SP-46)	3.4.1-37	E
					Water Chemistry Program	VIII.B2-2 (SP-46)	3.4.1-37	A

TABLE 3.4.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MAIN STEAM ISOLATION AND AUTOMATIC DEPRESSURIZATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Pressure boundary	Stainless steel	Treated water or steam (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.B2-1 (SP-45)	3.4.1-13	A
				Loss of material	One-Time Inspection Program	VIII.B2-2 (SP-46)	3.4.1-37	E
					Water Chemistry Program	VIII.B2-2 (SP-46)	3.4.1-37	A
Valve Class 1	Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Dried air/gas (internal)	None	None	VIII.I-15 (SP-4)	3.4.1-44	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-6 (R-16)	3.1.1-13	202, C
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Cracking	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program Water Chemistry Program	IV.C1-1 (R-03)	3.1.1-48	237, A

TABLE 3.4.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MAIN STEAM ISOLATION AND AUTOMATIC DEPRESSURIZATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, Class 1 (continued)	Pressure boundary	Stainless steel	Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	IV.C1-14 (RP-27)	3.1.1-15	A
Valve operator, damper operator	Pressure boundary	Carbon steel	Air/gas (external)	None	None			231, I
			Dried air/gas (internal)	None	None	VIII.I-15 (SP-4)	3.4.1-44	A
Valve, damper	Pressure boundary	Aluminum alloy	Air/gas (external)	None	None	VII.J-1 (AP-36)	3.3.1-95	A
			Dried air/gas (internal)	None	None	VIII.I-1 (SP-23)	3.4.1-44	A
		Carbon steel	Dried air/gas (internal)	None	None	VIII.I-15 (SP-4)	3.4.1-44	A
		Cast austenitic stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Dried air/gas (internal)	None	None	VIII.I-12 (SP-15)	3.4.1-44	A

TABLE 3.4.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MAIN STEAM ISOLATION AND AUTOMATIC DEPRESSURIZATION SYSTEM

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Pressure boundary	Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Dried air/gas (internal)	None	None	VIII.I-3 (SP-5)	3.4.1-44	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program			207, G
		Stainless steel	Dried air/gas (internal)	None	None	VIII.I-12 (SP-15)	3.4.1-44	A
	Leakage boundary (spatial) Pressure boundary	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Steam (internal)	Loss of material	One-Time Inspection Program	VIII.B2-3 (S-05)	3.4.1-37	202, E
					Water Chemistry Program	VIII.B2-3 (S-05)	3.4.1-37	202, A
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Steam (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.B2-1 (SP-45)	3.4.1-13	A
				Loss of material	One-Time Inspection Program	VIII.B2-2 (SP-46)	3.4.1-37	E
					Water Chemistry Program	VIII.B2-2 (SP-46)	3.4.1-37	A

TABLE 3.4.2-5
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Accumulator, pulsation damper, low pressure tank	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-14 (SP-25)	3.4.1-7	202, A
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-9 (SP-38)	3.4.1-19	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
Blower, compressor, fan, vacuum pump	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-15 (S-04)	3.4.1-2	A

TABLE 3.4.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fastener, bolting, washers, nuts	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	Bolting Integrity Program	VIII.H-4 (S-34)	3.4.1-22	203, A
				Loss of preload	Bolting Integrity Program	VIII.H-5 (S-33)	3.4.1-22	A
		Stainless steel	Air/gas (external)	Loss of preload	Bolting Integrity Program			207, F
Filter, screens, strainer	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-14 (SP-25)	3.4.1-7	202, A
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-16 (S-06)	3.4.1-2	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A

TABLE 3.4.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-14 (SP-25)	3.4.1-7	202, C
			Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VIII.E-6 (S-24)	3.4.1-31	208, E
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-15 (S-04)	3.4.1-2	C
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-7 (S-18)	3.4.1-5	A
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-9 (SP-38)	3.4.1-19	C

TABLE 3.4.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Heat exchanger, condenser, cooler, fan coil (continued)	Leakage boundary (spatial)	Stainless steel	Raw water (internal)	Loss of material	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	VII.C1-15 (A-54)	3.3.1-79	202, E
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-4 (S-21)	3.4.1-16	A
Instrumentation (flow indicator, flow gauge, sight gauge, level gauge)	Leakage boundary (spatial)	Aluminum alloy	Air/gas (external)	None	None	VIII.I-1 (SP-23)	3.4.1-44	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program			202, 207, F
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-14 (SP-25)	3.4.1-7	202, A
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A

**TABLE 3.4.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation (flow indicator, flow gauge, sight gauge, level gauge) (continued)	Leakage boundary (spatial)	Cast iron	Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-14 (SP-25)	3.4.1-7	202, A
					Selective Leaching of Materials Program			207, G
		Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-3 (SP-32)	3.4.1-18	202, 225, A
		Glass	Air/gas (external)	None	None	VIII.1-5 (SP-9)	3.4.1-40	A
			Lube oil (internal)	None	None	VIII.I-6 (SP-10)	3.4.1-40	A
			Treated water (internal)	None	None	VIII.I-8 (SP-35)	3.4.1-40	A
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A

**TABLE 3.4.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Instrumentation (flow elements, flow orifices)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	None	None			231, I
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-15 (S-04)	3.4.1-2	A
		Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
Pipe, pipe fittings, hoses, tubes, rupture disk	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-14 (SP-25)	3.4.1-7	202, A
			Steam (internal)	Loss of material	Flow Accelerated Corrosion Program	VIII.A-17 (S-15)	3.4.1-29	A
					One-Time Inspection Program Water Chemistry Program	VIII.A-15 (S-04)	3.4.1-2	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A

TABLE 3.4.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pipe, pipe fittings, hoses, tubes, rupture disk (continued)	Leakage boundary (spatial)	Copper	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-5 (SP-61)	3.4.1-15	A
		Stainless steel	Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-9 (SP-38)	3.4.1-19	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Steam (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.A-11 (SP-45)	3.4.1-13	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-12 (SP-43)	3.4.1-37	A

TABLE 3.4.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Pumps, positive pressure devices (except blowers)	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-14 (SP-25)	3.4.1-7	202, A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	A
		Cast iron	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-14 (SP-25)	3.4.1-7	202, A
					Selective Leaching of Materials Program			207, G
Thermowell	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-14 (SP-25)	3.4.1-7	202, A

**TABLE 3.4.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Thermowell (continued)	Leakage boundary (spatial)	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
Turbine	Leakage boundary (spatial)	Carbon steel	Air/gas (external)	None	None			231, I
			Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-15 (S-04)	3.4.1-2	C
Valve, damper	Leakage boundary (spatial)	Brass	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-3 (SP-32)	3.4.1-18	202, A
		Carbon steel	Air/gas (external)	Loss of material	External Surfaces Monitoring Program	VIII.H-7 (S-29)	3.4.1-28	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-14 (SP-25)	3.4.1-7	202, A

TABLE 3.4.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Carbon steel	Steam (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-15 (S-04)	3.4.1-2	202, A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-33 (S-09)	3.4.1-4	202, A
		Cast austenitic stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-9 (SP-38)	3.4.1-19	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
		Copper alloy	Air/gas (external)	None	None	VIII.I-2 (SP-6)	3.4.1-41	A
			Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-3 (SP-32)	3.4.1-18	202, 225, A

**TABLE 3.4.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Valve, damper (continued)	Leakage boundary (spatial)	Stainless steel	Lube oil (internal)	Loss of material	Lubricating Oil Analysis Program One-Time Inspection Program	VIII.A-9 (SP-38)	3.4.1-19	A
			Treated water (internal)	Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.E-29 (SP-16)	3.4.1-16	A
	Leakage boundary (spatial) Pressure boundary	Stainless steel	Air/gas (external)	None	None	VIII.I-10 (SP-12)	3.4.1-41	A
			Steam (internal)	Cracking	One-Time Inspection Program Water Chemistry Program	VIII.A-11 (SP-45)	3.4.1-13	A
				Loss of material	One-Time Inspection Program Water Chemistry Program	VIII.A-12 (SP-43)	3.4.1-37	A

NOTES FOR TABLES 3.4.2-1 THROUGH 3.4.2-5

A. Consistent with NUREG-1801 item for component, material, environment, and aging effect. Aging management program is consistent with NUREG-1801 aging management program.

B. Consistent with NUREG-1801 item for component, material, environment, and aging effect. Aging management program takes some exceptions to NUREG-1801 aging management program.

C. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. Aging management program is consistent with NUREG-1801 aging management program.

D. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. Aging management program takes some exceptions to NUREG-1801 aging management program.

E. Consistent with NUREG-1801 item for material, environment, and aging effect, but a different aging management program is credited, or a plant-specific aging management program.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material, and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-Specific Notes:

201. Not Used

202. Aging mechanism is in addition to aging mechanisms in NUREG-1801. This may include galvanic corrosion, MIC and/or selective leaching.

203. Crevice and pitting corrosion is not applicable for an air/gas environment for carbon steel components due to not being exposed to a concentration of contaminates or aggressive environments.

204. Not Used

205. Components with a “wet air/gas” environment are analyzed in the same manner as raw water for conservatism.

206. Not Used

207. Material/environment combination and/or aging effect/mechanism not identified in NUREG-1801. The aging management program(s) referenced are appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.

208. Program is different than identified in NUREG-1801. The aging management program(s) referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.

209. Not Used

210. Component is different, but consistent with NUREG-1801 for material, environment, and aging effect. The aging management program(s) referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.

211. Not Used

212. These elastomers (neoprene, rubber, etc.) components are indoors and not subject to ultraviolet or ozone, nor are they in locations that are subject to radiation exposure. These locations are also not subject to temperatures where change in material properties or cracking could occur (>95^{o}F). Therefore, no aging management is required.

213. Not Used

214. Not Used

215. Not Used

216. Not Used

217. Not Used

218. Material science evaluation for this material in this environment results in no aging effects requiring management.

219. Galvanic corrosion is not applicable to the components since it is not in contact with metal higher in the galvanic series.

220. Well Water is Raw Water that comes from wells. Well Water does not contain (mussels, clams, bryozoa, etc) or silting. Therefore, Loss of Material due to macrofouling and/or lining/coating degradation are not potential aging effects.

221. Duane Arnold does not have operating experience supporting microbiologically-influenced corrosion in treated water and/or oil systems. Therefore, microbiologically-influenced corrosion is not an applicable aging mechanism.

222. As described in the plant operating experience database, erosion has occurred on some components. Loss of material due to erosion for these components in managed by the Flow Accelerated Corrosion Program.

223. The component and material are different, but consistent with NUREG-1801 for environment and aging effect. The aging management program referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects are effectively managed through the period of extended operation.

224. The component and environment are different, but consistent with NUREG-1801 for material and aging effect. The aging management program referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects are effectively managed through the period of extended operation.

225. Crevice and pitting corrosion are not applicable aging mechanisms for copper alloy components with less than 15% zinc and aluminum bronze components with less than 8% aluminum in fuel oil and lube oil environments at Duane Arnold.

226. Loss of material due to macro-fouling is not a potential aging effect for this lube oil heat exchanger.

227. Duane Arnold does not have operating experience that supports heat transfer degradation due to fouling in treated water and lube oil environments. Therefore, fouling is not a potential aging effect.

228. The material and environment are different, but consistent with NUREG-1801 for component and aging effect. The aging management program referenced is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects are effectively managed through the period of extended operation.

229. Not Used

230. Loss of material due to fouling does not apply to carbon steel components exposed to fuel oil that are not tanks and do not have a potential for particulate fouling (sediment, silt, dust, and corrosion products).

231. Loss of material due to corrosion is not an applicable aging effect due to system temperatures are greater than 212^{o}F.

232. The component does not have the potential for water contamination.

233. The component is not located in an aggressive environment.

234. Non-metallic (fiberglass, PVC, CPVC) in this environment was evaluated and contained no aging effects.

235. Non-metallic elastomers (rubber) in this environment was evaluated and contains no aging effects.

236. Ducting, piping, piping components, piping elements or valves having air-indoor uncontrolled for both their internal and external environments have the same aging effects on both internal/external surfaces.

237. DAEC has plant specific OE for cracking of small bore piping. Therefore, Program XI.M35 is not applicable to DAEC. At DAEC small bore piping is included in the ASME Section XI, ISI Program.

3.5 AGING MANAGEMENT OF STRUCTURES AND STRUCTURAL COMPONENTS

This section provides the results of the aging management review for those components identified in LRA Section 2.4, Scoping and Screening Results: Structures and Structural Components, as being subject to aging management review. The structures, structural components and commodity groups, which are addressed in this section, are described in the indicated sections.

- Subsection 2.4.1 – Buildings, Structures Affecting Safety
- Subsection 2.4.2 – Control Building
- Subsection 2.4.3 – Cranes and Hoists
- Subsection 2.4.4 – Intake Structure
- Subsection 2.4.5 – Miscellaneous Yard Structures
- Subsection 2.4.6 – Offgas Stack
- Subsection 2.4.7 – Primary Containment Structure
- Subsection 2.4.8 – Pump House
- Subsection 2.4.9 – Reactor Building
- Subsection 2.4.10 – Supports
- Subsection 2.4.11 – Turbine Building

LRA Table 3.5-1, Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 [Reference 3.5-1] Structures and Component Supports, provides the summary of the programs evaluated in NUREG-1801 for the Structures and Structural Components component groups that are relied on for license renewal. This table uses the format described in LRA Section 3.0. Note that this table only includes those component and commodity groups that are applicable to a boiling water reactor.

3.5.1 RESULTS SUMMARY

The materials that specific components and commodity groups are fabricated from, the environments to which components and commodity groups are exposed, the potential aging effects requiring management, and the aging management programs used to manage these aging effects are provided for each of the Structures and Structural Components in the following subsections: The following tables summarize the results of the aging management review for the Structures and Structural Components and their commodity groups:

- Buildings, Structures Affecting Safety - Subsection 3.5.1.1 and Table 3.5.2-1
- Control Building - Subsection 3.5.1.2 and Table 3.5.2-2
- Cranes and Hoists - Subsection 3.5.1.3 and Table 3.5.2-3
- Intake Structure - Subsection 3.5.1.4 and Table 3.5.2-4

- Miscellaneous Yard Structures - Subsection 3.5.1.5 and Table 3.5.2-5
- Offgas Stack - Subsection 3.5.1.6 and Table 3.5.2-6
- Primary Containment Structure - Subsection 3.5.1.7 and Table 3.5.2-7
- Pump House - Subsection 3.5.1.8 and Table 3.5.2-8
- Reactor Building - Subsection 3.5.1.9 and Table 3.5.2-9
- Supports - Subsection 3.5.1.10 and Table 3.5.2-10
- Turbine Building - Subsection 3.5.1.11 and Table 3.5.2-11

3.5.1.1 Buildings, Structures Affecting Safety

Materials

The materials of construction for the Building, Structures Affecting Safety components and commodity groups are:

- Carbon steel
- Concrete

Environments

The Building, Structures Affecting Safety components and commodity groups are exposed to the following environments:

- Air/gas
- Atmosphere/ weather

Aging Effects Requiring Management

The following aging effects, associated with the Building, Structures Affecting Safety components and commodity groups, require management:

- Cracking, loss of bond, loss of material (spalling, scaling)
- Expansion and cracking
- Increase in porosity and permeability, cracking, loss of material (spalling, scaling)
- Loss of material
- Loss of material, cracking

Aging Management Programs

The following aging management programs manage the aging effects for the Building, Structures Affecting Safety components and commodity groups:

- Structures Monitoring Program

Summary of Aging Management Review Results

See LRA Table 3.5.2-1.

3.5.1.2 Control Building

Materials

The materials of construction for the Control Building components and commodity groups are:

- Carbon steel
- Concrete
- Elastomer
- Non-metallic fire proofing

Environments

The Control Building components and commodity groups are exposed to the following environments:

- Air/gas
- Atmosphere/ weather
- Soil

Aging Effects Requiring Management

The following aging effects, associated with the Control Building components and commodity groups, require management:

- Cracking
- Cracking, delamination
- Cracking, loss of bond, loss of material (spalling, scaling)
- Expansion and cracking
- Increase in porosity and permeability, cracking, loss of material (spalling, scaling)
- Increased hardness and shrinkage
- Loss of leak tightness
- Loss of material
- Loss of material, cracking
- Separation, environmental degradation, water in-leakage

Aging Management Programs

The following aging management programs manage the aging effects for the Control Building components and commodity groups:

- Fire Protection Program
- Structures Monitoring Program

Summary of Aging Management Review Results

See LRA Table 3.5.2-2.

3.5.1.3 Cranes and Hoists

Materials

The material of construction for the Cranes and Hoists components and commodity groups is:

- Carbon steel

Environments

The Cranes and Hoists components and commodity groups are exposed to the following environment:

- Air/gas

Aging Effects Requiring Management

The following aging effect, associated with the Cranes and Hoists components and commodity groups, require management:

- Loss of material

Aging Management Programs

The following aging management programs manage the aging effects for the Cranes and Hoists components and commodity groups:

- Overhead Handling Systems Program
- Structures Monitoring Program

Summary of Aging Management Review Results

See LRA Table 3.5.2-3.

3.5.1.4 Intake Structure

Materials

The materials of construction for the Intake Structure components and commodity groups are:

- Carbon steel
- Concrete
- Roofing

Environments

The Intake Structure components and commodity groups are exposed to the following environments:

- Air/gas
- Atmosphere/ weather
- Raw water

- Soil

Aging Effects Requiring Management

The following aging effects, associated with the Intake Structure components and commodity groups, require management:

- Cracking
- Cracking, loss of bond, loss of material (spalling, scaling)
- Expansion and cracking
- Increase in porosity and permeability, cracking, loss of material (spalling, scaling)
- Loss of material
- Loss of material, cracking
- Separation, environmental degradation, water in-leakage

Aging Management Programs

The following aging management programs manage the aging effects for the Intake Structure components and commodity groups:

- Fire Protection Program
- Structures Monitoring Program

Summary of Aging Management Review Results

See LRA Table 3.5.2-4.

3.5.1.5 Miscellaneous Yard Structures

Materials

The materials of construction for the Miscellaneous Yard Structures components and commodity groups are:

- Carbon steel
- Concrete

Environments

The Miscellaneous Yard Structures components and commodity groups are exposed to the following environments:

- Air/gas
- Atmosphere/ weather
- Soil
- Raw water

Aging Effects Requiring Management

The following aging effects, associated with the Miscellaneous Yard Structures components and commodity groups, require management:

- Cracking
- Cracking, loss of bond, loss of material (spalling, scaling)
- Expansion and cracking
- Increase in porosity and permeability, cracking, loss of material (spalling, scaling)
- Loss of material
- Loss of material, cracking

Aging Management Programs

The following aging management programs manage the aging effects for the Miscellaneous Yard Structures components and commodity groups:

- Buried Pipe and Tanks Inspection Program
- Fire Protection Program
- Structures Monitoring Program

Summary of Aging Management Review Results

See LRA Table 3.5.2-5.

3.5.1.6 Offgas Stack

Materials

The materials of construction for the Offgas Stack components and commodity groups are:

- Carbon steel
- Concrete
- Stainless steel

Environments

The Offgas Stack components and commodity groups are exposed to the following environments:

- Atmosphere/ weather
- Soil

Aging Effects Requiring Management

The following aging effects, associated with the Offgas Stack components and commodity groups, require management:

- Cracking

- Cracking, loss of bond, loss of material (spalling, scaling)
- Expansion and cracking
- Increase in porosity and permeability, cracking, loss of material (spalling, scaling)
- Loss of material
- Loss of material, cracking

Aging Management Programs

The following aging management programs manage the aging effects for the Offgas Stack components and commodity groups:

- Structures Monitoring Program

Summary of Aging Management Review Results

See LRA Table 3.5.2-6.

3.5.1.7 Primary Containment Structure

Materials

The materials of construction for the Primary Containment Structure components and commodity groups are:

- Carbon steel
- Concrete
- Elastomer
- Stainless steel

Environments

The Primary Containment Structure components and commodity groups are exposed to the following environments:

- Air/gas
- Embedded in concrete
- Raw water
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Primary Containment Structure components and commodity groups, require management:

- Change in material properties and cracking
- Cracking, loss of bond, loss of material (spalling, scaling)
- Expansion and cracking

- Increase in porosity and permeability, cracking, loss of material (spalling, scaling)
- Loss of leak tightness
- Loss of material
- Loss of sealing, leakage through containment

Aging Management Programs

The following aging management programs manage the aging effects for the Primary Containment Structure components and commodity groups:

- 10 CFR 50 Appendix J Program
- ASME Section XI, Subsection IWE Program
- Structures Monitoring Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.5.2-7.

3.5.1.8 Pump House

Materials

The materials of construction for the Pump House components and commodity groups are:

- Carbon steel
- Concrete
- Elastomer
- Non-metallic fire proofing

Environments

The Pump House components and commodity groups are exposed to the following environments:

- Air/gas
- Atmosphere/ weather
- Raw water
- Soil

Aging Effects Requiring Management

The following aging effects, associated with the Pump House components and commodity groups, require management:

- Cracking
- Cracking, loss of bond, loss of material (spalling, scaling)

- Expansion and cracking
- Increase in hardness and shrinkage
- Increase in porosity and permeability, cracking, loss of material (spalling, scaling)
- Loss of material
- Loss of material, cracking
- Separation, environmental degradation, water in-leakage

Aging Management Programs

The following aging management programs manage the aging effects for the Pump House components and commodity groups:

- Fire Protection Program
- Structures Monitoring Program

Summary of Aging Management Review Results

See LRA Table 3.5.2-8.

3.5.1.9 Reactor Building

Materials

The materials of construction for the Reactor Building components and commodity groups are:

- Aluminum
- Carbon steel
- Concrete
- Elastomer
- Non-metallic fire proofing
- Stainless steel

Environments

The Reactor Building components and commodity groups are exposed to the following environments:

- Air/gas
- Atmosphere/ weather
- Soil
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Reactor Building components and commodity groups, require management:

- Cracking
- Cracking, loss of bond, loss of material (spalling, scaling)
- Expansion and cracking
- Increase in hardness and shrinkage
- Increase in porosity and permeability, cracking, loss of material (spalling, scaling)
- Loss of material
- Loss of material, cracking
- Separation, environmental degradation, water in-leakage

Aging Management Programs

The following aging management programs manage the aging effects for the Reactor Building components and commodity groups:

- Fire Protection Program
- Structures Monitoring Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.5.2-9.

3.5.1.10 Supports

Materials

The materials of construction for the Supports components and commodity groups are:

- Aluminum
- Carbon steel
- Concrete
- Elastomer
- Stainless steel

Environments

The Supports components and commodity groups are exposed to the following environments:

- Air/gas
- Atmosphere/ weather

- Embedded in concrete
- Soil
- Raw water
- Treated water

Aging Effects Requiring Management

The following aging effects, associated with the Supports components and commodity groups, require management:

- Expansion and cracking
- Loss of material
- Loss of mechanical function
- Reduction in concrete anchor capacity
- Reduction or loss of isolation function

Aging Management Programs

The following aging management programs manage the aging effects for the Supports components and commodity groups:

- ASME Section XI, Subsection IWF Program
- Structures Monitoring Program
- Water Chemistry Program

Summary of Aging Management Review Results

See LRA Table 3.5.2-10.

3.5.1.11 Turbine Building

Materials

The materials of construction for the Turbine Building components and commodity groups are:

- Carbon steel
- Concrete
- Elastomer
- Non-metallic fire proofing

Environments

The Turbine Building components and commodity groups are exposed to the following environments:

- Air/gas
- Atmosphere/ weather
- Soil

Aging Effects Requiring Management

The following aging effects, associated with the Turbine Building components and commodity groups, require management:

- Cracking
- Cracking, loss of bond, loss of material (spalling, scaling)
- Expansion and cracking
- Increase in hardness and shrinkage
- Increase in porosity and permeability, cracking, loss of material (spalling, scaling)
- Loss of material
- Loss of material, cracking
- Separation, environmental degradation, water in-leakage

Aging Management Programs

The following aging management programs manage the aging effects for the Turbine Building components and commodity groups:

- Fire Protection Program
- Structures Monitoring Program

Summary of Aging Management Review Results

See LRA Table 3.5.2-11.

3.5.2 FURTHER EVALUATION OF AGING MANAGEMENT AS RECOMMENDED BY NUREG-1801

NUREG-1801 Volume 1 Tables provide the basis for identifying those programs that warrant further evaluation by the reviewer in the license renewal application. For the Containments, Structures, and Component Supports, those programs are addressed in the following sections. (The following subsections are numbered to correspond to the appropriate section of NUREG-1800 [Reference 3.5-2])

3.5.2.2.1 PWR and BWR Containments

3.5.2.2.1.1 Aging of Inaccessible Concrete Areas

Duane Arnold has a Mark I free-standing steel containment located in the reactor building.

Concrete in inaccessible areas is evaluated in accordance with NUREG-1801 for increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide. Duane Arnold concrete was constructed in accordance with the recommendations in American Concrete Institute (ACI) 201.2R-77 for durability. Materials used in the design conformed to American Society for Testing and Material (ASTM) specifications that ensure consistent, reliable concrete of the highest quality. Aggregates conformed to the requirements of ASTM C-33 and were accepted based on ASTM C-295 (petrographic), C-289 (reactivity), and other tests. Concrete mix proportions were in accordance with ACI 613 (superseded by ACI 211.1). Mixing and delivery of concrete was in accordance with ACI 306 and ACI 605 for hot and cold weather conditions. Therefore, increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide of containment concrete are not aging effects requiring aging management for the period of extended operation.

The Duane Arnold environment is non aggressive (pH > 5.5, chlorides < 500 ppm, and sulfates < 1500 ppm). The Structures Monitoring Program will include examinations of below-grade concrete, when excavated for any reason. The condition of the accessible area is used to evaluate the condition of the inaccessible area. To ensure that below grade environment remains non-aggressive, ground water chemistry is monitored periodically for the above parameters as part of the Structures Monitoring Program. Therefore, cracking, loss of bond, and loss of material due to corrosion of containment embedded steel are not aging effects requiring aging management for the period of extended operation.

3.5.2.2.1.2 Cracks and Distortion Due to Increased Stress Levels from Settlement; Reduction of Foundation Strength, Cracking, and Differential Settlement Due to Erosion of Porous Concrete Subfoundations, if not Covered by Structures Monitoring Program

Seismic Category 1 structures at Duane Arnold are located on the top of limestone bedrock or soil. General differential settlement in all seismic Category 1 buildings can be detected during Maintenance Rule routine inspections. Groundwater at Duane Arnold is non-aggressive and there is no indication that groundwater chemistry has changed. Therefore, cracks and distortion of containment concrete due to increased levels of settlement are not aging effects requiring management for the period of extended operation.

Seismic Category I structures at Duane Arnold are located on the top of rock or on soil. For the structures built on rock, the ground was excavated to the top of rock then a subfoundation that consisted of fill with lean concrete was placed on the top of rock. Then, the mat foundation was placed on the top of the sub-foundation. Buildings located on soil were supported primarily on compacted granular backfill material placed in contact with the natural glacial till soils or placed over bedrock. Then, the mat foundation was placed on the top of the backfill. The cement used in both the foundation and the subfoundation is low-alkali Portland cement, Type II (not porous concrete foundation or calcium aluminate cement). General differential settlement in all seismic Category I buildings can be detected during the Maintenance Rule inspections because the effects of the settlements could be visible on concrete structures in the form of cracking near areas of stress concentration, such as at discontinuities and large penetrations. Therefore, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations for the containment, are not aging effects requiring management for the period of extended operation.

3.5.2.2.1.3 Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperatures

The Duane Arnold drywell cooling system maintains the drywell ambient air temperatures to less than 150°F and there are no local area temperatures greater than 200°F. The highest concrete normal maximum operating temperature is at the main steam pipe chase and inside drywell. The main steam pipe chase and drywell general area normal maximum operating temperature is 135°F or less. Elevated air temperatures in the drywell are not an issue for Duane Arnold containment concrete. Therefore, reduction in strength and modulus of containment concrete structures due to elevated temperatures is not an aging effect requiring management for the period of extended operation.

3.5.2.2.1.4 Loss of Material Due to General, Pitting, and Crevice Corrosion

The Duane Arnold primary containment is a steel, Mark I containment system employing a drywell and a separate pressure suppression chamber. The drywell is surrounded by a reinforced concrete structure (bioshield) and separated from the concrete by an air gap. The base of the drywell is supported on reinforced concrete. There is a sand (cushion) pocket at the transition from concrete to the air gap.

Duane Arnold concrete in contact with the drywell shell was constructed in accordance with the recommendations in American Concrete Institute (ACI) 201.2R-77. Concrete is monitored for cracks under the Structures Monitoring Program. The drywell shell and the moisture barrier where the drywell shell is embedded in the drywell concrete floor are inspected in accordance with the ASME Section XI IWE Program. The sand pocket is drained to protect the exterior surface of the drywell shell at the sand pocket interface from water that might enter the gap.

To address LR-ISG-2006-01, Corrosion of the Mark I Steel Containment Drywell Shell [Reference 3.5-3], the following is provided: (Item numbers correspond to item numbers for recommendations in the ISG.)

1) Ultrasonic testing measurements conducted in 1990 (Duane Arnold started operating in 1974) indicated that no measurable corrosion has occurred. Minimum shell / liner thickness calculations show that in the sand pocket area, the thickness required, for the most conservative loading combination, is less than 1-inch, and the nominal plate design thickness is 1.5-inches or more; therefore inferring a corrosion allowance of about 0.5-inches. Since no loss in thickness has been identified, the corrosion rate is indeterminate.

   Note: Drywell shell ultrasonic wall thickness measurements were taken in 1990, because of corrosion concerns due to control rod drive piping leaks in the drywell air gap area. Concrete was removed at the concrete-to-shell interface inside the drywell for ultrasonic measurements at 95° and 185° azimuths. The locations are at the exterior sand pocket region. The results of the drywell shell thickness measurements ranged from 1.56-inches to 1.63-inches out of more than 200 ultrasonic readings, indicating that the drywell shell thickness has adequate corrosion allowance margin.

2) Ultrasonic measurements performed in 1990 have concluded that no measurable corrosion has occurred, therefore, no corrosion rate can be established.

3) No measurable degradation has been identified in the accessible or inaccessible areas of the drywell. Therefore, an evaluation that addresses the conditions for similar conditions is not applicable for Duane Arnold.

4) Moisture levels associated with accelerated corrosion rates do not exist in the exterior portion of the drywell shell. Duane Arnold sand pocket at the transition from air gap to the drywell support concrete is sealed with a galvanized steel plate. Any leakage of water into the air gap between the drywell and surrounding concrete shield wall above the sheet metal plate would be directed to the torus room basement via four drain lines. If water penetrates the sheet metal or seal and enters the sand pocket, four additional sand-filled drain lines would drain the sand pocket to the torus room basement.

   The design of the drywell to reactor building refueling bellows prevents leakage of water into the drywell air gap. Four bellows area drain lines are seal welded to a steel plate below the refueling bellows. Any leakage past the bellows area will be directed through drain lines. A lip between the air gap and the drain lines prevents bellows leakage from entering the drywell air gap. Drainage from this area is directed to the Rad Waste System. Any leakage greater than 0.1 gpm, will trigger an alarm which will initiate operator action to determine and correct the cause of excessive leakage.

   The area in the torus room basement where the air gap drain lines and the sand filled drains lines drain are inspected periodically.

5) No moisture/leakage has been found due to refueling bellows or fuel pool leakage. Inspections of the sand pocket drain lines in response to Generic Letter 87-05 [Reference 3.5-4], indicated that no moisture/leakage was present in the sand pocket area, after inspection of the air gap drain lines and the sand filled drains lines.

   Moisture had been detected in the inaccessible area on the exterior of the drywell shell in August 1985 in the Torus Room near downcomer / vent line penetration X-05C. Leakage rate was estimated at ~1 gph. In May 1990, a pinhole leak near the toe of a control rod drive insert / withdraw line fillet weld to the drywell shell was found to be the source of moisture. Subsequent investigations found flaws in the southwest control rod drive penetration bundle. Ultrasonic testing of drywell shell in the affected area did not indicate any loss of thickness due to corrosion. In addition, no leakage was identified at the other three control rod drive penetration bundles. Repairs were satisfactorily made to the southwest control rod drive bundle in 1990, and no recurrence of control rod drive line leakage has been identified.

   No leakage since 1990 has been experienced or identified.

6) No further actions are required since the Duane Arnold drywell shell has not exhibited any loss of material that could result in loss of its intended function over the period of extended operation.

Duane Arnold will continue to implement current inspections and observations to ensure that any leakage is detected and corrective action taken. Since there has not been any measurable corrosion and the drywell shell has not exhibited any leakage in the sand pocket area, significant corrosion of the drywell shell is not expected, and no additional aging management program is required for the period of extended operation.

3.5.2.2.1.5 Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature

Not applicable for Duane Arnold. Duane Arnold is a Mark I steel containment and does not incorporate pre-stressed concrete in its design.

3.5.2.2.1.6 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in LRA Subsection 4.4.

3.5.2.2.1.7 Cracking Due to Stress Corrosion Cracking

Components potentially susceptible to stress corrosion cracking for the Duane Arnold containment are: penetration sleeves, penetration bellows, dissimilar metal welds, and vent line bellows.

Based on EPRI Report 1002950 [Reference 3.5-5], aging management is not required for crack initiation and growth (cracking) due to stress corrosion cracking of stainless steel in the air/gas environment encountered at Duane Arnold, since this environment does not contain aggressive contaminates, and the material temperature is less than 140^{o}F. Both temperature and aggressive contaminate levels must breach industry limits for stress corrosion cracking to occur. Therefore, cracking of containment stainless steel due to stress corrosion cracking is not an aging effect requiring management for the period of extended operation.

3.5.2.2.1.8 Cracking Due to Cyclic Loading

Per NUREG-1801, cracking due to cyclic loading of steel, stainless steel and dissimilar metal weld is applicable if the current licensing basis does not include a fatigue analysis.

Steel, stainless steel and dissimilar metal weld components that the current licensing basis for Duane Arnold does not include fatigue analysis and that are potentially susceptible to cracking due to cyclic loading are: penetration sleeves, penetration bellows, suppression pool shell, and unbraced downcomers. For these components, cracking due to cyclic stress is an aging effect requiring management by the ASME Section XI IWE Program for the period of extended operation.

Steel, stainless steel and dissimilar metal weld components that the current licensing basis for Duane Arnold does include fatigue analysis and that are potentially susceptible to cracking due to cyclic loading are: torus, vent line, vent header, vent line bellows, and downcomers. Since the current licensing basis has a fatigue analysis for these components, cracking due to cyclic stress is not an aging effect requiring management for the period of extended operation. The primary containment component fatigue analysis is a time-limited aging analysis (TLAA) discussed in LRA Subsection 4.4.

3.5.2.2.1.9 Loss of Material (Scaling, Cracking, and Spalling) Due to Freeze-Thaw

Not Applicable. Duane Arnold is a Mark I steel containment located in the reactor building. Loss of material (scaling, cracking, and spalling) due to freeze-thaw is only applicable to concrete containments exposed to this environment.

3.5.2.2.1.10 Cracking Due to Expansion and Reaction with Aggregate, and Increase in Porosity and Permeability due to Leaching of Calcium Hydroxide

Duane Arnold has a Mark I free-standing steel containment located in the reactor building.

Per NUREG-1801, aging management is not required for inaccessible areas if concrete was constructed in accordance with the recommendations in American Concrete Institute (ACI) 201.2R. Duane Arnold concrete was constructed in accordance with the recommendations in (ACI) 201.2R-77. Therefore, cracking of containment concrete due to expansion and reaction with aggregate, and increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide do not require aging management for the period of extended operation.

3.5.2.2.2 Safety-Related and Other Structures, and Component Supports

3.5.2.2.2.1 Aging of Structures Not Covered by Structures Monitoring Program

1. Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling) Due to Corrosion of Embedded Steel for Groups 1-5, 7, 9 Structures.

   Concrete in inaccessible areas is evaluated for cracking, loss of bond, and loss of material due to corrosion of embedded steel. Plant documents confirm that the Duane Arnold below-grade environment is not aggressive (pH > 6.6, chlorides < 200 ppm and the sulfates < 1200 ppm). The Structures Monitoring Program will include examinations of below grade concrete when excavated for any reason. The condition of the accessible area is used to evaluate the condition of the inaccessible area. To ensure the below grade environment remains non-aggressive, ground water chemistry is monitored periodically for the above parameters as part of the Structures Monitoring Program. Therefore cracking, loss of bond, and loss of material due to corrosion of embedded steel are not aging effects requiring aging management for the period of extended operation.

2. Increase in Porosity and Permeability, Cracking, Loss of Material (Spalling, Scaling) Due to Aggressive Chemical Attack for Groups 1-5, 7, 9 Structures.

   Concrete in inaccessible areas is evaluated for increase in porosity and permeability, cracking, and loss of material due to aggressive chemical attack. Plant documents confirm that the below-grade environment is not aggressive (pH > 6.6, chlorides < 200 ppm and the sulfates < 1200 ppm). The Structures Monitoring Program includes examinations of below grade concrete when excavated for any reason. The condition of the accessible area is used to evaluate the condition of the inaccessible area. To ensure the below grade environment remains non-aggressive, ground water chemistry is monitored periodically for the above parameters as part of the Structures Monitoring Program. Therefore, increases in porosity and permeability, cracking, and loss of material due to aggressive chemical attack of concrete are not aging effects requiring aging management for the period of extended operation.

3. Loss of Material Due to Corrosion for Groups 1-5, 7, 8 Structures

   Loss of material due to corrosion is an aging effect requiring management for the period of extended operation. The Duane Arnold Structures Monitoring Program will be used to manage this aging effect for Groups 1-5, 7, 8 Structures.

4. Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw for Groups 1-5, 7-9 Structures

   Concrete in inaccessible areas is evaluated for loss of material and cracking due to freeze-thaw. Duane Arnold is located in a severe weathering region according to Figure 1 of ASTM C33-77. Plant documents confirm that the concrete had air content between 3 and 6%, and subsequent inspections performed on concrete in accessible areas did not exhibit degradation related to freeze-thaw. Therefore loss of material and cracking of concrete due to freeze-thaw are not aging effects requiring aging management for the period of extended operation.

5. Cracking Due to Expansion and Reaction With Aggregates for Group 1-5, 7-9 Structures

   Concrete in inaccessible areas is evaluated for expansion and cracking due to reaction with aggregate. Tests and petrographic examinations performed according to ASTM C289-64 and ASTM C295-54 verified that aggregates used are not reactive. Therefore expansion and cracking of concrete due to reaction with aggregate are not aging effects requiring aging management for the period of extended operation.

6. Cracks and Distortion Due to Increased Stress Levels From Settlement for Groups 1-3, 5-9 Structures

   Seismic Category 1 structures at Duane Arnold are located on the top of limestone bedrock or soil. General differential settlement in all seismic Category 1 buildings can be detected during Maintenance Rule routine inspections. Groundwater at Duane Arnold is non-aggressive and there is no indication that groundwater chemistry has changed. Therefore, cracks and distortion of concrete due to increased levels of settlement, are not aging effects requiring management for the period of extended operation.

7. Reduction in Foundation Strength, Cracking, Differential Settlement Due to Erosion of Porous Concrete Subfoundation for Groups 1-3, 5-9 Structures.

   Seismic Category I structures at Duane Arnold are located on the top of rock or on soil. For the structures built on rock, the ground was excavated to the top of rock then a subfoundation that consisted of fill with lean concrete was placed on the top of rock. Then, the mat foundation was placed on the top of the sub-foundation. Buildings located on soil were supported primarily on compacted granular backfill material placed in contact with the natural glacial till soils or placed over bedrock. Then, the mat foundation was placed on the top of the backfill. The cement used in both the foundation and the subfoundation is low-alkali Portland cement, Type II (not porous concrete foundation or calcium aluminate cement). General differential settlement in all seismic Category I buildings can be detected during the Maintenance Rule inspections because the effects of the settlements could be visible on concrete structures in the form of cracking near areas of stress concentration, such as at discontinuities and large penetrations. Therefore, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations, are not aging effects requiring management for the period of extended operation.

8. Lock Up Due to Wear for Lubrite Radial Beam Seats in Drywell and Other Sliding Support Bearings and Sliding Support Surfaces.

   NUREG-1801 requires aging management for fretting or lockup due to mechanical wear of Lubrite or similar material. However, EPRI 1015078 evaluates the aging effect (loss of material) and says that wear is not significant since there is insufficient relative motion and frequency due to thermal cycling during plant heat-up, cool-down, and normal operation. There is no known aging effect that would lead to a loss of intended function. Fretting or lockup due to mechanical wear is not significant for the steel drywell head and downcomers. Therefore, loss of material of Lubrite or similar material due to wear is not an aging effect requiring management for the period of extended operation.

<u>3.5.2.2.2.2 Aging Management of Inaccessible Areas (Below-Grade Inaccessible Concrete Areas of Groups 1-5, 7, 9 Structures)</u>

1. Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw for Groups 1-3, 5, and 7-9 structures.

   Concrete in inaccessible areas is evaluated for loss of material and cracking due to freeze-thaw. Duane Arnold is located in a severe weathering region according to Figure 1 of ASTM C33-77. Plant documents confirm that the concrete had air content between 3 and 6%, and subsequent inspections performed on concrete in accessible areas did not exhibit degradation related to freeze-thaw. Therefore loss of material and cracking of concrete due to freeze-thaw are not aging effects requiring aging management for the period of extended operation.

2. Cracking Due to Expansion and Reaction With Aggregates for Groups 1-5 and 7-9 Structures.

   Concrete in inaccessible areas is evaluated for expansion and cracking due to reaction with aggregate. Tests and petrographic examinations performed according to ASTM C289-64 and ASTM C295-54 verified that aggregates used are not reactive. Therefore expansion and cracking of concrete due to reaction with aggregate are not aging effects requiring aging management for the period of extended operation.

3. Cracks and Distortion Due to Increased Stress Levels from Settlement and Reduction of Foundation Strength, Cracking, and Differential Settlement Due to Erosion of Porous Concrete Subfoundations for Groups 1-3, 5, and 7-9 Structures.

Seismic Category 1 structures at Duane Arnold are located on the top of limestone bedrock or soil. General differential settlement in all seismic Category 1 buildings can be detected during Maintenance Rule routine inspections. Groundwater at Duane Arnold is non-aggressive and there is no indication that groundwater chemistry has changed. Therefore, cracks and distortion of concrete due to increased levels of settlement, are not aging effects requiring management for the period of extended operation.

Seismic Category I structures at Duane Arnold are located on the top of rock or on soil. For the structures built on rock, the ground was excavated to the top of rock then a subfoundation that consisted of fill with lean concrete was placed on the top of rock. Then, the mat foundation was placed on the top of the sub-foundation. Buildings located on soil were supported primarily on compacted granular backfill material placed in contact with the natural glacial till soils or placed over bedrock. Then, the mat foundation was placed on the top of the backfill. The cement used in both the foundation and the subfoundation is low-alkali Portland cement, Type II (not porous concrete foundation or calcium aluminate cement). General differential settlement in all seismic Category I buildings can be detected during the Maintenance Rule inspections because the effects of the settlements could be visible on concrete structures in the form of cracking near areas of stress concentration, such as at discontinuities and large penetrations. Therefore, reduction of foundation strength, cracking, and differential settlement due to erosion of porous concrete subfoundations, are not aging effects requiring management for the period of extended operation.

4. Increase in Porosity and Permeability, and Loss of Material (Spalling, Scaling) Due to Aggressive Chemical Attack; Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling) Due to Corrosion of Embedded Steel for Groups 1-3, 5, and 7-9 Structures.

   Concrete in inaccessible areas is evaluated for increase in porosity and permeability, cracking, and loss of material due to aggressive chemical attack. Plant documents confirm that the below-grade environment is not aggressive (pH > 7, chlorides < 100 ppm and the sulfates < 100 ppm). The Structures Monitoring Program includes examinations of below grade concrete when excavated for any reason. The condition of the accessible area is used to evaluate the condition of the inaccessible area. To ensure the below grade environment remains non-aggressive, ground water chemistry is monitored periodically for the above parameters as part of the Structures Monitoring Program. Therefore, increases in porosity and permeability, cracking, and loss of material due to aggressive chemical attack of concrete are not aging effects requiring aging management for the period of extended operation.

   Concrete in inaccessible areas is evaluated for cracking, loss of bond, and loss of material due to corrosion of embedded steel. Plant documents confirm that the Duane Arnold below-grade environment is not aggressive (pH > 7, chlorides < 200 ppm and the sulfates < 1200 ppm). The Structures Monitoring Program will include examinations of below grade concrete when excavated for any reason. The condition of the accessible area is used to evaluate the condition of the inaccessible area. To ensure the below grade environment remains non-aggressive, ground water chemistry is monitored periodically for the above parameters as part of the Structures Monitoring Program. Therefore cracking, loss of bond, and loss of material due to corrosion of embedded steel are not aging effects requiring aging management for the period of extended operation.

5. Increase in Porosity and Permeability, and Loss of Strength Due to Leaching of Calcium Hydroxide for Groups 1-3, 5, and 7-9 Structures.

   Concrete in inaccessible areas is evaluated for increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide. Plant documents confirm that the concrete was constructed in accordance with the recommendations in ACI 201.2R-77 for durability. Materials used in the design conformed to ASTM specifications that ensure consistent, reliable concrete of the highest quality. Aggregates conformed to the requirements of ASTM C-33 and were accepted based on ASTM C-295 (petrographic) C-289 (reactivity) and other tests. Concrete mix proportions were in accordance with ACI 613 (superseded by ACI 211.1). Mixing and delivering of concrete was in accordance with ACI standards for hot and cold weather conditions (ACI 306 and ACI 605). Concrete slumps tests were performed in accordance with ASTM C-143. Therefore, increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide of concrete are not aging effects requiring aging management for the period of extended operation.

3.5.2.2.2.3 Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperatures for Group 1-5 Structures

ACI 349 specifies the concrete temperature limits for normal operations or any other long-term period. The temperature shall not exceed 150^{o}F except for local areas, which are allowed to have increased temperatures not to exceed 200^{o}F.

Group 1-5 concrete elements do not exceed the temperature limits associated with aging degradation due to elevated temperature. Therefore, reduction of strength and modulus of concrete structures due to elevated temperatures is not an aging effect requiring management for the period of extended operation.

3.5.2.2.2.4 Aging Management of Inaccessible Areas for Group 6 Structures (Below-Grade Inaccessible Concrete Areas)

1. Increase in Porosity and Permeability, and Loss of Material (Spalling, Scaling) Due to Aggressive Chemical Attack; Cracking, Loss of Bond, and Loss of Material (Spalling, Scaling) Due to Corrosion of Embedded Steel.

   Concrete in inaccessible areas is evaluated for increase in porosity and permeability, cracking, and loss of material due to aggressive chemical attack. Plant documents confirm that the below-grade environment is not aggressive (pH > 6.6, chlorides < 200 ppm and the sulfates < 470 ppm). The Structures Monitoring Program includes examinations of below grade concrete when excavated for any reason. The condition of the accessible area is used to evaluate the condition of the inaccessible area. To ensure the below grade environment remains non-aggressive, ground water chemistry is monitored periodically for the above parameters as part of the Structures Monitoring Program. Therefore, increases in porosity and permeability, cracking, and loss of material due to aggressive chemical attack of concrete are not aging effects requiring aging management for the period of extended operation.

Concrete in inaccessible areas is evaluated for cracking, loss of bond, and loss of material due to corrosion of embedded steel. Plant documents confirm that the Duane Arnold below-grade environment is not aggressive (pH > 7, chlorides < 200 ppm and the sulfates < 1200 ppm). The Structures Monitoring Program will include examinations of below grade concrete when excavated for any reason. The condition of the accessible area is used to evaluate the condition of the inaccessible area. To ensure the below grade environment remains non-aggressive, ground water chemistry is monitored periodically for the above parameters as part of the Structures Monitoring Program. Therefore cracking, loss of bond, and loss of material due to corrosion of embedded steel are not aging effects requiring aging management for the period of extended operation.

2. Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw.

   Concrete in inaccessible areas is evaluated for loss of material and cracking due to freeze-thaw. Duane Arnold is located in a severe weathering region according to Figure 1 of ASTM C33-77. Plant documents confirm that the concrete had air content between 3 and 6%, and subsequent inspections performed on concrete in accessible areas did not exhibit degradation related to freeze-thaw. Therefore loss of material and cracking of concrete due to freeze-thaw are not aging effects requiring aging management for the period of extended operation.

3. Cracking Due to Expansion and Reaction With Aggregates and Increase in Porosity and Permeability, and Loss of Strength Due to Leaching of Calcium Hydroxide

   Concrete in inaccessible areas is evaluated for expansion and cracking due to reaction with aggregate. Tests and petrographic examinations performed according to ASTM C289-64 and ASTM C295-54 verified that aggregates used are not reactive. Therefore expansion and cracking of concrete due to reaction with aggregate are not aging effects requiring aging management for the period of extended operation.

   Concrete in inaccessible areas is evaluated for increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide. Plant documents confirm that the concrete was constructed in accordance with the recommendations in ACI 201.2R-77 for durability. Materials used in the design conformed to ASTM specifications that ensure consistent, reliable concrete of the highest quality. Aggregates conformed to the requirements of ASTM C-33 and were accepted based on ASTM C-295 (petrographic) C-289 (reactivity) and other tests. Concrete mix proportions were in accordance with ACI 613 (superseded by ACI 211.1). Mixing and delivering of concrete was in accordance with ACI standards for hot and cold weather conditions (ACI 306 and ACI 605). Concrete slumps tests were performed in accordance with ASTM C-143. Therefore, increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide of concrete are not aging effects requiring aging management for the period of extended operation.

<u>3.5.2.2.2.5 Cracking Due to Stress Corrosion Cracking and Loss of Material Due to Pitting and Crevice Corrosion for Group 7 and 8 Stainless Steel Tank Liners</u>

Based on EPRI Report 1002950, aging management is not required for crack initiation and growth (cracking) due to stress corrosion cracking of stainless steel in the air/gas environment encountered at Duane Arnold, since this environment does not contain aggressive contaminates, and the material temperature is less than 140°F. Both temperature and aggressive contaminate levels must breach industry limits for stress corrosion cracking to occur. Therefore, cracking of stainless steel due to stress corrosion cracking is not an aging effect requiring management for the period of extended operation.

There are no components at Duane Arnold that are subject to this aging effect.

3.5.2.2.2.6 Aging of Supports Not Covered by Structures Monitoring Program

1. Loss of Material Due to General and Pitting Corrosion for Group B2 – B5 Supports.

   Loss of material due to general and pitting corrosion is an aging effect requiring management for the period of extended operation. The Duane Arnold Structures Monitoring Program will be used to manage this aging effect for Group B2 – B5 Supports.

2. Reduction in Concrete Anchor Capacity Due to Degradation of the Surrounding Concrete for Group B1-B5 Supports.

   Reduction in concrete anchor capacity due to degradation of the surrounding concrete is an aging effect requiring management for the period of extended operation. The Duane Arnold Structures Monitoring Program will be used to manage this aging effect for Group B1 – B5 Supports.

3. Reduction / Loss of Isolation Function Due to Degradation of Vibration Isolation Elements for Group B4 Supports..

   Reduction / loss of isolation function due to degradation of vibration isolation elements is an aging effect requiring management for the period of extended operation. The Duane Arnold Structures Monitoring Program will be used to manage this aging effect for Group B4 Supports.

3.5.2.2.2.7 Cumulative Fatigue Damage

Fatigue is a TLAA as defined in 10 CFR 54.3. TLAAs are evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in LRA Subsection 4.4.

3.5.2.2.2.8 Quality Assurance for Aging Management of Nonsafety-Related Components

See LRA Appendix B Subsection B.1.3 for discussion of the Duane Arnold quality assurance procedures and administrative controls for aging management programs.

3.5.3 TIME-LIMITED AGING ANALYSIS

The time-limited aging analyses (TLAAs) identified below are associated with the Structures and Structural Components and their commodity groups:

- Cranes
- Metal fatigue

3.5.4 CONCLUSION

The Structures and Structural Components and their commodity groups that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Structures and Structural Components and their commodity groups are identified in the summaries in LRA Section 3.5.2 above.

A description of these aging management programs is provided in LRA 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 LRA Appendix B, the effects of aging associated with the Structures and Structural Components and their commodity groups will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

3.5.5 REFERENCES

3.5-1 NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Revision 1, U.S. Nuclear Regulatory Commission, September 2005.

3.5-2 NUREG 1800, Standard Review Plan for License Renewal Applications for Nuclear Power Plants, Revision 1, Nuclear Regulatory Commission, September 2005.

3.5-3 LR-ISG-2006-01, Corrosion of the Mark I Steel Containment Drywell Shell.

3.5-4 GL 87-05 “Request for Additional Information Assessment of Licensee Measures To Mitigate and/or Identify Potential Degradation of Mark I Drywells,” U.S. Nuclear Regulatory Commission.

3.5-5 EPRI Report 1015078, “Aging Effects for Structures and Structural Components (Structural Tools),” December 2007.

TABLE 3.5-1
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
BWR Concrete (Mark II and III) and Steel (Mark I, II, and III) Containment					
3.5.1-1	Concrete elements: walls, dome, basemat, ring girder, buttresses, containment (as applicable	Aging of accessible and inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel	ISI (IWL) and for inaccessible concrete, an examination of representative samples of below-grade concrete and periodic monitoring of groundwater if environment is non-aggressive. A plant-specific program is to be evaluated if environment is aggressive.	Yes, plant-specific, if environment is aggressive	This line item is not applicable at DAEC. DAEC has a Mark I, free standing steel containment. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.1
3.5.1-2	Concrete elements: all	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program. If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation.	Yes, if not within the scope of the applicant's structures monitoring program or a de-watering system is relied upon	This line item is not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.2
3.5.1-3	Concrete elements: foundation, subfoundation	Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program. If a de-watering system is relied upon to control erosion of cement from porous concrete subfoundations, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation	Yes, if not within the scope of the applicant's structures monitoring program or a de-watering system is relied upon	This line item is not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.2
3.5.1-4	Concrete elements: dome, wall, basemat, ring girder, buttresses, containment, concrete fill-in annulus (as applicable)	Reduction of strength and modulus due to elevated temperature	Plant-specific	Yes, plant-specific if temperature limits are exceeded	This line item is not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.3

TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.5.1-5	Steel elements: Drywell; torus; drywell head; embedded shell and sand pocket regions; drywell support skirt; torus ring girder; downcomers; liner plate, ECCS suction header, support skirt, region shielded by diaphragm floor, suppression chamber (as applicable)	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes, if corrosion is significant for inaccessible areas	These programs are consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.4
3.5.1-6	Steel elements: steel liner, liner anchors, integral attachments	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50, Appendix J	Yes, if corrosion is significant for inaccessible areas	This line item is not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.4
3.5.1-7	Prestressed containment tendons	Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	This line item is not applicable at DAEC. DAEC has a Mark I, free standing steel containment. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.5

**TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS**

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.5.1-8	Steel and stainless steel elements: vent line, vent header, vent line bellows; downcomers	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.6
3.5.1-9	Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.6
3.5.1-10	Stainless steel penetration sleeves, penetration bellows, dissimilar metal welds	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J and additional appropriate examinations / evaluations for bellows assemblies and dissimilar metal welds	Yes, detection of aging is to be evaluated	This line item is not applicable at DAEC. The DAEC environment does not support this aging effect. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.7
3.5.1-11	Stainless steel vent line bellows	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50, Appendix J and additional appropriate examinations / evaluations for bellows assemblies and dissimilar metal welds	Yes, detection of aging is to be evaluated	Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.7

**TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS**

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.5.1-12	Steel, stainless steel elements, dissimilar metal welds: penetration sleeves, penetration bellows; suppression pool shell, unbraced downcomers	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J supplemented to detect fine cracks	Yes, detection of aging is to be evaluated	This line item is not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.8
3.5.1-13	Steel, stainless steel elements, dissimilar metal welds: torus vent line; vent header; vent line bellows; downcomers	Cracking due to cyclic loading	ISI (IWE) and 10 CFR Part 50, Appendix J supplemented to detect fine cracks	Yes, detection of aging is to be evaluated	This line item is not applicable at DAEC. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.8
3.5.1-14	Concrete elements: dome, wall, basemat, ring girder, buttresses, containment (as applicable)	Loss of material (scaling, cracking, and spalling) due to freeze –thaw	ISI (IWL) Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day – inch/yr) (NUREG-1557)	Yes, for inaccessible areas of plants located in moderate to severe weathering conditions	This line item is not applicable at DAEC. DAEC has a Mark I, free standing steel containment. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.9
3.5.1-15	Concrete elements: walls, dome, basemat, ring girder, buttresses, containment, concrete fill-in annulus (as applicable)	Increase in porosity permeability due to leaching of calcium hydroxide; cracking due to expansion and reaction with aggregate	ISI (IWL) for accessible areas. None for inaccessible areas if concrete was constructed in accordance with the recommendations of ACI 201.2R	Yes, if concrete was not constructed as stated for inaccessible areas	This line item is not applicable at DAEC. DAEC has a Mark I, free standing steel containment. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.1.10

TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.5.1-16	Seals, gaskets, and moisture barriers	Loss of sealing and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	ISI (IWE) and 10 CFR Part 50, Appendix J	No	These programs are consistent with NUREG-1801.
3.5.1-17	Personnel airlock, equipment hatch and CRD hatch locks, hinges, and closure mechanisms	Loss of leak tightness in closed position due to mechanical wear of locks, hinges, and closure mechanisms	10 CFR Part 50, Appendix J and plant Technical Specifications	No	This program is consistent with NUREG-1801.
3.5.1-18	Steel penetration sleeves and dissimilar metal welds; personnel airlock, equipment hatch, and CRD hatch	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50 Appendix J	No	These programs are consistent with NUREG-1801.
3.5.1-19	Steel elements: stainless steel suppression chamber shell (inner surface)	Cracking due to stress corrosion cracking	ISI (IWE) and 10 CFR Part 50 Appendix J	No	These programs are consistent with NUREG-1801.
3.5.1-20	Steel elements: suppression chamber shell (inner surface)	Loss of material due to general, pitting, and crevice corrosion	ISI (IWE) and 10 CFR Part 50 Appendix J	No	These programs are consistent with NUREG-1801.
3.5.1-21	Steel elements: drywell head and downcomer pipes	Fretting or lock up due to mechanical wear	ISI (IWE)	No	This program is consistent with NUREG-1801.
3.5.1-22	Prestressed containment: tendons and anchorage components	Loss of material due to corrosion	ISI (IWL)	No	This line item is not applicable at DAEC. DAEC has a Mark I, free standing steel containment.

TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
Safety Related and Other Structures; and Component Supports					
3.5.1-23	All Groups except Group 6: interior and above grade exterior concrete	Cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel	Structures Monitoring Program	Yes, if not within the scope of the applicant's Structures Monitoring Program	This program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Sections 3.5.2.2.2.1 and 3.5.2.2.2.2
3.5.1-24	All Groups except Group 6: interior and above grade exterior concrete	Increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack	Structures Monitoring Program	Yes, if not within the scope of the applicant's Structures Monitoring Program	This program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Sections 3.5.2.2.2.1 and 3.5.2.2.2.2
3.5.1-25	All Groups except Group 6: steel components: all structural steel	Loss of material due to corrosion	Structures Monitoring Program If protective coatings are relied upon to manage the effects of aging, the structures monitoring program is to include provisions to address protective coating monitoring and maintenance	Yes, if not within the scope of the applicant's Structures Monitoring Program	This program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Sections 3.5.2.2.2.1 and 3.5.2.2.2.2

TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.5.1-26	All Groups except Group 6: accessible and inaccessible concrete: foundation	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Structures Monitoring Program Evaluation is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUREG-1557)	Yes, if not within the scope of the applicant's Structures Monitoring Program or for inaccessible areas of plants located in moderate to severe weathering conditions	This program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Sections 3.5.2.2.2.1 and 3.5.2.2.2.2
3.5.1-27	All Groups except Group 6: accessible and inaccessible interior / exterior concrete	Cracking due to expansion due to reaction with aggregates	Structures Monitoring Program None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77	Yes, if not within the scope of the applicant's Structures Monitoring Program or concrete was not constructed as stated for inaccessible areas	This program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Sections 3.5.2.2.2.1 and 3.5.2.2.2.2
3.5.1-28	Groups 1-3, 5-9: All	Cracks and distortion due to increased stress levels from settlement	Structures Monitoring Program If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation	Yes, if not within the scope of the applicant's Structures Monitoring Program or a de-watering system is relied upon	There are no structures at DAEC subject to settlement. A de-watering system is not used. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Sections 3.5.2.2.2.1 and 3.5.2.2.2.2

TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.5.1-29	Groups 1-3, 5-9: foundation	Reduction in foundation strength, cracking, differential settlement due to erosion of porous concrete subfoundation	Structures Monitoring Program If a de-watering system is relied upon for control of settlement, then the licensee is to ensure proper functioning of the de-watering system through the period of extended operation	Yes, if not within the scope of the applicant's Structures Monitoring Program or a de-watering system is relied upon	There are no structures at DAEC subject to settlement. A de-watering system is not used. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Sections 3.5.2.2.2.1 and 3.5.2.2.2.2
3.5.1-30	Group 4: Radial beam seats in BWR drywell	Lock-up due to wear	ISI (IWF) or Structures Monitoring Program	Yes, if not within the scope of ISI of Structures Monitoring Program	There are no components at DAEC that are subject to lock up due to wear. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Sections 3.5.2.2.2.1 and 3.5.2.2.2.2
3.5.1-31	Groups 1-3, 5, 7-9: below grade concrete components, such as exterior walls below grade and foundation	Increase in porosity and permeability, cracking, loss of material (spalling, scaling) / aggressive chemical attack; cracking, loss of bond, and loss of material (spalling, scaling)/ corrosion of embedded steel	Structures Monitoring Program Examination of representative samples of below grade concrete, and periodic monitoring of groundwater, if the environment is non-aggressive. A plant-specific program is to be evaluated if the environment is aggressive	Yes, plant-specific if environment is aggressive	This program is consistent with NUREG-1801. DAEC does not have an aggressive environment. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Sections 3.5.2.2.2.1 and 3.5.2.2.2.2

TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.5.1-32	Groups 1-3, 5, 7-9: exterior above and below grade reinforced concrete foundations	Increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide	Structures Monitoring Program for accessible areas. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R-77	Yes, if concrete was not constructed as stated for inaccessible areas	This program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Sections 3.5.2.2.2.1 and 3.5.2.2.2.2
3.5.1-33	Group 1-5: concrete	Reduction in strength and modulus due to elevated temperature	Plant-specific	Yes, plant specific if temperature limits are exceeded	There are no components at DAEC that are subject to this aging effect. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.2.3
3.5.1-34	Group 6: concrete; all	Cracking, loss of bond, loss of material due to corrosion of embedded steel, increase in porosity and permeability, cracking, loss of material due to aggressive chemical attack	Inspection of Water Control Structures Associated with Nuclear Power Plants and for inaccessible concrete, examination of representative samples of below grade concrete, and periodic monitoring of groundwater, if environment is non-aggressive. Plant-specific if environment is aggressive	Yes, plant-specific if environment is aggressive	This program is consistent with NUREG-1801. DAEC does not have an aggressive environment. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.2.4, Item 1

TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.5.1-35	Group 6: exterior above and below grade concrete foundation	Loss of material (spalling, scaling) and cracking due to freeze-thaw	Inspection of Water Control Structures Associated with Nuclear Power Plants is needed for plants that are located in moderate to severe weathering conditions (weathering index >100 day-inch/yr) (NUEG 1557)	Yes, for inaccessible areas of plants located in moderate to severe weathering conditions	This program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.2.4, Item 2
3.5.1-36	Group 6: all accessible / inaccessible reinforced concrete	Cracking due to expansion / reaction with aggregates	Accessible areas: Inspection of Water Control Structures Associated with Nuclear Power Plants. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R77	Yes, if concrete was not constructed as stated for inaccessible areas	This program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.2.4, Item 3
3.5.1-37	Group 6: exterior above and below grade reinforced concrete foundation interior slab	Increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide	For accessible areas, Inspection of Water Control Structures Associated with Nuclear Power Plants. None for inaccessible areas if concrete was constructed in accordance with the recommendations in ACI 201.2R77	Yes, if concrete was not constructed as stated for inaccessible areas	This program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.2.4, Item 3

TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.5.1-38	Group 7, 8: Tank liners	Cracking due to stress corrosion cracking; loss of material due to pitting and crevice corrosion	Plant-specific	Yes, plant-specific	There are no components at DAEC that are subject to this aging effect. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.2.5
3.5.1-39	Support members; welds; bolted connections; support anchorage to building structure	Loss of material due to general and pitting corrosion	Structures Monitoring Program	Yes, if not within the scope of the applicant's Structures Monitoring Program	This program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.2.6
3.5.1-40	Building concrete at locations of expansion and grouted anchors; grout pads for support base plates	Reduction in concrete anchor capacity due to local concrete degradation / service-induced cracking or other concrete aging mechanisms	Structures Monitoring Program	Yes, if not within the scope of the applicant's Structures Monitoring Program	This program is consistent with NUREG-1801. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.2.6

TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.5.1-41	Vibration isolation elements	Reduction or loss of isolation function / radiation hardening, temperature, humidity, sustained vibratory loading	Structures Monitoring Program	Yes, if not within the scope of the applicant's Structures Monitoring Program	There are no components at DAEC that are subject to this aging effect. Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.2.6
3.5.1-42	Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA evaluated in accordance with 10 CFR 54.21(c)	Yes, TLAA	Further evaluation is provided in LRA Subsection 3.5.2, NUREG-1800 Section 3.5.2.2.2.7
3.5.1-43	Group 1-3, 5, 6: all masonry block walls	Cracking due to restraint shrinkage, creep, and aggressive environment	Masonry Wall Program	No	This program is consistent with NUREG-1801.
3.5.1-44	Group 6 elastomer seals, gaskets, and moisture barriers	Loss of sealing due to deterioration of seals, gaskets, and moisture barriers (caulking, flashing, and other sealants)	Structures Monitoring Program	No	This program is consistent with NUREG-1801.
3.5.1-45	Group 6: exterior above and below ground concrete foundation; interior slab	Loss of material due to abrasion, cavitation	Inspection of Water Control Structures Associated with Nuclear Power Plants	No	This program is consistent with NUREG-1801.

TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.5.1-46	Group 5: fuel pool liners	Cracking due to stress corrosion cracking; loss of material due to pitting and crevice corrosion	Water Chemistry and Monitoring of spent fuel pool water level and level of fluid in the leak chase channel	No	The spent fuel pool is normally maintained less than 140oF, therefore Stress Corrosion Cracking is not an aging effect that requires management. Crevice and pitting corrosion are managed by the Water Chemistry Program and inspected by the Structures Monitoring Program. These programs are consistent with NUREG-1801.
3.5.1-47	Group 6: all metal structural members	Loss of material due to general (steel only), pitting, and crevice corrosion	Inspection of Water Control Structures Associated with Nuclear Power Plants. If protective coatings are relied upon to manage aging, protective coating monitoring and maintenance provisions should be included	No	This program is consistent with NUREG-1801.
3.5.1-48	Group 6: earthen water control structures – dams, embankments, reservoirs, channels, canals, and ponds	Loss of material, loss of form due to erosion, settlement, sedimentation, frost action, waves, currents, surface runoff, seepage	Inspection of Water Control Structures Associated with Nuclear Power Plants	No	There are no components at DAEC that are subject to this aging effect.
3.5.1-49	Support members: welds, bolted connections; support anchorage to building structure	Loss of material / general, pitting, and crevice corrosion	Water Chemistry and ISI (IWF)	No	These programs are consistent with NUREG-1801.

TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.5.1-50	Groups B2 and B4: galvanized steel, aluminum, stainless steel support members; welds; bolted connections; support anchorage to building structure	Loss of material due to pitting and crevice corrosion	Structures Monitoring Program	No	There are no components at DAEC that are subject to this aging effect.
3.5.1-51	Group B1.1: high strength low-alloy bolts	Cracking due to stress corrosion cracking; loss of material due to general corrosion	Bolting Integrity	No	There are no high strength bolts at DAEC that are subject to this aging effect.
3.5.1-52	Groups B2 and B4: sliding support bearings and sliding support surfaces	Loss of mechanical function due to corrosion, distortion, dirt, overload, fatigue due to vibratory and cyclic thermal loads	Structures Monitoring Program	No	There are no sliding support bearings of surfaces at DAEC that are subject to this aging effect.
3.5.1-53	Groups B1.1, B1.2, and B1.3: support members: welds; bolted connections; support anchorage to building structure	Loss of material due to general and pitting corrosion	ISI (IWF)	No	This program is consistent with NUREG-1801.
3.5.1-54	Group B1.1, B1.2, and B1.3: Constant and variable load spring hangers; guides; stops	Loss of mechanical function due to corrosion, distortion, dirt, overload fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	No	This program is consistent with NUREG-1801.
3.5.1-55	Pressurized water reactor only				
3.5.1-56	Groups B1.1, B1.2, and B1.3: Sliding surfaces	Loss of mechanical function due to corrosion, distortion, dirt, overload fatigue due to vibratory and cyclic thermal loads	ISI (IWF)	No	There are no sliding surfaces at DAEC that are subject to this aging effect.

TABLE 3.5-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTERS II AND III OF NUREG-1801
STRUCTURES AND STRUCTURAL COMPONENTS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.5.1-57	Groups B1.1, B1.2, and B1.3: Vibration isolation elements	Reduction or loss of isolation function / radiation hardening, temperature, humidity, sustained vibratory loading	ISI (IWF)	No	This program is consistent with NUREG-1801.
3.5.1-58	Galvanized steel and aluminum support members; welds; bolted connections; support anchorage to building structure exposed to air – indoor uncontrolled	None	None	NA – no aging effect management or aging management program	DAEC is consistent with NUREG-1801.
3.5.1-59	Stainless steel support members; welds; bolted connections; support anchorage to building structure	None	None	NA – no aging effect management or aging management program	DAEC is consistent with NUREG-1801.

TABLE 3.5.2-1
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
BUILDINGS, STRUCTURES AFFECTING SAFETY

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Low level radwaste processing facility interior concrete	Structural support	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
Low level radwaste processing facility carbon steel	Structural support	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Machine shop carbon steel	Structural support	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Machine shop interior concrete	Structural pressure barrier Structural support	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A

TABLE 3.5.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
BUILDINGS, STRUCTURES AFFECTING SAFETY

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Offgas retention building interior concrete	Structural pressure barrier Structural support	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
Offgas retention building carbon steel	Structural support	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Radwaste building interior carbon steel	Structural support	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Radwaste building interior concrete	Structural pressure barrier Structural support	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A

TABLE 3.5.2-1 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
BUILDINGS, STRUCTURES AFFECTING SAFETY

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Railroad airlock carbon steel	Structural support Structural pressure barrier	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Railroad airlock exterior concrete	Structural pressure barrier	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A3-6 (T-01)	3.5.1-26	A
Railroad airlock interior concrete	Structural pressure barrier Structural support	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A2-10 (T-06)	3.5.1-24	A

TABLE 3.5.2-2
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Built-up roofing	Shelter, protection	Elastomer	Atmosphere/ weather (external)	Separation, environmental degradation, water in leakage	Structures Monitoring Program	III.A6-12 (TP-7)	3.5.1-44	505, C
Concrete buried (below grade)	Structural support	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A1-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A1-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A1-5 (T-07)	3.5.1-31	A
Concrete	Fire barrier Missile barrier Shielding Structural support	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Fire Protection Program	VII.G-29 (A-91)	3.3.1-67	B
					Structures Monitoring Program	III.A1-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Fire Protection Program	VII.G-30 (A-92)	3.3.1-66	B
					Structures Monitoring Program	III.A1-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Fire Protection Program	III.A1-10 (T-06)	3.5.1-24	E
					Structures Monitoring Program	III.A1-10 (T-06)	3.5.1-24	A

TABLE 3.5.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Concrete (continued)	Fire barrier Missile barrier Shielding Structural support	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A1-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A1-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A1-10 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A1-6 (T-01)	3.5.1-26	A
Concrete masonry units	Fire barrier Missile barrier Shielding Structural support	Concrete	Air/gas (external)	Cracking	Fire Protection Program	III.A1-11 (T-12)	3.5.1-43	E
					Structures Monitoring Program	III.A1-11 (T-12)	3.5.1-43	A
	Fire barrier Missile barrier Shelter, protection Structural support	Concrete	Atmosphere/ weather (external)	Cracking	Fire Protection Program	III.A1-11 (T-12)	3.5.1-43	E
					Structures Monitoring Program	III.A1-11 (T-12)	3.5.1-43	A

TABLE 3.5.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Control room suspended ceiling carbon steel	Structural support	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A1-12 (T-11)	3.5.1-25	A
Door carbon steel	Control building habitability Structural support	Carbon steel	Air/gas (external)	Loss of leak tightness	Structures Monitoring Program	III.A1-12 (T-11)	3.5.1-25	C
				Loss of material	Structures Monitoring Program	III.A1-12 (T-11)	3.5.1-25	A
Fire door	Fire barrier	Carbon steel	Air/gas (external)	Loss of material	Fire Protection Program	VII.G-3 (A-21)	3.3.1-63	B
					Structures Monitoring Program	III.A1-12 (T-11)	3.5.1-25	A
Penetration fire seal elastomer	Control bldg habitability Fire barrier	Elastomer	Air/gas (external)	Increased hardness and shrinkage	Fire Protection Program	VII.G-1 (A-19)	3.3.1-65	A
Structural steel fire proofing	Fire barrier	Non-metallic fire proofing	Air/gas (external)	Cracking, delamination	Fire Protection Program	VII.G-28 (A-90)	3.3.1-65	506, B
				Loss of material	Fire Protection Program	VII.G-29 (A-91)	3.3.1-67	506, B

TABLE 3.5.2-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CONTROL BUILDING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Structural steel	Missile barrier Structural support	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A1-12 (T-11)	3.5.1-25	A

TABLE 3.5.2-3
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CRANES AND HOISTS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Drywell monorails	Structural support	Carbon steel	Air/gas (external)	Loss of material	Overhead Handling Systems Program	VII.B-3 (A-07)	3.3.1-73	A
					Structures Monitoring Program	VII.B-3 (A-07)	3.3.1-73	E
Reactor building crane	Structural support	Carbon steel	Air/gas (external)	Loss of material	Overhead Handling Systems Program	VII.B-3 (A-07)	3.3.1-73	A
					Structures Monitoring Program	VII.B-3 (A-07)	3.3.1-73	E
Reactor building crane rails	Structural support	Carbon steel	Air/gas (external)	Loss of material	Overhead Handling Systems Program	VII.B-1 (A-05)	3.3.1-74	A
					Structures Monitoring Program	VII.I-8 (A-77)	3.3.1-58	E
Reactor building crane trolley	Structural support	Carbon steel	Air/gas (external)	Loss of material	Overhead Handling Systems Program	VII.B-3 (A-07)	3.3.1-73	A
					Structures Monitoring Program	VII.B-3 (A-07)	3.3.1-73	E
Reactor building monorails	Structural support	Carbon steel	Air/gas (external)	Loss of material	Overhead Handling Systems Program	VII.B-3 (A-07)	3.3.1-73	A
					Structures Monitoring Program	VII.B-3 (A-07)	3.3.1-73	E

TABLE 3.5.2-3 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
CRANES AND HOISTS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Refuel floor jib crane	Structural support	Carbon steel	Air/gas (external)	Loss of material	Overhead Handling Systems Program	VII.B-3 (A-07)	3.3.1-73	A
					Structures Monitoring Program	VII.B-3 (A-07)	3.3.1-73	E
Refuel platform auxiliary hoist monorail	Structural support	Carbon steel	Air/gas (external)	Loss of material	Overhead Handling Systems Program	VII.B-3 (A-07)	3.3.1-73	A
					Structures Monitoring Program	VII.B-3 (A-07)	3.3.1-73	E
Refueling platform	Structural support	Carbon steel	Air/gas (external)	Loss of material	Overhead Handling Systems Program	VII.B-3 (A-07)	3.3.1-73	A
					Structures Monitoring Program	VII.B-3 (A-07)	3.3.1-73	E
Refueling platform rails	Structural support	Carbon steel	Air/gas (external)	Loss of material	Overhead Handling Systems Program	VII.B-1 (A-05)	3.3.1-74	A
					Structures Monitoring Program	VII.I-8 (A-77)	3.3.1-58	E
Torus monorail	Structural support	Carbon steel	Air/gas (external)	Loss of material	Overhead Handling Systems Program	VII.B-3 (A-07)	3.3.1-73	A
					Structures Monitoring Program	VII.B-3 (A-07)	3.3.1-73	E
Turbine building crane	Structural support	Carbon steel	Air/gas (external)	Loss of material	Overhead Handling Systems Program	VII.B-3 (A-07)	3.3.1-73	A
					Structures Monitoring Program	VII.B-3 (A-07)	3.3.1-73	E
Turbine building crane rails	Structural support	Carbon steel	Air/gas (external)	Loss of material	Overhead Handling Systems Program	VII.B-1 (A-05)	3.3.1-74	A
					Structures Monitoring Program	VII.I-8 (A-77)	3.3.1-58	E

TABLE 3.5.2-4
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
INTAKE STRUCTURE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Built-up roofing	Shelter, protection	Elastomer	Atmosphere/ weather (external)	Separation, environmental degradation, water in leakage	Structures Monitoring Program	III.A6-12 (TP-7)	3.5.1-44	505, C
Carbon steel	Structural integrity (attached) Structural support	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A6-11 (T-21)	3.5.1-47	A
	Shutdown cooling water Structural support	Carbon steel	Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A6-11 (T-21)	3.5.1-47	A
	Structural support Structure	Carbon steel	Raw water (external)	Loss of material	Structures Monitoring Program	III.A6-11 (T-21)	3.5.1-47	A
Carbon steel - buried	Structural support	Carbon steel	Soil (external)	Loss of material	Structures Monitoring Program	III.A6-11 (T-21)	3.5.1-47	509, A

TABLE 3.5.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
INTAKE STRUCTURE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Concrete buried	Shelter, protection Structural support Structure	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A6-1 (T-18)	3.5.1-34	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A6-3 (T-19)	3.5.1-34	A
Concrete	Fire barrier Structural support Structure	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Fire Protection Program	VII.G-29 (A-91)	3.3.1-67	B
					Structures Monitoring Program	III.A6-1 (T-18)	3.5.1-34	A
				Expansion and cracking	Fire Protection Program	VII.G-28 (A-90)	3.3.1-65	B
					Structures Monitoring Program	III.A6-2 (T-17)	3.5.1-36	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Fire Protection Program	III.A6-3 (T-19)	3.5.1-34	E
					Structures Monitoring Program	III.A6-3 (T-19)	3.5.1-34	A

TABLE 3.5.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
INTAKE STRUCTURE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Concrete (continued)	Missile barrier Shelter, protection Structural support Structure	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A6-1 (T-18)	3.5.1-34	A
				Expansion and cracking	Structures Monitoring Program	III.A6-2 (T-17)	3.5.1-36	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A2-10 (T-06)	3.5.1-24	C
				Loss of material, cracking	Structures Monitoring Program	III.A6-5 (T-15)	3.5.1-35	A
	Shelter, protection Structural support Structure	Concrete	Raw water (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A6-1 (T-18)	3.5.1-34	508, A
				Expansion and cracking	Structures Monitoring Program	III.A6-2 (T-17)	3.5.1-36	A
				Increase in porosity and permeability, loss of strength	Structures Monitoring Program	III.A6-6 (T-16)	3.5.1-37	A
				Loss of material	Structures Monitoring Program	III.A6-7 (T-20)	3.5.1-45	A

TABLE 3.5.2-4 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
INTAKE STRUCTURE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Concrete masonry units	Fire barrier Structural support	Concrete	Air/gas (external)	Cracking	Fire Protection Program	III.A6-10 (T-12)	3.5.1-43	E
					Structures Monitoring Program	III.A6-10 (T-12)	3.5.1-43	A
Fire door	Fire barrier	Carbon steel	Air/gas (external)	Loss of material	Fire Protection Program	VII.G-3 (A-21)	3.3.1-63	B
					Structures Monitoring Program	III.A2-12 (T-11)	3.5.1-25	A
Grout	Fire barrier Structural support	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Fire Protection Program	VII.G-28 A-90	3.3.1-65	511, B
					Structures Monitoring Program	III.A3-9 T-04	3.5.1-23	511, A
				Expansion and cracking	Fire Protection Program	VII.G-28 A-90	3.3.1-65	511, B
					Structures Monitoring Program	III.A3-9 T-04	3.5.1-23	511, A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Fire Protection Program	III.A3-10 T-06	3.5.1-24	511, E
					Structures Monitoring Program	III.A3-10 T-06	3.5.1-24	511, A

**TABLE 3.5.2-5
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MISCELLANEOUS YARD STRUCTURES**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Concrete masonry units inside manhole	Fire barrier	Concrete	Atmosphere/ weather (external)	Cracking	Structures Monitoring Program	III.A3-11 (T-12)	3.5.1-43	A
					Fire Protection Program	VII.G-30 (A-92)	3.3.1-66	B
Cooling tower basin concrete	Structure	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A3-6 (T-01)	3.5.1-26	A
			Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A

TABLE 3.5.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MISCELLANEOUS YARD STRUCTURES

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Cooling tower basin-concrete (continued)	Structure	Concrete	Raw water	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	509, A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A
						III.A3-7 (T-02)	3.5.1-32	A
				Loss of material	Structures Monitoring Program	III.A6-7 (T-20)	3.5.1-45	A
Cooling tower reinforced concrete pipe	Structure	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A

**TABLE 3.5.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MISCELLANEOUS YARD STRUCTURES**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Cooling tower reinforced concrete pipe	Structure	Concrete	Raw water (internal)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	509, A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A
				Increase in porosity and permeability, loss of strength	Structures Monitoring Program	III.A3-7 (T-02)	3.5.1-32	A
				Loss of material	Structures Monitoring Program	III.A6-7 (T-20)	3.5.1-45	E
Condensate storage tank anchor bolt	Structure	Carbon steel	Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A

TABLE 3.5.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MISCELLANEOUS YARD STRUCTURES

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Condensate storage tank foundation concrete below grade	Structural support Structure	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A
Condensate storage tank foundation concrete	Structural support Structure	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A3-6 (T-01)	3.5.1-26	A
Diesel generator fuel oil tank concrete anchor below grade	Structural support Structure	Concrete	Soil (external)	Cracking, Loss of Bond, Loss of Material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A

TABLE 3.5.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MISCELLANEOUS YARD STRUCTURES

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Diesel generator fuel tank wire rope below grade	Structural support Structure	Carbon steel	Soil (external)	Loss of material	Buried Piping & Tanks Inspection	III.A3-12 (T-11)	3.5.1-25	E
Dilution structure reinforced concrete below grade	Structural support	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A
Dilution structure reinforced concrete	Missile barrier Structural support	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A3-6 (T-01)	3.5.1-26	A

TABLE 3.5.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MISCELLANEOUS YARD STRUCTURES

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Electrical cable manhole concrete masonry unit grout	Fire barrier	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Fire Protection Program	VII.G-30 (A-92)	3.3.1-66	B
					Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Fire Protection Program	VII.G-30 (A-92)	3.3.1-66	B
					Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Fire Protection Program	III.A3-10 (T-06)	3.5.1-24	E
					Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
Electrical cable manhole concrete masonry unit grout (continued)	Fire barrier	Concrete	Atmosphere/ weather (external)	Loss of material, cracking	Fire Protection Program	VII.G-30 (A-92)	3.3.1-66	B
				Loss of material, cracking	Structures Monitoring Program	III.A3-6 (T-01)	3.5.1-26	A
Electrical cable manhole lid	Missile barrier Shelter, protection Structural support Structure	Carbon steel	Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A

TABLE 3.5.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MISCELLANEOUS YARD STRUCTURES

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Electrical cable manhole concrete below grade	Shelter, protection Structural support Structure	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A
Electrical cable manhole concrete	Missile barrier Structural support Structure	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A3-6 (T-01)	3.5.1-26	A
Electrical cable trench concrete below grade	Structural support Structure	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A

TABLE 3.5.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MISCELLANEOUS YARD STRUCTURES

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Electrical cable trench concrete	Structural support Structure	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A3-6 (T-01)	3.5.1-26	A
Electrical duct bank concrete below grade	Shelter, protection Structural support Structure	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A
Exhaust extension pipe carbon steel	Flood barrier	Carbon steel	Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	507, C

TABLE 3.5.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MISCELLANEOUS YARD STRUCTURES

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Rigid steel duct embedded in concrete duct bank	Structural support	Carbon steel	Embedded in concrete	None	None			513, I
Stop logs	Flood barrier	Carbon steel	Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	507, C
Substation structure foundation below grade	Structural support Structure	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A
Substation structure foundation	Structural support Structure	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A3-6 (T-01)	3.5.1-26	A

TABLE 3.5.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MISCELLANEOUS YARD STRUCTURES

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Substation carbon steel control house	Structure	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
			Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Substation carbon steel structures	Structure	Carbon steel	Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Substation control building concrete	Structural support Structure	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
Transformer foundation concrete below grade	Structural support Structure	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A

TABLE 3.5.2-5 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
MISCELLANEOUS YARD STRUCTURES

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Transformer foundation concrete	Structural support Structure	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A3-6 (T-01)	3.5.1-26	A

TABLE 3.5.2-6
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
OFFGAS STACK

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Concrete buried	Shelter, protection Structural support	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A9-3 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A9-1 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A9-4 (T-07)	3.5.1-31	A
Exterior carbon steel fasteners	Structural support	Carbon steel	Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	C
Exterior concrete	Shelter, protection Structural support	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A9-8 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A9-1 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A9-9 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A9-5 (T-01)	3.5.1-26	A

**TABLE 3.5.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
OFFGAS STACK**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Exterior structural steel	Structural support	Carbon steel	Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	C
Interior block wall	Structural support	Concrete	Atmosphere/ weather (external)	Cracking	Structures Monitoring Program	III.A3-11 (T-12)	3.5.1-43	C
Interior carbon steel fasteners	Structural support	Carbon steel	Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	C
Interior concrete	Shelter, protection Structural support	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A9-8 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A9-1 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A9-9 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A9-5 (T-01)	3.5.1-26	A

TABLE 3.5.2-6 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
OFFGAS STACK

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Interior grout	Shelter, protection Structural support	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A9-8 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A9-1 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A9-9 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A9-5 (T-01)	3.5.1-26	A
Interior stainless steel fastener	Structural support	Stainless steel	Atmosphere/ weather (external)	None	None	III.B1.2-7 (TP-5)	3.5.1-59	A
Interior structural steel	Structural support	Carbon steel	Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	C
Interior structural steel (non-safety affecting safety)	Structural support	Carbon steel	Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	C

TABLE 3.5.2-7
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT STRUCTURE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Drywell carbon steel liner and skirt	Structural pressure barrier Structural support	Carbon steel	Embedded in concrete (external)	Loss of material	ASME Section XI, Subsection IWE Program	II.B1.1-2 (C-19)	3.5.1-5	C
Drywell electrical penetration	Shelter, protection Structural pressure barrier Structural support	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B4-1 (C-12)	3.5.1-18	A
					ASME Section XI, Subsection IWE Program	II.B4-1 (C-12)	3.5.1-18	A
Drywell hatches and airlock	Shelter, protection Structural pressure barrier Structural support	Carbon steel	Air/gas (external)	Loss of leak tightness	10 CFR 50 Appendix J Program	II.B4-5 (C-17)	3.5.1-17	501, A
				Loss of material	10 CFR 50 Appendix J Program	II.B4-6 (C-16)	3.5.1-18	A
					ASME Section XI, Subsection IWE Program	II.B4-6 (C-16)	3.5.1-18	A

TABLE 3.5.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT STRUCTURE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Drywell head access hatch	Structural pressure barrier	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B4-6 (C-16)	3.5.1-18	A
					ASME Section XI, Subsection IWE Program	II.B4-6 (C-16)	3.5.1-18	A
Drywell head access, equipment and control rod drive hatch elastomer	Structural pressure barrier	Elastomer	Air/gas (external)	Change in material properties and cracking	ASME Section XI, Subsection IWE Program	II.B4-7 (C-18)	3.5.1-16	A
				Loss of sealing, leakage through containment	10 CFR 50 Appendix J Program	II.B4-7 (C-18)	3.5.1-16	A
					ASME Section XI, Subsection IWE Program	II.B4-7 (C-18)	3.5.1-16	A
Drywell head	Shelter, protection Structural pressure barrier Structural support	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B1.1-2 (C-19)	3.5.1-5	A
					ASME Section XI, Subsection IWE Program	II.B1.1-1 (C-23)	3.5.1-21	502, A
Drywell head elastomer in air/gas	Structural pressure barrier	Elastomer	Air/gas (external)	Change in material properties and cracking	ASME Section XI, Subsection IWE Program	II.B4-7 (C-18)	3.5.1-16	A
				Loss of sealing, leakage through containment	10 CFR 50 Appendix J Program	II.B4-7 (C-18)	3.5.1-16	A
					ASME Section XI, Subsection IWE Program	II.B4-7 (C-18)	3.5.1-16	A

TABLE 3.5.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT STRUCTURE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Drywell head fasteners	Structural pressure barrier Structural support	Carbon steel	Air/gas (external)	Loss of material	ASME Section XI, Subsection IWE Program	II.B1.1-2 (C-19)	3.5.1-5	C
Drywell head hatch	Structural pressure barrier	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B4-6 (C-16)	3.5.1-18	A
					ASME Section XI, Subsection IWE Program	II.B4-6 (C-16)	3.5.1-18	A
Drywell penetration	Shelter, protection Structural pressure barrier Structural support	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B4-1 (C-12)	3.5.1-18	A
					ASME Section XI, Subsection IWE Program	II.B4-1 (C-12)	3.5.1-18	A
Drywell shell	Shelter, protection Structural pressure barrier Structural support	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B1.1-2 (C-19)	3.5.1-5	A
					ASME Section XI, Subsection IWE Program	II.B1.1-2 (C-19)	3.5.1-5	A

TABLE 3.5.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT STRUCTURE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Drywell shell (at air gap)	Shelter, protection Structural pressure barrier Structural support	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B1.1-2 (C-19)	3.5.1-5	503, A
					ASME Section XI, Subsection IWE Program	II.B1.1-2 (C-19)	3.5.1-5	503, A
Drywell structures	Missile barrier Pipe whip restraint Structural support	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A4-5 (T-11)	3.5.1-25	A
Miscellaneous primary containment structure elastomers	Shelter, protection	Elastomer	Air/gas (external)	Loss of sealing, leakage through containment	ASME Section XI, Subsection IWE Program	II.B4-7 (C-18)	3.5.1-16	A
Non-structural drywell/ reactor pressure vessel bioshield	Shielding	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A4-3 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A4-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A4-4 (T-06)	3.5.1-24	A

TABLE 3.5.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT STRUCTURE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Penetration bellows	Flood barrier	Carbon steel	Air/gas (external)	Loss of material	ASME Section XI, Subsection IWE Program	II.B4-1 (C-12)	3.5.1-18	A
	HELB shielding Structural pressure barrier	Stainless steel -	Air/gas (external)	Cracking	ASME Section XI, Subsection IWE Program	II.B4-2 (C-15)	3.5.1-10	A
Personnel airlock elastomer	Structural pressure barrier	Elastomer	Air/gas (external)	Loss of sealing, leakage through containment	10 CFR 50 Appendix J Program	II.B4-7 (C-18)	3.5.1-16	501, A
					ASME Section XI, Subsection IWE Program	II.B4-7 (C-18)	3.5.1-16	A
Primary containment reinforced concrete	Shielding Structural support	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A4-3 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A4-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A4-4 (T-06)	3.5.1-24	A
	Shielding Structural support	Concrete	Raw water (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A4-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A

TABLE 3.5.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT STRUCTURE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Seismic restraint inspection port	Shelter, protection Structural pressure barrier	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B4-6 (C-16)	3.5.1-18	A
					ASME Section XI, Subsection IWE Program	II.B4-6 (C-16)	3.5.1-18	A
Seismic restraint inspection port elastomer (gasket)	Structural pressure barrier	Elastomer	Air/gas (external)	Loss of sealing, leakage through containment	10 CFR 50 Appendix J Program	II.B4-7 (C-18)	3.5.1-16	A
					ASME Section XI, Subsection IWE Program	II.B4-7 (C-18)	3.5.1-16	A
Torus downcomer	Pressure boundary	Carbon steel	Treated water (external)	Loss of material	ASME Section XI, Subsection IWE Program	II.B1.1-2 (C-19)	3.5.1-5	A
					Water Chemistry Program	II.B1.1-2 (C-19)	3.5.1-5	E
Torus carbon steel (exterior)	Shelter, protection Structural pressure barrier Structural support	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B1.1-2 (C-19)	3.5.1-5	A
					ASME Section XI, Subsection IWE Program	II.B1.1-2 (C-19)	3.5.1-5	A
Torus structural steel	Structural support	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	II.B1.1-2 (C-19)	3.5.1-5	512, A
			Treated water (internal)	Loss of material	Structures Monitoring Program	II.B1.1-2 (C-19)	3.5.1-5	E

TABLE 3.5.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT STRUCTURE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Torus electrical penetration	Shelter, protection Structural pressure barrier Structural support	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B4-1 (C-12)	3.5.1-18	A
				Loss of material	ASME Section XI, Subsection IWE Program	II.B4-1 (C-12)	3.5.1-18	A
Torus hatch	Shelter, protection Structural pressure barrier	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B4-6 (C-16)	3.5.1-18	A
					ASME Section XI, Subsection IWE Program	II.B4-6 (C-16)	3.5.1-18	A
Torus hatch elastomer	Structural pressure barrier	Elastomer	Air/gas (external)	Loss of sealing, leakage through containment	10 CFR 50 Appendix J Program	II.B4-7 (C-18)	3.5.1-16	A
					ASME Section XI, Subsection IWE Program	II.B4-7 (C-18)	3.5.1-16	A
Torus penetration	Structural pressure barrier Structural support	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B4-1 (C-12)	3.5.1-18	A
					ASME Section XI, Subsection IWE Program	II.B4-1 (C-12)	3.5.1-18	A
			Treated water (external)	Loss of material	ASME Section XI, Subsection IWE Program	II.B1.1-2 (C-19)	3.5.1-5	C
					Water Chemistry Program	II.B1.1-2 (C-19)	3.5.1-5	E

TABLE 3.5.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT STRUCTURE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Torus shell and ring girders	Shelter, protection Structural pressure barrier Structural support	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B1.1-2 (C-19)	3.5.1-5	A
					ASME Section XI, Subsection IWE Program	II.B1.1-2 (C-19)	3.5.1-5	A
	Heat sink Structural pressure barrier Structural support	Carbon steel	Treated water (external)	Loss of material	ASME Section XI, Subsection IWE Program	II.B1.1-2 (C-19)	3.5.1-5	A
					Water Chemistry Program	II.B1.1-2 (C-19)	3.5.1-5	E
Torus thermowell	Structural pressure barrier Structural support	Carbon steel	Treated water (external)	Loss of material	ASME Section XI, Subsection IWE Program	II.B1.1-2 (C-19)	3.5.1-5	A
					Water Chemistry Program	II.B1.1-2 (C-19)	3.5.1-5	E
Torus vent header and downcomer	Pressure boundary Structural pressure barrier	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B1.1-2 (C-19)	3.5.1-5	A
					ASME Section XI, Subsection IWE Program	II.B1.1-2 (C-19)	3.5.1-5	A
Vent line bellows	Expansion/ separation Structural pressure barrier	Stainless steel -	Air/gas (external)	Cracking	10 CFR 50 Appendix J Program	II.B1.1-5 (C-22)	3.5.1-11	A
					ASME Section XI, Subsection IWE Program	II.B1.1-5 (C-22)	3.5.1-11	A

TABLE 3.5.2-7 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PRIMARY CONTAINMENT STRUCTURE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Vent line	Pressure boundary Structural pressure barrier	Carbon steel	Air/gas (external)	Loss of material	10 CFR 50 Appendix J Program	II.B1.1-2 (C-19)	3.5.1-5	A
					ASME Section XI, Subsection IWE Program	II.B1.1-2 (C-19)	3.5.1-5	A

TABLE 3.5.2-8
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PUMP HOUSE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Carbon steel	Shelter, protection Structural support Structure	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
			Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Concrete below grade	Shelter, protection Structural support Structure	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A

TABLE 3.5.2-8 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PUMP HOUSE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Concrete	Fire barrier Shelter, protection Structural support Structure	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Fire Protection Program	VII.G-29 (A-91)	3.3.1-67	B
					Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Fire Protection Program	VII.G-28 (A-90)	3.3.1-65	B
					Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Fire Protection Program	III.A3-10 (T-06)	3.5.1-24	E
					Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
	Shelter, protection Structural support Structure	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A3-6 (T-01)	3.5.1-26	A

TABLE 3.5.2-8 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PUMP HOUSE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Concrete (continued)	Structural support Structure	Concrete	Raw water (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	509, A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A
				Increase in porosity and permeability, loss of strength	Structures Monitoring Program	III.A3-7 (T-02)	3.5.1-32	A
				Loss of material	Structures Monitoring Program	III.A6-7 (T-20)	3.5.1-45	C
Concrete masonry units	Fire barrier Shelter, protection Structural support Structure	Concrete	Air/gas (external)	Cracking	Fire Protection Program	III.A3-11 (T-12)	3.5.1-43	E
					Structures Monitoring Program	III.A3-11 (T-12)	3.5.1-43	A
Fire door	Fire barrier	Carbon steel	Air/gas (external)	Loss of material	Fire Protection Program	VII.G-3 (A-21)	3.3.1-63	B
					Structures Monitoring Program	VII.G-3 (A-21)	3.3.1-63	E

TABLE 3.5.2-8 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PUMP HOUSE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Grout	Fire barrier Shelter, protection Structural support Structure	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Fire Protection Program	III.A3-11 (T-12)	3.5.1-43	511, E
					Structures Monitoring Program	III.A3-11 (T-12)	3.5.1-43	511, A
				Expansion and cracking	Fire Protection Program	III.A3-11 (T-12)	3.5.1-43	511, E
					Structures Monitoring Program	III.A3-11 (T-12)	3.5.1-43	511, A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Fire Protection Program	III.A3-11 (T-12)	3.5.1-43	511, E
					Structures Monitoring Program	III.A3-11 (T-12)	3.5.1-43	511, A
Penetration fire seal elastometers	Fire barrier	Elastomer	Air/gas (external)	Increased hardness and shrinkage	Fire Protection Program	VII.G-1 (A-19)	3.3.1-61	B
		Elastomer	Atmosphere /weather (external)	Increased hardness and shrinkage	Fire Protection Program	VII.G-2 (A-20)	3.3.1-61	B
Penetrations	Fire barrier Flood barrier	Elastomer	Air/gas (external)	Increased hardness and shrinkage	Structures Monitoring Program	VII.G-1 (A-19)	3.3.1-61	E
					Fire Protection Program	VII.G-1 (A-19)	3.3.1-61	B
			Atmosphere/ weather (external)	Increased hardness and shrinkage	Structures Monitoring Program	VII.G-2 (A-20)	3.3.1-61	E
					Fire Protection Program	VII.G-2 (A-20)	3.3.1-61	B
Roofing	Shelter, protection	Elastomer	Atmosphere/ weather (external)	Separation, environmental degradation, water in leakage	Structures Monitoring Program	III.A6-12 (TP-7)	3.5.1-44	505, C

TABLE 3.5.2-8 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
PUMP HOUSE

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Wall/ceiling fire barrier	Fire barrier	Non-metallic fire proofing	Air/gas (external)	Loss of material	Fire Protection Program	VII.G-28 (A-90)	3.3.1-65	506, D
					Structures Monitoring Program	III.A3-11 (T-12)	3.5.1-43	506, C
Watertight (submarine) door	Fire barrier Flood barrier	Carbon steel	Air/gas (external)	Loss of material	Fire Protection Program	III.A3-12 (T-11)	3.5.1-25	E
					Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Watertight door fire seal elastometers	Fire barrier Flood barrier	Elastomer	Air/gas (external)	Increased hardness and shrinkage	Fire Protection Program	VII.G-1 (A-19)	3.3.1-61	B
					Structures Monitoring Program	VII.G-1 (A-19)	3.3.1-61	E

TABLE 3.5.2-9
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Airlock door	Structural pressure barrier	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A2-12 (T-11)	3.5.1-25	A
Aluminum	Shielding Structural support	Aluminum alloy	Air/gas (external)	None	None	III.B1.1-6 (TP-8)	3.5.1-58	C
Carbon steel	Shelter, protection Structural support Structure	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A2-12 (T-11)	3.5.1-25	A
			Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A2-12 (T-11)	3.5.1-25	A
Concrete	Fire barrier Missile barrier Shelter, protection Shielding Structural support	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Fire Protection Program	VII.G-29 (A-91)	3.3.1-67	B
					Structures Monitoring Program	III.A2-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Fire Protection Program	VII.G-28 (A-90)	3.3.1-65	B
					Structures Monitoring Program	III.A2-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Fire Protection Program	III.A2-10 (T-06)	3.5.1-24	E
					Structures Monitoring Program	III.A2-10 (T-06)	3.5.1-24	A

TABLE 3.5.2-9 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Concrete (continued)	Shelter, protection Structural support Structure	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A2-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A2-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A2-10 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A2-6 (T-01)	3.5.1-26	A
Concrete below grade	Shelter, protection Structural support Structure	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A2-4 (T-05)	3.5.1-31	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A2-5 (T-07)	3.5.1-31	A
Concrete masonry units	Fire barrier Missile barrier Shelter, protection Structural support Structure	Concrete	Air/gas (external)	Cracking	Fire Protection Program	III.A2-11 (T-12)	3.5.1-43	E
					Structures Monitoring Program	III.A2-11 (T-12)	3.5.1-43	A
Door	Structural support	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A2-12 (T-11)	3.5.1-25	A

TABLE 3.5.2-9 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Fire barrier	Fire barrier	Non-metallic fire proofing	Air/gas (external)	Loss of material	Fire Protection Program	VII.G-29 (A-91)	3.3.1-67	506, D
					Structures Monitoring Program	VII.G-29 (A-91)	3.3.1-67	506, C
Fire door	Fire barrier	Carbon steel	Air/gas (external)	Loss of material	Fire Protection Program	VII.G-3 (A-21)	3.3.1-63	B
					Structures Monitoring Program	III.A2-12 (T-11)	3.5.1-25	A
Fuel pool and components	Shelter, protection Structural support Structure	Stainless steel -	Treated water (external)	Loss of material	Structures Monitoring Program	III.A5-10 (T-06)	3.5.1-49	E
					Water Chemistry Program	III.A5-10 (T-06)	3.5.1-49	A
Grout	Fire barrier Shelter, protection Structural support Structure	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Fire Protection Program	VII.G-29 (A-91)	3.3.1-67	511, D
					Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	511, C
				Expansion and cracking	Fire Protection Program	VII.G-28 (A-90)	3.3.1-65	511, D
					Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	511, C
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Fire Protection Program	III.A3-10 (T-06)	3.5.1-24	511, E
					Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	511, C

TABLE 3.5.2-9 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Penetration bellows	Flood barrier	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A2-12 (T-11)	3.5.1-25	A
	HELB shielding Structural pressure barrier	Stainless steel	Air/gas (external)	None	None	III.B1.1-9 (TP-5)	3.5.1-59	A
Penetration fire barrier	Fire barrier	Elastomer	Air/gas (external)	Increased hardness and shrinkage	Fire Protection Program	VII.G-1 (A-19)	3.3.1-61	B
					Structures Monitoring Program	VII.G-1 (A-19)	3.3.1-61	E
			Atmosphere/ weather (external)	Increased hardness and shrinkage	Fire Protection Program	VII.G-2 (A-20)	3.3.1-61	B
					Structures Monitoring Program	VII.G-2 (A-20)	3.3.1-61	E
Penetration flood barrier	Fire barrier Flood barrier Structural pressure barrier	Elastomer	Air/gas (external)	Increased hardness and shrinkage	Fire Protection Program	VII.G-1 (A-19)	3.3.1-61	B
					Structures Monitoring Program	VII.G-1 (A-19)	3.3.1-61	E
			Atmosphere/ weather (external)	Increased hardness and shrinkage	Fire Protection Program	VII.G-2 (A-20)	3.3.1-61	B
					Structures Monitoring Program	VII.G-2 (A-20)	3.3.1-61	E

TABLE 3.5.2-9 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
REACTOR BUILDING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Penetration secondary containment barrier	Fire barrier Shielding Structural support	Elastomer	Air/gas (external)	Increased hardness and shrinkage	Fire Protection Program	VII.G-1 (A-19)	3.3.1-61	B
					Structures Monitoring Program	VII.G-1 (A-19)	3.3.1-61	E
			Atmosphere/ weather (external)	Increased hardness and shrinkage	Fire Protection Program	VII.G-2 (A-20)	3.3.1-61	A
					Structures Monitoring Program	VII.G-2 (A-20)	3.3.1-61	E
Roofing	Shelter, protection Structural pressure barrier	Elastomer	Atmosphere/ weather (external)	Separation, environmental degradation, water in leakage	Structures Monitoring Program	III.A6-12 (TP-7)	3.5.1-44	505, C
Siding	Structural pressure barrier	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A2-12 (T-11)	3.5.1-25	A
			Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A2-12 (T-11)	3.5.1-25	A
Steam tunnel blow out panels	Pressure relief	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A2-12 (T-11)	3.5.1-25	A
Watertight (submarine) door	Flood barrier	Carbon steel	Air/gas (external)	Loss of material	Fire Protection Program	VII.G-3 (A-21)	3.3.1-63	B
					Structures Monitoring Program	III.A2-12 (T-11)	3.5.1-25	A
Watertight doors fire seal elastomer	Fire barrier	Elastomer	Air/gas (external)	Increased hardness and shrinkage	Fire Protection Program	VII.G-1 (A-19)	3.3.1-61	A
					Structures Monitoring Program	VII-G-1 (A-19	3.3.1-61	E

TABLE 3.5.2-10
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SUPPORTS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
ASME Class 1 constant and variable load spring hangers, guides and stops	Structural support Structure	Carbon steel	Air/gas (external)	Loss of mechanical function	ASME Section XI, Subsection IWF ISI Program	III.B1.1-2 (T-28)	3.5.1-54	A
ASME Class 1 non-metal	Structural support	Elastomer	Air/gas (external)	Reduction or loss of isolation function	ASME Section XI, Subsection IWF ISI Program	III.B1.1-15 (T-33)	3.5.1-57	A
ASME Class 1 pipe supports	Structural support Structure	Concrete	Air/gas (external)	Reduction in concrete anchor capacity	Structures Monitoring Program	III.B1.1-1 (T-29)	3.5.1-40	A
ASME Class 1 stainless steel	Structural support Structure	Stainless steel	Air/gas (external)	None	None	III.B1.1-9 (TP-5)	3.5.1-59	A
			Treated water (external)	Loss of material	ASME Section XI, Subsection IWF ISI Program	III.B1.1-11 (TP-10)	3.5.1-49	A
					Water Chemistry Program	III.B1.1-11 (TP-10)	3.5.1-49	A
ASME Class 1 support	Structural support Structure	Carbon steel	Air/gas (external)	Loss of material	ASME Section XI, Subsection IWF ISI Program	III.B1.1-13 (T-24)	3.5.1-53	A

TABLE 3.5.2-10 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SUPPORTS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
ASME Class 2/3 constant and variable load spring hangers, guides and stops	Structural support Structure	Carbon steel	Air/gas (external)	Loss of mechanical function	ASME Section XI, Subsection IWF ISI Program	III.B1.2-2 (T-28)	3.5.1-54	A
ASME Class 2/3 non-metal	Structural support Structure	Elastomer	Air/gas (external)	Reduction or loss of isolation function	ASME Section XI, Subsection IWF ISI Program	III.B1.2-12 (T-33)	3.5.1-57	A
ASME Class 2/3 pipe supports	Structural support Structure	Concrete	Air/gas (external)	Reduction in concrete anchor capacity	Structures Monitoring Program	III.B1.2-1 (T-29)	3.5.1-40	A
ASME Class 2/3 support	Structural support Structure	Carbon steel	Air/gas (external)	Loss of material	ASME Section XI, Subsection IWF ISI Program	III.B1.2-10 (T-24)	3.5.1-53	A
		Stainless steel	Air/gas (external)	None	None	III.B1.2-7 (TP-5)	3.5.1-59	A

**TABLE 3.5.2-10 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SUPPORTS**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
ASME Class MC support	Structural support Structure	Stainless steel	Air/gas (external)	None	None	III.B1.3-7 (TP-5)	3.5.1-59	A
			Treated water (external)	Loss of material	ASME Section XI, Subsection IWF ISI Program	III.B1.1-11 (TP-10)	3.5.1-49	A
					Water Chemistry Program	III.B1.1-11 (TP-10)	3.5.1-49	A
ASME Class MC support (continued)	Structural support Structure	Carbon steel	Air/gas (external)	Loss of material	ASME Section XI, Subsection IWF ISI Program	III.B1.3-10 (T-24)	3.5.1-53	A
			Treated water (external)	Loss of material	ASME Section XI, Subsection IWF ISI Program	II.B1.1-2 (C-19)	3.5.1-5	E
		Concrete	Air/gas (external)	Reduction in concrete anchor capacity	Structures Monitoring Program	III.B1.3-1 (T-29)	3.5.1-40	A
Concrete masonry unit block wall	Structural support Structure	Concrete	Air/gas (external)	Reduction in concrete anchor capacity	Structures Monitoring Program	III.B5-1 (T-29)	3.5.1-40	A
Concrete masonry unit block wall supports	Structural support Structure	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.B5-7 (T-30)	3.5.1-39	A

TABLE 3.5.2-10 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SUPPORTS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Control rod drive housing support (1R226)	Structural support Structure	Carbon steel	Air/gas (external)	Loss of material	ASME Section XI, Subsection IWF ISI Program	III.B1.2-10 (T-24)	3.5.1-53	A
Defective fuel storage container in treated water	Structural support	Stainless steel	Treated water (external)	Loss of material	ASME Section XI, Subsection IWF ISI Program	VII.A2-6 (A-96)	3.3.1-39	E
					Water Chemistry Program	VII.A2-6 (A-96)	3.3.1-39	C
Emergency diesel generator concrete	Structural support Structure	Concrete	Air/gas (external)	Reduction in concrete anchor capacity	Structures Monitoring Program	III.B4-1 (T-29)	3.5.1-40	A
Emergency diesel generator support	Structural support Structure	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.B4-10 (T-30)	3.5.1-39	A
Holtec spent fuel rack support	Structure	Stainless steel	Treated water (external)	Loss of material	Water Chemistry Program	VII.A2-6 (A-96)	3.3.1-39	A
New fuel storage racks support	Structural support	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	VII.A1-1 (A-94)	3.3.1-86	A

TABLE 3.5.2-10 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SUPPORTS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Non-ASME constant and variable load spring hangers, guides and stops	Structural support Structure	Carbon steel	Air/gas (external)	Loss of mechanical function	Structures Monitoring Program	III.B1.2-2 (T-28)	3.5.1-54	E
Non-ASME piping and components concrete below grade	Structural support	Concrete	Soil (external)	Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
Non-ASME piping and components concrete	Structural support Structure	Concrete	Air/gas (external)	Reduction in concrete anchor capacity	Structures Monitoring Program	III.B2-1 (T-29)	3.5.1-40	A
	Structural support	Concrete	Atmosphere/ weather (external)	Reduction in concrete anchor capacity	Structures Monitoring Program	III.B2-1 (T-29)	3.5.1-40	A

TABLE 3.5.2-10 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SUPPORTS

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Non-ASME support	Structural support Structure	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.B2-10 (T-30)	3.5.1-39	A
			Raw water (external)	Loss of material	Structures Monitoring Program	III.A6-11 (T-21)	3.5.1-47	A
	Structural support	Carbon steel	Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.B2-10 (T-30)	3.5.1-39	A
	Structural support Structure	Stainless steel	Air/gas (external)	None	None	III.B2-8 (TP-5)	3.5.1-59	A
Panels	Structural support Structure	Aluminum alloy	Air/gas (external)	None	None	III.B3-2 (TP-8)	3.5.1-58	A
		Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.B3-7 (T-30)	3.5.1-39	A
			Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.B3-7 (T-30)	3.5.1-39	A
Panels (continued)	Structural support Structure	Concrete	Air/gas (external)	Reduction in concrete anchor capacity	Structures Monitoring Program	III.B3-1 (T-29)	3.5.1-40	A
			Atmosphere /weather (external)	Reduction in concrete anchor capacity	Structures Monitoring Program	III.B3-1 (T-29)	3.5.1-40	A

**TABLE 3.5.2-10 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
SUPPORTS**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Platform	Structural support Structure	Concrete	Air/gas (external)	Reduction in concrete anchor capacity	Structures Monitoring Program	III.B5-1 (T-29)	3.5.1-40	A
	Structural support	Concrete	Atmosphere/ weather (external)	Reduction in concrete anchor capacity	Structures Monitoring Program	III.B5-1 (T-29)	3.5.1-40	A
Platform supports	Pipe whip restraint Structural support Structure	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.B5-7 (T-30)	3.5.1-39	A
	Structural support	Carbon steel	Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.B5-7 (T-30)	3.5.1-39	A
Reactor vessel stabilizer support	Structural support Structure	Carbon steel	Embedded in concrete (external)	Loss of material	ASME Section XI, Subsection IWF ISI Program	III.B1.1-13 (T-24)	3.5.1-53	A
Reactor vessel stabilizer support	Structural support	Carbon steel	Air/gas (external)	Loss of mechanical function	ASME Section XI, Subsection IWF ISI Program	III.B1.1-2 (T-28)	3.5.1-54	C
Ventilation system components	Structural support	Concrete	Atmosphere /weather (external)	Reduction in concrete anchor capacity	Structures Monitoring Program	III.B4-1 (T-29)	3.5.1-40	A

TABLE 3.5.2-11
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE BUILDING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Airlock door	Structural pressure barrier	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Carbon steel	Shelter, protection Structural support Structure	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
			Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Concrete below grade	Structural support	Concrete	Soil (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-4 (T-05)	3.5.1-31	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-5 (T-07)	3.5.1-31	A

TABLE 3.5.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE BUILDING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Concrete	Fire barrier Missile barrier Shelter, protection Shielding Structural support	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Fire Protection Program	VII.G-29 (A-91)	3.3.1-67	B
					Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Fire Protection Program	VII.G-28 (A-90)	3.3.1-65	B
					Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Fire Protection Program	III.A3-10 (T-06)	3.5.1-24	E
					Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
	Flood barrier Missile barrier Shelter, protection Structural support	Concrete	Atmosphere/ weather (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	A
				Expansion and cracking	Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	A
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	A
				Loss of material, cracking	Structures Monitoring Program	III.A3-6 (T-01)	3.5.1-26	A

TABLE 3.5.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE BUILDING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Concrete masonry units	Fire barrier Missile barrier Shelter, protection Shielding Structural integrity (attached) Structural support Structure	Concrete	Air/gas (external)	Cracking	Fire Protection Program	III.A3-11 (T-12)	3.5.1-43	E
					Structures Monitoring Program	III.A3-11 (T-12)	3.5.1-43	A
	Missile barrier Shelter, protection Shielding Structural integrity (attached) Structural support Structure	Concrete	Atmosphere/ weather (external)	Cracking	Structures Monitoring Program	III.A3-11 (T-12)	3.5.1-43	A

TABLE 3.5.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE BUILDING

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Door	Structural support	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Fire door	Fire barrier	Carbon steel	Air/gas (external)	Loss of material	Fire Protection Program	VII.G-3 (A-21)	3.3.1-63	B
					Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Grout	Fire barrier Shelter, protection Structural support Structure	Concrete	Air/gas (external)	Cracking, loss of bond, loss of material (spalling, scaling)	Fire Protection Program	VII.G-29 (A-91)	3.3.1-67	506, D
					Structures Monitoring Program	III.A3-9 (T-04)	3.5.1-23	506, C
				Expansion and cracking	Fire Protection Program	VII.G-28 (A-90)	3.3.1-65	506, D
					Structures Monitoring Program	III.A3-2 (T-03)	3.5.1-27	506, C
				Increase in porosity and permeability, cracking, loss of material (spalling, scaling)	Fire Protection Program	III.A3-10 (T-06)	3.5.1-24	506, E
					Structures Monitoring Program	III.A3-10 (T-06)	3.5.1-24	506, C
Penetrations	Fire barrier Flood barrier Structural pressure barrier	Elastomer	Air/gas (external)	Increased hardness and shrinkage	Structures Monitoring Program	VII.G-1 (A-19)	3.3.1-61	E
					Fire Protection Program	VII.G-1 (A-19)	3.3.1-61	B
			Atmosphere/ weather (external)	Increased hardness and shrinkage	Structures Monitoring Program	VII.G-2 (A-20)	3.3.1-61	E
					Fire Protection Program	VII.G-2 (A-20)	3.3.1-61	B

**TABLE 3.5.2-11 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
TURBINE BUILDING**

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.X-1 Item	Notes
Roofing	Shelter, protection	Elastomer	Atmosphere/ weather (external)	Separation, environmental degradation, water in leakage	Structures Monitoring Program	III.A6-12 (TP-7)	3.5.1-44	505, C
Siding	Shelter, protection	Carbon steel	Air/gas (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
			Atmosphere/ weather (external)	Loss of material	Structures Monitoring Program	III.A3-12 (T-11)	3.5.1-25	A
Structural steel fire proofing	Fire barrier Shelter, protection	Non-metallic fire proofing	Air/gas (external)	Loss of material	Fire Protection Program	VII.G-29 (A-91)	3.3.1-67	506, D
					Structures Monitoring Program	VII.G-29 (A-91)	3.3.1-67	506, C

NOTES FOR TABLES 3.5.2-1 THROUGH 3.5.2-11

A. Consistent with NUREG-1801 item for component, material, environment, and aging effect. Aging management program is consistent with NUREG-1801 aging management program.

B. Consistent with NUREG-1801 item for component, material, environment, and aging effect. Aging management program takes some exceptions to NUREG-1801 aging management program.

C. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. Aging management program is consistent with NUREG-1801 aging management program.

D. Component is different, but consistent with NUREG-1801 item for material, environment, and aging effect. Aging management program takes some exceptions to NUREG-1801 aging management program.

E. Consistent with NUREG-1801 item for material, environment, and aging effect, but a different aging management program is credited, or a plant-specific aging management program.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material and environment combination.

I. Aging effect in NUREG-1801 for this component, material, and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-specific notes:

501. Technical specification 3.6.1.2 addresses airlock leakage (LCO 3.6.1.1 if leakage rate exceeds acceptance criteria).

502. Aging effect includes “fretting and lockup” due to wear.

503. No loss of material due to corrosion aging management program required for inaccessible surfaces of drywell, including sand pocket area.

504. Fatigue analysis exists and time-limited aging analyses applies.

505. Built-up roofing is not in NUREG-1801, III.A6-12 is for elastomer – material is similar, environment is same, and aging management program is Structures Monitoring Program.

506. Component is cementitious fire proofing/insulating material and will exhibit similar aging effects as concrete.

507. Component is in storage for use in event of probable maximum flood, and is not installed plant equipment.

508. Cracking, loss of bond, and loss of material (spalling, scaling) / corrosion of embedded steel is not listed in GALL III.A.6 as an aging effect for concrete in raw water. Duane Arnold manages this effect with the Structures Monitoring Program.

509. For aging management purposes, buried, below grade, and ground water / raw and treated water environments are treated the same.

510. Reduction in concrete anchor capacity is an aging effect that is addressed in LRAM-SUPT.

511. Grout is part of masonry wall construction, used as fill / bond of reinforcing steel in block walls.

512. For aging management purposes, carbon steel inside the torus below or above treated water is treated as carbon steel in treated water, because the corrosion from below the water level could propagate to steel above the water level.

513. At DAEC concrete meets the requirements of ACI 318 or 349. Therefore loss of material due corrosion is not an applicable aging effect.

3.6 AGING MANAGEMENT OF ELECTRICAL AND INSTRUMENTATION AND CONTROLS SYSTEMS

This section provides the results of the aging management review for those commodity groups identified in LRA Subsection 2.5, Scoping and Screening Results: Electrical and Instrumentation and Control Systems, as being subject to aging management review. As indicated in Section 2.5, electrical and instrumentation and control (EIC) components that are subject to an aging management review are evaluated in LRA Subsection 2.5.4, Electrical and I&C Components Requiring an Aging Management Review. The EIC component commodity groups, which are addressed in this section, are.

- Electrical Conductors including:
    - Transmission conductors and connections
    - Insulated cables and connections
    - Electrical Connections
    - Fuse Holders
    - Switchyard bus and connections
    - Metal Enclosed Bus
- High Voltage Insulators
- Electrical Penetration Assemblies

As indicated in LRA Section 2.1.3.3, EIC components (cables, splices, terminal blocks, electrical penetration assemblies, etc.) associated with the 10 CFR 50.49 Environmental Qualification (EQ) Program [Reference 3.6-1] are defined as short-lived (i.e., subject to replacement based on qualified life) and are addressed by time-limited aging analyses (TLAA). Therefore, these EIC components are not included in the set of EIC component commodity groups requiring aging management review.

Table 3.6-1, Summary of Aging Management Evaluations in Chapter VI of NUREG-1801 [Reference 3.6-2] for EIC component commodity groups, provides the summary of the programs evaluated in NUREG-1801 for the EIC component commodity groups that are relied on for license renewal. This table uses the format described in LRA Section 3.0. Note that this table only includes those commodity groups that are applicable to a boiling water reactor.

3.6.1 RESULTS SUMMARY

The materials that specific commodity groups are fabricated from, the environments to which commodity groups are exposed, the potential aging effects requiring management, and the aging management programs used to manage these aging effects are provided for each of the EIC component commodity groups in the following subsections. LRA Table 3.6-2 summarizes the results of the aging management review for the EIC component commodity groups.

Materials

The materials of construction for the EIC component commodity groups components are:

- Cement
- Ceramics
- Elastomers
- Fiberglass conductor supports
- Galvanized metal
- Glass cloth and fiber
- Potting boards
- Various epoxies
- Various conducting metals
- Various organic polymers

Environments

The EIC component commodity groups are exposed to the following environments:

- Air/gas
- Atmosphere/weather
- Adverse localized environment caused by heat or radiation in the presence of oxygen
- Adverse localized environment caused by exposure to moisture and voltage
- Adverse localized environment caused by heat in the presence of oxygen or > 60-year service limiting temperature

Aging Effects Requiring Management

The following aging effects, associated with the EIC component commodity groups, require management:

- Loosening of connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion and oxidation applicable to Electrical Connections
- Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR) and electrical failure due to thermal and radiological aging mechanisms applicable to Electrical Cable and Connections and Electrical Cables and Connections Used in Instrumentation Circuits
- Localized damage and breakdown of insulation leading to electrical failure due to moisture intrusion for medium voltage cables due to moisture aging mechanisms applicable to Inaccessible Medium Voltage Cable

- Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure due to thermal aging mechanisms applicable to Fuse Holder Insulation Material
- Fatigue/ohmic heating, thermal cycling and frequent manipulation applicable to Fuse Holder Metallic Clips
- Loosening of bolted connections due to thermal cycling and ohmic heating applicable to Metal Enclosed Bus, Buswork and Connections
- Hardening and loss of strength/ elastomer degradation applicable to Metal Enclosed Bus Enclosure Assemblies
- Loss of material/general corrosion applicable to Metal Enclosed Bus Enclosure Assemblies
- Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR) and electrical failure due to thermal aging mechanisms and debris intrusion applicable to Metal Enclosed Bus Insulation Material and Insulators
- Increased resistance of connection due to oxidation or loss of preload applicable to Switchyard and Transmission Connections
- Moisture intrusion degrading the epoxy insulation between conductors applicable to Electrical Penetration Assemblies

<u>Aging Management Programs</u>

The following aging management programs manage the aging effects for the EIC components commodity group:

- Electrical Cable and Connection Program
- Electrical Cables and Connections Used in Instrumentation Circuits Program
- Inaccessible Medium Voltage Cable Program
- Metal Enclosed Bus Program
- Fuse Holder Program
- Electrical Connections Program
- Electrical Penetration Assembly Program
- Structures Monitoring Program

<u>Summary of Aging Management Review Results</u>

See Table 3.6-2.

3.6.2 FURTHER EVALUATION OF AGING MANAGEMENT AS RECOMMENDED BY NUREG-1801

NUREG-1801 Volume 1 [Reference 3.6-2] Tables provide the basis for identifying those programs that warrant further evaluation by the reviewer in the license renewal application. For the Electrical and Instrumentation and Controls, those programs are addressed in the following sections. (The following subsections are numbered to correspond to the appropriate section of NUREG-1800 [Reference 3.6-3])

3.6.3.2.1 Electrical Equipment Subject to Environmental Qualification

Environmental qualification is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed separately in LRA Subsection 4.4.

3.6.3.2.2 High Voltage Insulators

Industry experience, as listed in NUREG-1801 Volume 1 [Reference 3.6-2] Table 6, has shown that the possible aging effects of high voltage insulators are degradation of insulation quality due to presence of any salt deposits and surface contamination and loss of material caused by mechanical wear due to wind blowing on transmission conductors.

Salt Deposits and Surface Contamination:

Various airborne materials such as dust, salt, and industrial effluents can contaminate insulator surfaces. The buildup of surface contamination is gradual and in most areas such contamination is washed away by rain; the glazed insulator surface aids this contamination removal. A large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover.

Surface contamination can be a problem in areas where there are greater concentrations of airborne particles such as near facilities that discharge soot or near the seacoast where salt spray is prevalent. Duane Arnold is located in an area with moderate rainfall and airborne particle concentrations are comparatively low. Consequently, the rate of contamination buildup on the insulators is not significant. At Duane Arnold, as in most areas of the power transmission system in this region, contamination build-up on insulators is not a problem.

Therefore, surface contamination of the insulators is not considered a potential aging mechanism.

Mechanical Wear:

Mechanical wear is an aging effect for strain and suspension insulators, in that they are subject to movement. Movement of insulators can be caused by wind blowing the transmission conductor, causing it to sway from side to side. If this swinging is frequent enough, it could cause wear in the metal contact points of the insulator string and between an insulator and the supporting hardware. Although this mechanism is possible, experience has shown that the transmission conductors do not normally swing for very long, once the wind has subsided.

Generally, for distribution lines with average span lengths, Aeolian vibration damage will be eliminated if the design initial tensions at 60°F (15°C) are at or below 12 percent of the ultimate strength of the conductor.

There are two sets of cables and insulators that are subject to mechanical wear due to wind, 795 MCM 26/7 ACSR cable and the 3/8” EHS galvanized steel ground cable between the Switchyard and the Startup Transformer.

The ultimate strength of the 795 MCM 26/7 ACSR cable is 31,500 lbs. The tension for the maximum span of 590 ft is 1763 lbs or 5.6% of the ultimate strength.

The ultimate strength of the 3/8" EHS galvanized steel ground cable is 15,400 lbs. The tension for the maximum span of 590 ft, is 966 lbs or 6.3% of the ultimate strength.

The short cable runs are not susceptible to Aeolian vibration. Aeolian vibration only affects cables that are under tension greater than 15% of the rated strength. The cables listed below were not strung with any significant tension, so maximum tension that these cables could see is their own weight. For example, the 954 MCM AAC cable between the rigid bus and CB5560 has a weight of 896 lbs/1000 ft. and a rated strength of 16,400 lbs. For a 20 ft length of cable, the tension would be 17.92 lbs or about 0.1% of the rated strength.

Therefore loss of material due to wear is not an applicable aging effect for the insulators in the service conditions at Duane Arnold.

3.6.3.2.3 Transmission Conductors and Connections; Switchyard Conductors and Connections

Industry experience, as listed in NUREG-1801 Volume 1 [Reference 3.6-2] Table 6, has shown that the possible aging effects of transmission/switchyard conductors and connectors are loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion; and increased resistance of connection due to oxidation or loss of preload.

Wind Induced Abrasion:

Aeolian vibration is transmission conductor vibration or sway caused by wind loading. Wind loading that can cause a transmission line and insulators to vibrate is considered in the design and installation. Loss of material (wear) and fatigue that could be caused by transmission conductor vibration or sway are found not to be applicable aging effects at Duane Arnold, in that they would not cause a loss of intended function if left unmanaged for the extended period of operation. Duane Arnold has not experienced any problems that would indicate that Aeolian vibration is causing damage to transmission conductors.

Generally, for distribution lines with average span lengths, Aeolian vibration damage will be eliminated if the design initial tensions at 60°F (15°C) are at or below 12 percent of the ultimate strength of the conductor.

There are two sets of cables and insulators that are subject to mechanical wear due to wind, 795 MCM 26/7 ACSR cable and the 3/8" EHS galvanized steel ground cable between the Switchyard and the Startup Transformer.

The ultimate strength of the 795 MCM 26/7 ACSR cable is 31,500 lbs. The tension for the maximum span of 590 ft is 1763 lbs or 5.6% of the ultimate strength.

The ultimate strength of the 3/8" EHS galvanized steel ground cable is 15,400 lbs. The tension for the maximum span of 590 ft is 966 lbs or 6.3% of the ultimate strength.

The short cable runs are not susceptible to Aeolian vibration. Aeolian vibration only affects cables that are under tension greater than 15% of the rated strength. The cables listed below were not strung with any significant tension, so maximum tension that these cables could see is their own weight. For example, the 954 MCM AAC cable between the rigid bus and CB5560 has a weight of 896 lbs/1000 ft. and a rated strength of 16,400 lbs. For a 20 ft length of cable, the tension would be 17.92 lbs or about 0.1% of the rated strength.

Therefore, loss of material due to wind induced abrasion is not an applicable aging effect for the transmission conductors and connections in the service conditions at Duane Arnold.

Conductor Corrosion:

The most prevalent mechanism contributing to loss of conductor strength of an aluminum conductor steel reinforced (ACSR) transmission conductor is corrosion, which includes corrosion of the steel core and aluminum strand pitting. For aluminum conductor steel reinforced conductors, degradation begins as a loss of zinc from the galvanized steel core wires. Corrosion rates depend largely on air quality, which includes suspended particles chemistry, sulfur dioxide (SO_2) concentration in air, precipitation, fog chemistry and meteorological conditions. Tests performed by Ontario Hydroelectric showed a 30% loss of composite conductor strength of an 80-year-old aluminum conductor steel reinforced conductor due to corrosion.

There is a set percentage of composite conductor strength established at which a transmission conductor is replaced. As illustrated below, there is ample strength margin to maintain the transmission conductor intended function through the extended period of operation.

The National Electrical Safety Code (NESC) requires that tension on installed conductors be a maximum of 60% of the ultimate conductor strength. This section of the NESC also sets the maximum tension a conductor must be designed to withstand under heavy load requirements, which includes consideration of ice, wind and temperature. These requirements are reviewed concerning the specific conductors included in the aging management review.

The 795 MCM 26/7 ACSR between the Switchyard and the Startup Transformer will be used as an illustration. The ultimate strength and the NESC heavy load tension requirements of 795 MCM 26/7 ACSR are 31,500 lbs and 4160 lbs respectively. The margin between the NESC Heavy Load and the ultimate strength is 27,340 lbs; i.e., there is a 86.8% of ultimate strength margin. The Ontario Hydroelectric study showed a 30% loss of composite conductor strength in an 80-year-old conductor. In the case of the 795 MCM 26/7 ACSR transmission conductors, a 30% loss of ultimate strength would mean that there would still be a 56.8% ultimate strength margin between what is required by the NESC and the actual conductor strength.

The 795 MCM 26/7 ACSR conductors is the most risk significant of any transmission conductors included in the scope of this AMR. This illustrates with reasonable assurance that transmission conductors will have ample strength through the period of extended operation.

Corrosion of ACSR conductors is a very slow acting aging effect that is even slower for rural areas with generally less suspended particles and SO2 concentrations in the air than urban areas.

Based on the Ontario Hydroelectric study and that the DAEC is in a rural area, there are no applicable aging effects due to corrosion that could cause loss of the intended function of the transmission conductors for the period of extended operation.

Oxidation and Loss of Preload:

With respect to the NUREG-1801 aging effect of increased resistance of electrical connections, conductor connections are generally of the compression bolted category.

No organic materials are involved. Connection materials exposed to the service conditions of the Switchyard do not experience any appreciable aging effects, except for minor oxidation, which does not impact the ability of the conductor connection to perform its intended function. Based on operating experience, this method of installation has been shown to provide a low electrical resistance connection.

The only bolted connections associated with transmission conductors are switchyard bus connections, other switchyard components (breakers and current transformers) connections and transformers connections. The bolting hardware used for these connections was selected to be compatible with the aluminum connector/conductor coefficient of thermal expansion. This ensures that the contact pressure of the bolt and washer combination used in the connector is maintained to the initial vendor specified torque value. The design incorporates the use of stainless steel Belleville washers on the bolted electrical connections to compensate for temperature changes, maintain the proper torque, and prevent loosening of dissimilar metal connection hardware. This method of assembly is consistent with the good bolting practices.

Industry experience has shown that hydrogen embrittlement could be a problem with Belleville washers and other springs. When springs are electroplated, the plating process forces hydrogen into the metal grain boundaries. If the hydrogen is not removed, the spring may spontaneously fail at any time while in service. Although hydrogen embrittlement occurs infrequently, it is not recommended that electroplated Belleville washers and other springs be used. Hydrogen embrittlement does not affect Belleville washers having other finishes.

Plant drawings indicates that the Belleville washers used for transmission conductor and switchyard bus connections are stainless steel, but does not indicate if they are electroplated.

Connection materials exposed to the service conditions of the Switchyard may experience minor oxidation resulting in increased resistance across the electrical connection and Belleville washers may fail due to hydrogen embrittlement. To provide reasonable assurance that the electrical continuity function of the connection is maintained, these connections will be included in the Electrical Connections Program.

3.6.3.2.4 Quality Assurance for Aging Management of Nonsafety-Related Components

See LRA Appendix B Subsection B.1.3 for discussion of the Duane Arnold quality assurance procedures and administrative controls for aging management programs.

3.6.3 TIME-LIMITED AGING ANALYSIS

The time-limited aging analyses (TLAAs) identified below are associated with the Electrical and Instrumentation and Controls commodity groups:

- Environmental Qualification Program

3.6.4 CONCLUSION

The Electrical and Instrumentation and Controls commodity groups that are subject to aging management review have been identified in accordance with the requirements of 10 CFR 54.4. The aging management programs selected to manage aging effects for the Electrical and Instrumentation and Controls component commodity groups are identified in the summaries in Section 3.6.1 above.

A description of these aging management programs is provided in Appendix B, along with the demonstration that the identified aging effects will be managed for the period of extended operation.

Therefore, based on the demonstrations provided in Appendix B, the effects of aging associated with the Electrical and Instrumentation and Controls commodity groups will be adequately managed so that there is reasonable assurance that the intended function(s) will be maintained consistent with the current licensing basis during the period of extended operation.

3.6.5 REFERENCES

3.6-1 Code of Federal Regulations, Title 10, Energy.

3.6-2 NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Volume 1, Revision 1, Nuclear Regulatory Commission, September 2005.

3.6-3 NUREG 1800, Standard Review Plan for License Renewal Applications for Nuclear Power Plants, Revision 1, Nuclear Regulatory Commission, September 2005.

TABLE 3.6-1
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VI OF NUREG-1801
ELECTRICAL AND INSTRUMENTATION AND CONTROLS COMMODITY GROUPS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.6.1-1	Electrical equipment subject to 10 CFR 50.49 environmental qualification (EQ) requirements	Degradation effects due to various aging mechanisms	Environmental qualification of electrical components	Yes. TLAA	Further evaluation is provided in LRA Subsection 3.6.2
3.6.1-2	Conductor insulation for electrical cables, connections and fuse holders	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure/ degradation of organics (Thermal/ thermoxidative), radiolysis and photolysis (UV sensitive materials only) of organics; radiation induced oxidation, and moisture intrusion	Electrical Cables And Connections Program	No	Consistent with NUREG-1801.

TABLE 3.6-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VI OF NUREG-1801 ELECTRICAL AND INSTRUMENTATION AND CONTROLS COMMODITY GROUPS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.6.1-3	Conductor insulation for electrical cables and connections used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (IR)	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure/ degradation of organics (Thermal/ thermoxidative), radiolysis and photolysis (UV sensitive materials only) of organics; radiation induced oxidation, and moisture intrusion	Electrical Cables And Connections Used in Instrumentation Circuits Program	No	Consistent with NUREG-1801.
3.6.1-4	Conductor insulation for inaccessible medium voltage (2kV to 35 kV) cables (e.g., installed in conduit or direct buried) not subject to 10 CFR 50.49 EQ requirements	Localized damage and breakdown of insulation leading to electrical failure due to moisture intrusion, water trees	Inaccessible Medium Voltage Cables Program	No	Consistent with NUREG-1801.
3.6.1-5	Pressurized water reactor only				
3.6.1-6	Fuse holders (not part of a larger assembly): Fuse holders – metallic clamp	Fatigue/ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation	Fuse Holders Program	No	Consistent with NUREG-1801.

TABLE 3.6-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VI OF NUREG-1801 ELECTRICAL AND INSTRUMENTATION AND CONTROLS COMMODITY GROUPS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.6.1-7	Metal enclosed bus – bus / connections	Loosening of bolted connections due to thermal cycling and ohmic heating	Metal Enclosed Bus Program	No	Consistent with NUREG-1801 with one exception. Inspections will be performed with the Startup Transformer major inspection once every 6 years instead of once every 5 years. See Appendix B.3.31.
3.6.1-8	Metal enclosed bus – insulation / insulators	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure/thermal/ thermoxidative degradation of organics/ thermoplastics, radiation-induced oxidation; moisture/debris intrusion, and ohmic heating	Metal Enclosed Bus Program	No	Consistent with NUREG-1801 with one exception. Inspections will be performed with the Startup Transformer major inspection once every 6 years instead of once every 5 years. See Appendix B.3.31.

TABLE 3.6-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VI OF NUREG-1801 ELECTRICAL AND INSTRUMENTATION AND CONTROLS COMMODITY GROUPS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.6.1-9	Metal enclosed bus – enclosure assemblies	Loss of material due to general corrosion	Structures Monitoring Program	No	Consistent with NUREG-1801.
3.6.1-10	Metal enclosed bus – enclosure assemblies	Hardening and loss of strength due to elastomer degradation	Structures Monitoring Program	No	Consistent with NUREG-1801.
3.6.1-11	High voltage insulators	Degradation of insulation quality due to presence of any salt deposits and surface contamination; Loss of material caused by mechanical wear due to wind blowing on transmission conductors	Plant Specific	Yes, plant specific	Further evaluation is provided in LRA Subsection 3.6.2
3.6.1-12	Transmission conductors and connections; switchyard bus and connections	Loss of material due to wind induced abrasion and fatigue; loss of conductor strength due to corrosion; increased resistance of connection due to oxidation or loss of preload	Plant Specific	Yes, plant specific	Further evaluation is provided in LRA Subsection 3.6.2

TABLE 3.6-1 (continued)
SUMMARY OF AGING MANAGEMENT EVALUATIONS IN CHAPTER VI OF NUREG-1801 ELECTRICAL AND INSTRUMENTATION AND CONTROLS COMMODITY GROUPS

Item Number	Component	Aging Effect / Mechanism	Aging Management Program	Further Evaluation Recommended	Discussion
3.6.1-13	Cable connections – metallic parts	Loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation	Electrical Connections Program	No	Not consistent with NUREG-1801. A plant-specific one-time inspection program (Electrical Connection Program) as an alternate to the NUREG-1801, XI.E6 program. This one-time inspection program will verify the absence of aging effects requiring management.
3.6.1-14	Fuse Holders (not part of a larger assembly) insulation material	None	None	N/A – no AEM or AMP	Consistent with NUREG-1801.

TABLE 3.6-2
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
ELECTRICAL AND INSTRUMENTATION AND CONTROL COMMODITY GROUPS

Commodity Group	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.6-1 Item	Notes
Cable Connections (Metallic Parts)	Electrically connect specified sections of an electrical circuit or deliver voltage, current or signal	Various conducting metals	Air/gas Atmosphere /weather	Loosening of connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion and oxidation	Electrical Connections Program	VI.A-1	3.6.1-13	E, 605
Electrical Cables and connections	Electrically connect specified sections of an electrical circuit or deliver voltage, current or signal	Various organic polymers Various conducting metals	Adverse localized environment caused by heat or radiation the presence of oxygen.	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR) and electrical failure due to thermal and radiological aging mechanisms	Electrical Cables And Connections Program	VI.A-2	3.6.1-2	A
Electrical Cables and connections (used in instrumentation circuits)	Electrically connect specified sections of an electrical circuit or deliver voltage, current or signal	Various organic polymers Various conducting metals	Adverse localized environment caused by heat or radiation in the presence of oxygen.	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR) and electrical failure due to thermal and radiological aging mechanisms	Electrical Cables And Connections Used in Instrumentation Circuits Program	VI.A-3	3.6.1-3	A

TABLE 3.6-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
ELECTRICAL AND INSTRUMENTATION AND CONTROL COMMODITY GROUPS

Commodity Group	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.6-1 Item	Notes
Electrical Cables (inaccessible medium voltage [2kV to 35 kV] cables installed in conduit or direct buried)	Electrically connect specified sections of an electrical circuit or deliver voltage, current or signal	Various organic polymers Various conducting metals	Adverse localized environment caused by exposure to moisture and voltage	Localized damage and breakdown of insulation leading to electrical failure due to moisture intrusion for medium voltage cables due to moisture aging mechanisms	Inaccessible Medium Voltage Cable Program	VI.A-4	3.6.1-4	A
Fuse holders (insulation)	Electrically connect specified sections of an electrical circuit or deliver voltage, current or signal	Various organic polymers	Adverse localized environment caused by heat the presence of oxygen or > 60-year service limiting temperature	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure due to thermal aging mechanisms	Electrical Cables and Connections Program	VI.A-6 VI.A-7	3.6.1-2	A
Fuse holders (metallic clamp)	Electrically connect specified sections of an electrical circuit or deliver voltage, current or signal	Various conducting metals	Air/gas	Fatigue/ohmic heating, thermal cycling and frequent manipulation	Fuse Holders Program	VI.A-8	3.6.1-6	A

TABLE 3.6-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
ELECTRICAL AND INSTRUMENTATION AND CONTROL COMMODITY GROUPS

Commodity Group	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.6-1 Item	Notes
High voltage insulators	Insulate and support an electrical conductor	Ceramics Various organic polymers Various conducting metals Galvanized metals Cement	Atmosphere /weather	None	None	VI.A-9 VI.A-10	3.6.1-11	I, 603
Metal Enclosed Bus (bus and connections)	Electrically connect specified sections of an electrical circuit to deliver voltage, current, or signal.	Various conducting metals	Air/gas Atmosphere /weather	Loosening of bolted connections due to thermal cycling and ohmic heating	Metal Enclosed Bus Program	VI.A-11	3.6.1-7	B, 602
Metal Enclosed Bus (enclosure assemblies)	Electrically connect specified sections of an electrical circuit to deliver voltage, current, or signal.	Elastomers	Air/gas Atmosphere /weather	Hardening and loss of strength/ elastomer degradation	Structures Monitoring Program	VI.A-12	3.6.1-10	A

TABLE 3.6-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
ELECTRICAL AND INSTRUMENTATION AND CONTROL COMMODITY GROUPS

Commodity Group	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.6-1 Item	Notes
Metal Enclosed Bus (enclosure assemblies)	Electrically connect specified sections of an electrical circuit to deliver voltage, current, or signal.	Various conducting metals	Air/gas Atmosphere /weather	Loss of material/general corrosion	Structures Monitoring Program	VI.A-13	3.6.1-9	A
Metal Enclosed Bus (insulation and insulators)	Electrically connect specified sections of an electrical circuit to deliver voltage, current, or signal.	Various organic polymers Ceramics Fiberglass conductor supports	Air/gas Atmosphere /weather	Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR) and electrical failure due to thermal aging mechanisms and debris intrusion	Metal Enclosed Bus Program	VI.A-14	3.6.1-8	B, 602
Switchyard bus and connections	Electrically connect specified sections of an electrical circuit to deliver voltage, current, or signal.	Various conducting metals	Atmosphere /weather	Increased resistance of connection due to oxidation or loss of preload	Electrical Connection Program	VI.A-15	3.6.1-12	E, 601

TABLE 3.6-2 (continued)
SUMMARY OF AGING MANAGEMENT REVIEW RESULTS
ELECTRICAL AND INSTRUMENTATION AND CONTROL COMMODITY GROUPS

Commodity Group	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Volume 2 Line Item	Table 3.6-1 Item	Notes
Transmission conductors and connections	Electrically connect specified sections of an electrical circuit or deliver voltage, current or signal	Various conducting metals	Atmosphere /weather	Increased resistance of connection due to oxidation or loss of preload	Electrical Connection Program	VI.A-16	3.6.1-12	E, 601
Electrical penetration assemblies	Electrically connect specified sections of an electrical circuit or deliver voltage, current or signal	Various organic polymers Various epoxies Glass cloth and fiber Potting boards	Adverse localized environment caused by moisture and voltage	Moisture intrusion degrading the epoxy insulation between conductors	Electrical Penetration Assembly Program	None	None	J, 604

NOTES FOR TABLE 3.6-2

A. Consistent with NUREG-1801 item for component, material, environment and aging effect. AMP is consistent with NUREG-1801 AMP.

B. Consistent with NUREG-1801 item for component, material, environment and aging effect. AMP takes some exceptions to NUREG-1801 AMP

C. Component is different, but consistent with NUREG-1801 item for material, environment and aging effect. AMP is consistent with NUREG-1801 AMP.

D. Component is different, but consistent with NUREG-1801 item for material, environment and aging effect. AMP takes some exceptions to NUREG-1801 AMP

E. Consistent with NUREG-1801 for material, environment and aging effect, but a different aging management program is credited.

F. Material not in NUREG-1801 for this component.

G. Environment not in NUREG-1801 for this component and material.

H. Aging effect not in NUREG-1801 for this component, material, and environment combination.

I. Aging effect in NUREG-1801 for this component, material and environment combination is not applicable.

J. Neither the component nor the material and environment combination is evaluated in NUREG-1801.

Plant-specific notes:

601. See Section 3.6.2.

602. An exception is taken to the inspection periodicity in the NUREG-1801 AMP. The DAEC performs this inspection on a 6 year period instead of a 5 year period. The major inspection on the Startup Transformer is performed on a 6 year period and the Metal Enclosed Bus Aging Management Program inspections are part of the Startup Transformer major inspection. No degradation has been identified on the inspections performed since the bus insulation was replaced (1992 and 1993).

603. See Section 3.6.2.

604. The DAEC has identified an aging effect requiring management for Electrical Penetration Assemblies that are not included in the Environmental Qualification Program. Moisture has degraded the epoxy insulation between conductors. The aging effect is managed by maintaining the electrical penetration assembly at a positive pressure.

605. The NRC has issued a draft revised XI.E6 Program in LR-ISG-2007-02 (draft for comments) that significantly changes the NUREG-1801 XI.E6 Program. Since an approved LR-ISG has not been issued, a site specific program was developed.

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 (IPA), which is described in Chapters 2.0 and 3.0 of this LRA. The second area of technical review is the identification and evaluation of time-limited aging analyses (TLAAs) and exemptions. The identifications and evaluations included in this section meet the requirements contained in 10 CFR 54.21(c) and provide the information necessary for the NRC to make the finding contained in 10 CFR 54.29(a)(2).

4.1 IDENTIFICATION OF TIME-LIMITED AGING ANALYSES

10 CFR 54.21(c)(1) requires a listing and an evaluation of TLAAs.
10 CFR 54.21(c)(2) requires a listing and evaluation of active plant-specific exemptions granted under 10 CFR 50.12 that are based on TLAAs as defined in 10 CFR 54.3(a).

TLAAs are defined in 10 CFR 54.3 as those licensee calculations and analyses that:

1. Involve systems, structures, and components within the scope of license renewal, as delineated in 10 CFR 54.4(a);
2. Consider the effects of aging;
3. Involve time-limited assumptions defined by the current operating term, for example, 40 years;
4. Were determined to be relevant by the licensee in making a safety determination;
5. Involve conclusions or provide the basis for conclusions related to the capability of the system, structure, and component to perform its intended functions, as delineated in 10 CFR 54.4(b); and
6. Are contained or incorporated by reference in the current licensing basis (CLB).

4.1.1 TIME-LIMITED AGING ANALYSES IDENTIFICATION PROCESS

Potential TLAAs can be identified by searching the current licensing basis for calculations/analyses that contain a time-sensitive element. They can also be identified by reviewing lists of previously identified TLAAs and choosing those generically applicable to Duane Arnold for further evaluation.

The CLB documentation that was searched to identify potential TLAAs includes the following:

- Updated Final Safety Analysis Report (UFSAR)
- Technical Specifications
- Technical Requirements Manual
- Docketed correspondence
- NRC safety evaluation reports
- Fire Protection Program documents
- Design Calculations and Reports

Industry documents that were reviewed to provide additional assurance of the completeness of the plant-specific list include:

- Generic Aging Lessons Learned Report, NUREG-1801, Vol. 2, Rev. 1
- Standard Review Plan for License Renewal, NUREG-1800, Chapter 4, Rev. 1
- NEI 95-10, Industry Guidance for Implementing the Requirements of 10 CFR 54 – the License Renewal Rule
- Boiling Water Reactor Vessel and Internals Program (BWRVIP) documents
- Boiling Water Reactor Owners Group (BWROG) generic technical reports, and
- Previously submitted License Renewal Applications and Requests for Information

4.1.2 EVALUATION OF TIME-LIMITED AGING ANALYSES

As required by 10 CFR 54.21(c)(1), an evaluation of DAEC-specific TLAA must be performed to demonstrate that:

i. The analyses remain valid for the period of extended operation.

ii. The analyses have been projected to the end of the period of 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 summarized in Table 4.1-1 and are discussed in Sections 4.2 through Section 4.7.

4.1.3 IDENTIFICATION OF 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 in effect based on time-limited aging analyses as defined in 10 CFR 54.3. Docketed NRC correspondence and other DAEC CLB documentation, identified in Section 4.1.1, were reviewed for exemptions.

No Duane Arnold-specific exemptions were identified as a result of this review that meet the definition of a TLAA as defined by 10 CFR 54.3.

TABLE 4.1-1
TIME-LIMITED AGING ANALYSES

Description	Disposition	Section
Reactor Pressure Vessel Neutron Embrittlement		
Reactor Vessel Upper Shelf Energy (USE) Reduction	10CFR54.21(c)(1)(ii)	4.2.2
Adjusted Reference Temperature (ART) Increase	10CFR54.21(c)(1)(ii)	4.2.3
Reflood Thermal Shock of the Reactor Pressure Vessel	10CFR54.21(c)(1)(ii)	4.2.4
Reactor Vessel Thermal Limit – Operating P-T Limits	10CFR54.21(c)(1)(ii)	4.2.5
Reactor Vessel Circumferential Weld Examination Relief	10CFR54.21(c)(1)(ii)	4.2.6
Metal Fatigue		
RPV Fatigue	10CFR54.21(c)(1)(iii)	4.3.1
Fatigue of Class 1 Piping	10CFR54.21(c)(1)(i) and (ii)	4.3.2
Irradiation Assisted Stress Corrosion Cracking	10CFR54.21(c)(1)(iii)	4.3.3
Stress Relaxation (Core Plate Rim Hold-down Bolts)	10CFR54.21(c)(1)(i)	4.3.4
Effects of Reactor Coolant Environment (GSI 190)	10CFR54.21(c)(1)(iii)	4.3.5
Environmental Qualification		
Environmental Qualification of Electrical Equipment (EQ)	10CFR54.21(c)(1)(iii)	4.4
Concrete Containment Tendon		
Concrete Containment Tendon Prestress Analysis	Not applicable for DAEC	4.5
Fatigue of Primary Containment, Piping, and Components		
Fatigue Analysis of Suppression Chamber	10CFR54.21(c)(1)(ii)	4.6.1
Fatigue Analysis of the Vent System and Vent Line Bellows	10CFR54.21(c)(1)(ii)	4.6.2
Fatigue Analysis of Suppression Chamber External Piping and Penetrations	10CFR54.21(c)(1)(ii)	4.6.3
Stress Report – Design Calculations Containment Vessel	10CFR54.21(c)(1)(ii)	4.6.4
Design Analyses of Flued Heads for Class 1 Penetrations	10CFR54.21(c)(1)(ii)	4.6.5

TABLE 4.1-1 (continued)
TIME-LIMITED AGING ANALYSES

Description	Disposition	Section
Other Plant Specific TLAAs		
Cranes – Reactor and Turbine Building	10CFR54.21(c)(1)(iii)	4.7.1
Evaluation of the Fatigue Life of the Stabilizer Assembly	10CFR54.21(c)(1)(ii)	4.7.2
Evaluation of Existing HCC-B002 “Dollar Weld” Indication	10CFR54.21(c)(1)(ii)	4.7.3
Evaluation of Thermal Fatigue Effects on Steam Lead and Inlet to RPV	10CFR54.21(c)(1)(ii)	4.7.4
Control Rod Drive Mechanism Fatigue	10CFR54.21(c)(1)(i) and (ii)	4.7.5
Main Steam Isolation Valve D Flaw Evaluation	10CFR54.21(c)(1)(i)	4.7.6
Bellows Design Analysis	10CFR54.21(c)(1)(i)	4.7.7

4.2 REACTOR PRESSURE VESSEL NEUTRON EMBRITTLEMENT

The materials of the RPV and internals are subject to embrittlement due to high energy (E > 1 MeV) neutron exposure. Embrittlement means the material has lower toughness (i.e., will absorb less strain energy during a crack or rupture), thus allowing a crack to propagate more easily under thermal and/or pressure loading.

Toughness (indirectly measured in foot-pounds of absorbed energy in a Charpy impact test) is temperature-dependent in ferritic materials. An initial nil-ductility reference temperature (RT_{NDT}), the temperature associated with the transition from ductile to brittle behavior, is determined for vessel materials through a combination of Charpy and drop weight testing. Toughness increases with temperature up to a maximum value called the “upper-shelf energy,” or USE. Neutron embrittlement causes an increase in the RT_{NDT} and a decrease in the USE of RPV steels. The increase or shift in the initial nil-ductility reference temperature (ΔRT_{NDT}) means higher temperatures are required for the material to continue to act in a ductile manner.

To reduce the potential for brittle fracture during RPV operation by accounting for the changes in material toughness as a function of neutron radiation exposure (fluence), operating Pressure/Temperature (P/T) limit curves are included in the DAEC Technical Specifications. The P/T curves account for the decrease in material toughness associated with a given fluence, which is used to predict the loss in toughness of the RPV materials. Based on the projected drop in toughness for a given fluence, the P/T curves are generated to provide a minimum temperature limit associated with the RPV pressure. The P/T curves are determined by the RT_{NDT} and ΔRT_{NDT} values for the licensed operating period along with appropriate margins.

The RPV ΔRT_{NDT} and USE, calculated on the basis of neutron fluence, are part of the licensing basis and support safety determinations. The increases in RT_{NDT} (ΔRT_{NDT}) affect the bases for relief from circumferential weld inspection and their associated supporting calculation of limiting axial weld conditional failure probability. Therefore, these calculations are TLAAs and are addressed in the following sections.

4.2.1 NEUTRON FLUENCE

To evaluate the effects of radiation on RPV material embrittlement, analyses were performed to determine neutron fluence for extended operation. Using actual reactor core power histories to-date and conservative estimates of future core designs, extended operation to 60 years will be bounded by 54 EFPY (90 percent capacity factor times 60 years).

High energy (>1 MeV) neutron fluence for the welds and shells of the RPV beltline region was calculated using the RAMA fluence methodology. The RAMA methodology was developed for the Electric Power Research Institute and the Boiling Water Reactor Vessel and Internals Project. Use of this methodology for evaluations of fluence for the DAEC was performed in accordance with guidelines presented in Regulatory Guide 1.190 (Reference 4.8.1), as recommended in NUREG-1800, Section 4. The NRC has reviewed and approved RAMA for BWR RPV fluence predictions (Letter from William H. Bateman (U. S. NRC) to Bill Eaton

(BWRVIP), Safety Evaluation of Proprietary EPRI Reports BWRVIP-114, -115, -117, and -121 and TWE-PSE-001-R-001, dated May 13, 2005).

Fluence values for various locations for the DAEC RPV are provided in Table 4.2.1-1, below.

Table 4.2.1-1

Maximum >1.0 MeV Neutron Fluence at 54 EFPY

RPV Beltline Vertical Welds, Circumferential Welds, Shells, and Nozzles

Location	**¼T Fluence (n/cm^2)**	**0T Fluence (n/cm^2)**
Weld D1, D2 (Shell Ring 1)	3.75E+18	4.90E+18
Weld E1, E2 (Shell Ring 2)	4.81E+18	6.29E+18
Weld DE (Shell 1-2)	4.47E+18	5.85E+18
Shell Ring 1	4.47E+18	5.85E+18
Shell Ring 2	5.74E+18	7.51E+18
Nozzle N16 (Instrumentation Nozzle)	2.21E+18	2.89E+18
Nozzle N2 (Recirculation Inlet Nozzle)	5.22E+17	6.82E+17

These fluence values were used in the TLAA evaluations that follow.

4.2.2 REACTOR VESSEL UPPER SHELF ENERGY REDUCTION

The regulations governing reactor vessel integrity are in 10 CFR 50. Section 50.60 requires that all light-water reactors meet the fracture toughness, pressure-temperature limits, and material surveillance program requirements for the reactor coolant pressure boundary as set forth in 10 CFR 50 Appendices G and H. The DAEC current licensing basis analyses evaluating reduction of fracture toughness of the reactor vessel for 40 years are TLAAs. The reactor vessel neutron embrittlement TLAA has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii) as summarized below. Fifty-four effective full-power years (EFPY) are projected for the end of the period of extended operation (60 years) based on an average capacity factor of 90%.

Appendix G of 10CFR50 requires that reactor vessel beltline materials "…have Charpy upper-shelf energy…of no less than 75 ft-lb (102 J) initially and must maintain Charpy upper-shelf energy throughout the life of the vessel of no less than 50 ft-lb (68 J)…" These bounding limits are addressed using the methodology defined by BWRVIP-74-A. RG 1.99 defines the method for predicting upper-shelf energy (USE) drop in terms of a percentage from the unirradiated value.

USE is the standard industry parameter used to indicate the maximum toughness of a material at high temperature. 10CFR50 Appendix G requires the predicted end-of-life Charpy impact test USE for RPV materials to be at least 50 ft-lb (absorbed energy), unless an approved analysis supports a lower value. The predicted USE drop is determined in accordance with NRC Regulatory Guide 1.99, Revision 2. For Boiling Water Reactors (BWRs) that cannot meet the 50 ft-lb criterion, the BWR Vessel and Internals Project (BWRVIP) has provided a bounding equivalent margins USE analysis for plants in BWRVIP-74-A, which is valid for up to 54 EFPY of operation.

Predicted USE drop for each RPV material in the beltline region exposed to fluence greater than $1.0x10^{17}$ n/cm^2 for 54 EFPY was determined in accordance with RG 1.99. In cases where the 50 ft-lb criterion cannot be met, or where USE data is absent, an equivalent margin analysis (EMA) using BWRVIP-74-A was performed.

The USE and equivalent margins assessments for DAEC materials are shown in Tables 4.2.2-1 through 4.2.2-12. As shown in Table 4.2.2-1, the projected USE value of the surveillance plate, heat number B0673-1 for 54 EFPY is greater than 50 ft-lbs, and therefore does not require an EMA; the other plates and welds require EMA. Tables 4.2.2-2 through 4.2.2-12 show that those plates and welds are bounded by the EMA per BWRVIP-74-A. Therefore, all DAEC materials are acceptable from a USE standpoint for 54 EFPY.

Disposition: 10 CFR 54.21(c)(1)(ii)

The analyses have been projected through the period of extended operation.

Table 4.2.2-1

DAEC USE Assessment for 54 EFPY

	Description	Code No.	Heat No.	Flux Type & Lot No.	%Cu	Unirradiated C_vUSE(1) (ft-lbs)	1/4t Fluence (n/cm^2)	% Drop in C_vUSE	C_vUSE @ 1/4t(2) (ft-lbs)	Requires EMA
Plates	**Shell Ring #1**									
	1-18	---	C6439-2	---	0.090	EMA(3)	4.47E+18		---	YES
	1-19	---	B0402-1	---	0.130	EMA(3)	4.47E+18	---	---	YES
	Shell Ring #2									
	1-20	---	B0436-2	---	0.150	EMA(3)	5.74E+18		---	YES
	1-21	---	B0673-1	---	0.150	158.1	5.74E+18	21.0	124.9	NO
Welds	**Lower**									
	D1,D2	---	432Z4521	Lot B020A27A	0.010	EMA(3)	3.75E+18	---	---	YES
	D1,D2	---	432Z0471	Lot B003A27A	0.030	EMA(3)	3.75E+18	---	---	YES
	Lower-Intermediate									
	E1,E2	---	432Z4521	Lot B020A27A	0.010	EMA(3)	4.81E+18	---	---	YES
	E1,E2	---	432Z0471	Lot B003A27A	0.030	EMA(3)	4.81E+18	---	---	YES
	Girth									
	DE	---	09L853	Lot 017A27A	0.030	EMA(3)	4.47E+18		---	YES
	DE	---	07L669	Lot K004A27A	0.030	EMA(3)	4.47E+18	---	---	YES
	DE	---	CTY538	Lot A027A27A	0.030	EMA(3)	4.47E+18	---	---	YES

(1) Initial USE for plate B0673-1 from BWRVIP-135 Revision 1.

(2) C_vUSE @ 1/4t calculated by the following formula: $Unirradiated C_v USE \times \frac{1 - \% Drop C_v USE}{100}$

(3) The unirradiated C_vUSE was not reported in BWRVIP-135 Revision 1, and Equivalent Margin Analysis was reported in RVID2. Assesment for this material in accordance with BWRVIP-74-A will therefore be performed.

Table 4.2.2-2

DAEC EMA for Plate Shell Ring #1 Piece 1-18 for 54 EFPY

BWR/3-6 Plate
(Shell Ring #1 1-18, Heat No. C6439-2)

Surveillance Plate USE: DA 288° Capsule*

%Cu =	0.15	
Capsule Fluence =	0.49×10^{18} n/cm^2	
Measured % Decrease =	-0.4 (increase)	(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	12.0	(R.G. 1.99, Figure 2)

Surveillance Plate USE: DA 36° Capsule*

%Cu =	0.15	
Capsule Fluence =	1.1×10^{18} n/cm^2	
Measured % Decrease =	13.3	(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	14.5	(RG1.99, Figure 2)

Surveillance Plate USE: SSP F*

%Cu =	0.15	
Capsule Fluence =	1.87×10^{18} n/cm^2	
Measured % Decrease =	15.9	(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	16.5	(RG1.99, Figure 2)

* All above surveillance values obtained from Appendix A-3 of BWRVIP-135 Revision 1.

Plate Shell Ring #1 Piece 1-18 USE :

%Cu =	0.09	
54 EFPY Peak ID Fluence =	5.85×10^{18} n/cm^2	
54 EFPY 1/4t Fluence =	4.47×10^{18} n/cm^2	
R.G. 1.99 Predicted % Decrease =	15.7	
Adjusted % Decrease =	N/A	(RG1.99, Position 2.2)

15.7% ≤ 23.5%, so vessel plates are bounded by Equivalent Margin Analysis (EMA).

Table 4.2.2-3

DAEC EMA for Plate Shell Ring #1 Piece 1-19 for 54 EFPY

BWR/3-6 Plate
(Shell Ring #1 1-19, Heat No. B0402-1)

Surveillance Plate USE: DA 288° Capsule*

%Cu =	0.15		
Capsule Fluence =	0.49×10^{18}	n/cm^2	
Measured % Decrease =	-0.4 (increase)		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	12.0		(R.G. 1.99, Figure 2)

Surveillance Plate USE: DA 36° Capsule*

%Cu =	0.15		
Capsule Fluence =	1.1×10^{18}	n/cm^2	
Measured % Decrease =	13.3		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	14.5		(RG1.99, Figure 2)

Surveillance Plate USE: SSP F*

%Cu =	0.15		
Capsule Fluence =	1.87×10^{18}	n/cm^2	
Measured % Decrease =	15.9		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	16.5		(RG1.99, Figure 2)

* All above surveillance values obtained from Appendix A-3 of BWRVIP-135 Revision 1.

Plate Shell Ring #1 Piece 1-19 USE :

%Cu =	0.13		
54 EFPY Peak ID Fluence =	5.85×10^{18}	n/cm^2	
54 EFPY 1/4t Fluence =	4.47×10^{18}	n/cm^2	
R.G. 1.99 Predicted % Decrease =	18.2		
Adjusted % Decrease =	N/A		(RG1.99, Position 2.2)

18.2% ≤ 23.5%, so vessel plates are bounded by Equivalent Margin Analysis (EMA).

Table 4.2.2-4

DAEC EMA for Plate Shell Ring #2 Piece 1-20 for 54 EFPY

BWR/3-6 Plate
(Shell Ring #2 1-20, Heat No. B0436-2)

Surveillance Plate USE: DA 288° Capsule*

%Cu =	0.15		
Capsule Fluence =	0.49×10^{18}	n/cm^2	
Measured % Decrease =	-0.4 (increase)		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	12.0		(R.G. 1.99, Figure 2)

Surveillance Plate USE: DA 36° Capsule*

%Cu =	0.15		
Capsule Fluence =	1.1×10^{18}	n/cm^2	
Measured % Decrease =	13.3		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	14.5		(RG1.99, Figure 2)

Surveillance Plate USE: SSP F*

%Cu =	0.15		
Capsule Fluence =	1.87×10^{18}	n/cm^2	
Measured % Decrease =	15.9		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	16.5		(RG1.99, Figure 2)

* All above surveillance values obtained from Appendix A-3 of BWRVIP-135 Revision 1.

Plate Shell Ring #1 Piece 1-20 USE :

%Cu =	0.15		
54 EFPY Peak ID Fluence =	7.51×10^{18}	n/cm^2	
54 EFPY 1/4t Fluence =	5.74×10^{18}	n/cm^2	
R.G. 1.99 Predicted % Decrease =	21.0		
Adjusted % Decrease =	N/A		(RG1.99, Position 2.2)

21% ≤ 23.5%, so vessel plates are bounded by Equivalent Margin Analysis (EMA).

Table 4.2.2-5

DAEC EMA for Plate Shell Ring #2 Piece 1-21 for 54 EFPY

BWR/3-6 Plate
(Shell Ring #2 1-21, Heat No. B0673-1)

Surveillance Plate USE: DA 288° Capsule*

%Cu =	0.15		
Capsule Fluence =	0.49×10^{18}	n/cm^2	
Measured % Decrease =	-0.4 (increase)		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	12.0		(R.G. 1.99, Figure 2)

Surveillance Plate USE: DA 36° Capsule*

%Cu =	0.15		
Capsule Fluence =	1.1×10^{18}	n/cm^2	
Measured % Decrease =	13.3		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	14.5		(RG1.99, Figure 2)

Surveillance Plate USE: SSP F*

%Cu =	0.15		
Capsule Fluence =	1.87×10^{18}	n/cm^2	
Measured % Decrease =	15.9		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	16.5		(RG1.99, Figure 2)

* All above surveillance values obtained from Appendix A-3 of BWRVIP-135 Revision 1.

Plate Shell Ring #1 Piece 1-21 USE :

%Cu =	0.15		
54 EFPY Peak ID Fluence =	7.51×10^{18}	n/cm^2	
54 EFPY 1/4t Fluence =	5.74×10^{18}	n/cm^2	
R.G. 1.99 Predicted % Decrease =	21.0		
Adjusted % Decrease =	N/A		(RG1.99, Position 2.2)

21% ≤ 23.5%, so vessel plates are bounded by Equivalent Margin Analysis (EMA).

Table 4.2.2-6

DAEC EMA for Weld D1, D2, Heat Number 432Z4521 for 54 EFPY

BWR/2-6 Weld
(Lower Shell Welds D1,D2, Heat No. 432Z4521)

Surveillance Weld USE: DA1 288° Capsule*

%Cu =	0.02		
Capsule Fluence =	0.49×10^{18}	n/cm^2	
Measured % Decrease =	-2.7 (increase)		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	8.0		(R.G. 1.99, Figure 2)

Surveillance Weld USE: DA1 36° Capsule*

%Cu =	0.02		
Capsule Fluence =	1.10×10^{18}	n/cm^2	
Measured % Decrease =	3.4		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	12.0		(RG1.99, Figure 2)

Surveillance Weld USE: SSP Capsule F*

%Cu =	0.02		
Capsule Fluence =	1.93×10^{18}	n/cm^2	
Measured % Decrease =	0.0		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	13.0		(R.G. 1.99, Figure 2)

* All above surveillance values obtained from Appendix B-5 of BWRVIP-135 Revision 1.

Lower Weld D1,D2 USE:

%Cu =	0.01		
54 EFPY Peak ID Fluence =	4.90×10^{18}	n/cm^2	
54 EFPY 1/4t Fluence =	3.75×10^{18}	n/cm^2	
R.G. 1.99 Predicted % Decrease =	15.0		
Adjusted % Decrease =	N/A		(RG1.99, Position 2.2)

15% ≤ 39%, so vessel welds are bounded by Equivalent Margin Analysis (EMA).

Table 4.2.2-7

DAEC EMA for Weld D1, D2, Heat Number 432Z0471 for 54 EFPY

BWR/2-6 Weld
(Lower Shell Welds D1,D2, Heat No. 432Z0471)

Surveillance Weld USE: DA1 288° Capsule*

%Cu =	0.02		
Capsule Fluence =	0.49×10^{18}	n/cm^2	
Measured % Decrease =	-2.7 (increase)		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	8.0		(R.G. 1.99, Figure 2)

Surveillance Weld USE: DA1 36° Capsule*

%Cu =	0.02		
Capsule Fluence =	1.10×10^{18}	n/cm^2	
Measured % Decrease =	3.4		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	12.0		(RG1.99, Figure 2)

Surveillance Weld USE: SSP Capsule F*

%Cu =	0.02		
Capsule Fluence =	1.93×10^{18}	n/cm^2	
Measured % Decrease =	0.0		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	13.0		(R.G. 1.99, Figure 2)

* All above surveillance values obtained from Appendix B-5 of BWRVIP-135 Revision 1.

Lower Weld D1,D2 USE:

%Cu =	0.03		
54 EFPY Peak ID Fluence =	4.90×10^{18}	n/cm^2	
54 EFPY 1/4t Fluence =	3.75×10^{18}	n/cm^2	
R.G. 1.99 Predicted % Decrease =	15.0		
Adjusted % Decrease =	N/A		(RG1.99, Position 2.2)

15% ≤ 39%, so vessel welds are bounded by Equivalent Margin Analysis (EMA).

Table 4.2.2-8

DAEC EMA for Weld E1, E2, Heat Number 432Z4521 for 54 EFPY

BWR/2-6 Weld
(Lower-Intermediate Shell Welds E1,E2, Heat No. 432Z4521)

Surveillance Weld USE: DA1 288° Capsule*

%Cu =	0.02		
Capsule Fluence =	0.49×10^{18}	n/cm^2	
Measured % Decrease =	-2.7 (increase)		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	8.0		(R.G. 1.99, Figure 2)

Surveillance Weld USE: DA1 36° Capsule*

%Cu =	0.02		
Capsule Fluence =	1.10×10^{18}	n/cm^2	
Measured % Decrease =	3.4		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	12.0		(RG1.99, Figure 2)

Surveillance Weld USE: SSP Capsule F*

%Cu =	0.02		
Capsule Fluence =	1.93×10^{18}	n/cm^2	
Measured % Decrease =	0.0		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	13.0		(R.G. 1.99, Figure 2)

* All above surveillance values obtained from Appendix B-5 of BWRVIP-135 Revision 1.

Lower-Intermediate Weld E1,E2 USE:

%Cu =	0.01		
54 EFPY Peak ID Fluence =	6.29×10^{18}	n/cm^2	
54 EFPY 1/4t Fluence =	4.81×10^{18}	n/cm^2	
R.G. 1.99 Predicted % Decrease =	15.9		
Adjusted % Decrease =	N/A		(RG1.99, Position 2.2)

15.9% ≤ 39%, so vessel welds are bounded by Equivalent Margin Analysis (EMA).

Table 4.2.2-9

DAEC EMA for Weld E1, E2, Heat Number 432Z0471 for 54 EFPY

BWR/2-6 Weld
(Lower-Intermediate Shell Welds E1,E2, Heat No. 432Z0471)

<u>Surveillance Weld USE: DA1 288° Capsule*</u>

%Cu =	0.02		
Capsule Fluence =	0.49×10^{18}	n/cm^2	
Measured % Decrease =	-2.7 (increase)		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	8.0		(R.G. 1.99, Figure 2)

<u>Surveillance Weld USE: DA1 36° Capsule*</u>

%Cu =	0.02		
Capsule Fluence =	1.10×10^{18}	n/cm^2	
Measured % Decrease =	3.4		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	12.0		(RG1.99, Figure 2)

<u>Surveillance Weld USE: SSP Capsule F*</u>

%Cu =	0.02		
Capsule Fluence =	1.93×10^{18}	n/cm^2	
Measured % Decrease =	0.0		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	13.0		(R.G. 1.99, Figure 2)

* All above surveillance values obtained from Appendix B-5 of BWRVIP-135 Revision 1.

<u>Lower-Intermediate Weld E1,E2 USE:</u>

%Cu =	0.03		
54 EFPY Peak ID Fluence =	6.29×10^{18}	n/cm^2	
54 EFPY 1/4t Fluence =	4.81×10^{18}	n/cm^2	
R.G. 1.99 Predicted % Decrease =	15.9		
Adjusted % Decrease =	N/A		(RG1.99, Position 2.2)

15.9% ≤ 39%, so vessel welds are bounded by Equivalent Margin Analysis (EMA).

Table 4.2.2-10

DAEC EMA for Weld DE, Heat Number 09L853 for 54 EFPY

BWR/2-6 Weld
(Girth Welds DE, Heat No. 09L853)

Surveillance Weld USE: DA1 288° Capsule*

%Cu =	0.02		
Capsule Fluence =	0.49×10^{18}	n/cm^2	
Measured % Decrease =	-2.7 (increase)		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	8.0		(R.G. 1.99, Figure 2)

Surveillance Weld USE: DA1 36° Capsule*

%Cu =	0.02		
Capsule Fluence =	1.10×10^{18}	n/cm^2	
Measured % Decrease =	3.4		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	12.0		(RG1.99, Figure 2)

Surveillance Weld USE: SSP Capsule F*

%Cu =	0.02		
Capsule Fluence =	1.93×10^{18}	n/cm^2	
Measured % Decrease =	0.0		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	13.0		(R.G. 1.99, Figure 2)

* All above surveillance values obtained from Appendix B-5 of BWRVIP-135 Revision 1.

Girth Weld DE USE:

%Cu =	0.03		
54 EFPY Peak ID Fluence =	5.85×10^{18}	n/cm^2	
54 EFPY 1/4t Fluence =	4.47×10^{18}	n/cm^2	
R.G. 1.99 Predicted % Decrease =	15.7		
Adjusted % Decrease =	N/A		(RG1.99, Position 2.2)

15.7% ≤ 39%, so vessel welds are bounded by Equivalent Margin Analysis (EMA).

Table 4.2.2-11

DAEC EMA for Weld DE, Heat Number 07L669 for 54 EFPY

BWR/2-6 Weld
(Girth Welds DE, Heat No. 07L669)

Surveillance Weld USE: DA1 288° Capsule*

%Cu =	0.02		
Capsule Fluence =	0.49×10^{18}	n/cm^2	
Measured % Decrease =	-2.7 (increase)		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	8.0		(R.G. 1.99, Figure 2)

Surveillance Weld USE: DA1 36° Capsule*

%Cu =	0.02		
Capsule Fluence =	1.10×10^{18}	n/cm^2	
Measured % Decrease =	3.4		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	12.0		(RG1.99, Figure 2)

Surveillance Weld USE: SSP Capsule F*

%Cu =	0.02		
Capsule Fluence =	1.93×10^{18}	n/cm^2	
Measured % Decrease =	0.0		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	13.0		(R.G. 1.99, Figure 2)

* All above surveillance values obtained from Appendix B-5 of BWRVIP-135 Revision 1.

Girth Weld DE USE:

%Cu =	0.03		
54 EFPY Peak ID Fluence =	5.85×10^{18}	n/cm^2	
54 EFPY 1/4t Fluence =	4.47×10^{18}	n/cm^2	
R.G. 1.99 Predicted % Decrease =	15.7		
Adjusted % Decrease =	N/A		(RG1.99, Position 2.2)

15.7% ≤ 39%, so vessel welds are bounded by Equivalent Margin Analysis (EMA).

Table 4.2.2-12

DAEC EMA for Weld DE, Heat Number CTY538 for 54 EFPY

BWR/2-6 Weld
(Girth Welds DE, Heat No. CTY538)

Surveillance Weld USE: DA1 288° Capsule*

%Cu =	0.02		
Capsule Fluence =	0.49×10^{18}	n/cm^2	
Measured % Decrease =	-2.7 (increase)		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	8.0		(R.G. 1.99, Figure 2)

Surveillance Weld USE: DA1 36° Capsule*

%Cu =	0.02		
Capsule Fluence =	1.10×10^{18}	n/cm^2	
Measured % Decrease =	3.4		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	12.0		(RG1.99, Figure 2)

Surveillance Weld USE: SSP Capsule F*

%Cu =	0.02		
Capsule Fluence =	1.93×10^{18}	n/cm^2	
Measured % Decrease =	0.0		(Charpy Curves)
R.G. 1.99 Predicted % Decrease =	13.0		(R.G. 1.99, Figure 2)

* All above surveillance values obtained from Appendix B-5 of BWRVIP-135 Revision 1.

Girth Weld DE USE:

%Cu =	0.03		
54 EFPY Peak ID Fluence =	5.85×10^{18}	n/cm^2	
54 EFPY 1/4t Fluence =	4.47×10^{18}	n/cm^2	
R.G. 1.99 Predicted % Decrease =	15.7		
Adjusted % Decrease =	N/A		(RG1.99, Position 2.2)

15.7% ≤ 39%, so vessel welds are bounded by Equivalent Margin Analysis (EMA).

4.2.3 ADJUSTED REFERENCE TEMPERATURE INCREASE

The adjusted reference temperature (ART) of the limiting beltline material is used to adjust the beltline P-T curves to account for irradiation effects. RG 1.99 provides the methods for determining the ART. The RG 1.99 methods for determining the limiting material and adjusting the P-T curves using ART are discussed in this section.

The initial RT_{NDT}, nil-ductility reference temperature, is the temperature at which a non-irradiated metal (ferritic steel) changes in fracture characteristics going from ductile to brittle behavior. Neutron embrittlement raises the nil-ductility reference temperature. 10 CFR 50 Appendix G defines the fracture toughness requirements for the life of the vessel. The shift to the initial nil-ductility reference temperature (ΔRT_{NDT}) is evaluated as the difference in the 30 ft-lb index temperatures from the average Charpy curves measured before and after irradiation. This increase (ΔRT_{NDT}) means that higher temperatures are required for the material to continue to act in a ductile manner. The ART is defined as RT_{NDT} + ΔRT_{NDT} + margin. The margin is defined in RG 1.99. The P-T curves are developed from the ART for the RPV materials. These are determined by the unirradiated RT_{NDT} and by the ΔRT_{NDT} calculations for the licensed operating period. RG 1.99 defines the calculation methods for ΔRT_{NDT}, ART, and end-of-life USE.

The DAEC adjusted reference temperature (ART) values are shown in Table 4.2.3-1. The calculations were performed in accordance with Regulatory Guide (RG) 1.99, Revision 2.

ART values for 54 EFPY (corresponding to 60 years) are below the 200ºF suggested in Regulatory Guide 1.99 and are, therefore, acceptable for the period of extended operation.

Disposition: 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation.

Table 4.2.3-1

DAEC ART Calculations for 54 EFPY

	Description	Code No.	Heat No.	Flux Type & Lot No.	Initial RT_{NDT} (°F)	Chemistry		Chemistry Factor (d)	Adjustments For 1/4t			
									ΔRT_{NDT}	Margin Terms		ART_{NDT}
						Cu (wt %)	Ni (wt %)	(°F)	(°F)	σ_{Δ} (°F)	σ_{I} (°F)	(°F)
Plates	**Shell Ring #1**											
	1-18		C6439-2		40	0.090	0.510	58.00	45.02	17.00	0.00	119.0
	1-19		B0402-1		40	0.130	0.470	87.10	67.61	17.00	0.00	141.6
	Shell Ring #2											
	1-20		B0436-2		10	0.150	0.640	111.00	93.78	17.00	0.00	137.8
	1-21		B0673-1(a)		10	0.150	0.65 (c)	148.71	125.64	8.50	0.00	152.6

	Description	Code No.	Heat No.	Flux Type & Lot No.	Initial RT_{NDT} (°F)	Chemistry		Chemistry Factor (d)	Adjustments For 1/4t			
									ΔRT_{NDT}	Margin Terms		ART_{NDT}
						Cu (wt %)	Ni (wt %)	(°F)	(°F)	σ_{Δ} (°F)	σ_{I} (°F)	(°F)
Welds	**Lower**											
	D1,D2		432Z4521	Lot B020A27A	-50	0.010	0.980	20.00	14.57	7.29	0.00	-20.9
	D1,D2		432Z0471	Lot B003A27A	-50	0.030	0.910	41.00	29.87	14.94	0.00	9.7
	Lower-Intermediate											
	E1,E2		432Z4521	Lot B020A27A	-50	0.010	0.980	20.00	15.92	7.96	0.00	-18.2
	E1,E2		432Z0471	Lot B003A27A	-50	0.030	0.910	41.00	32.64	16.32	0.00	15.3
	Girth											
	DE		09L853	Lot L017A27A	-50	0.030	0.880	41.00	31.83	15.91	0.00	13.7
	DE		07L669	Lot K004A27A	-50	0.030	1.020	41.00	31.83	15.91	0.00	13.7
	DE		CTY538	Lot A027A27A	-50	0.030	0.830	41.00	31.83	15.91	0.00	13.7

	Description	Code No.	Heat No.	Plate Location	Initial RT_{NDT} (°F)	Chemistry		Chemistry Factor	Adjustments For 1/4t			
									ΔRT_{NDT}	Margin Terms		ART_{NDT}
						Cu (wt %)	Ni (wt %)	(°F)	(°F)	σ_{Δ} (°F)	σ_{I} (°F)	(°F)
Nozzles	Nozzle N16		Q2Q5VW (b)		40	0.180	0.850	141.75	84.14	17.00	0.00	158.1
	Nozzle N2		Q2Q6VW (b)		40	0.180	0.840	141.60	42.40	17.00	0.00	116.4

Fluence Data

	Location	Wall Thickness (in.)		Fluence at ID	Attenuation, 1/4t	Fluence @ 1/4t	Fluence Factor, FF
		Full	1/4t	(n/cm^2)	$e^{-0.24x}$	(n/cm^2)	$f^{(0.28-0.10\log f)}$
Plates	**Shell Ring #1**						
	1-18	4.469	1.117	5.85E+18	0.765	4.47E+18	0.7762
	1-19	4.469	1.117	5.85E+18	0.765	4.47E+18	0.7762
	Shell Ring #2						
	1-20	4.469	1.117	7.51E+18	0.765	5.74E+18	0.8448
	1-21	4.469	1.117	7.51E+18	0.765	5.74E+18	0.8448
Welds	**Lower**						
	D1,D2	4.469	1.117	4.90E+18	0.765	3.75E+18	0.7286
	D1,D2	4.469	1.117	4.90E+18	0.765	3.75E+18	0.7286
	Lower-Intermediate						
	E1,E2	4.469	1.117	6.29E+18	0.765	4.81E+18	0.7960
	E1,E2	4.469	1.117	6.29E+18	0.765	4.81E+18	0.7960
	Girth						
	DE	4.469	1.117	5.85E+18	0.765	4.47E+18	0.7762
	DE	4.469	1.117	5.85E+18	0.765	4.47E+18	0.7762
	DE	4.469	1.117	5.85E+18	0.765	4.47E+18	0.7762
Nozzles	Nozzle N16	4.469	1.117	2.89E+18	0.765	2.21E+18	0.5936
	Nozzle N2	4.469	1.117	6.82E+17	0.765	5.22E+17	0.2995

(a) Material in the surveillance program with adjusted CF in accordance with BWRVIP-135 Revision 1.
(b) Estimated copper in accordance with GE Report GE-NE-A22-00100-08-01-R2, Revision 2.
(c) Best-estimate nickel from all available data in BWRVIP-135 Revision 1.
(d) CF values do not include the ratio procedures adjustments in RVID. These adjustments are not required by RG1.99, Revision 2.

4.2.4 REFLOOD THERMAL SHOCK OF THE REACTOR PRESSURE VESSEL

GE Report No. NEDO-10029 addressed the concern for brittle fracture of the RPV due to reflood following a postulated LOCA. The thermal shock analysis documented in the report assumed a design basis LOCA followed by a LPCI accounting for the full effects of neutron embrittlement at the end of 40 years. The analysis showed that the total maximum vessel irradiation (E> 1 MeV) at the mid-core inside of the vessel would be 2.4×10^{17} n/cm^2, which was considered to be below the threshold level of any nil-ductility temperature shift for the RPV material. As a result, it was concluded that the irradiation effects on all locations of the RPV could be ignored. This analysis bounded only 40 years of operation.

NEDO-10029 is included in DAEC UFSAR Table 1.6-1, which lists GE topical reports submitted to the NRC. Therefore, reflood thermal shock of the RPV is considered a TLAA for the DAEC.

Since the time of the NEDO-10029 analysis, another analysis has been performed for BWR-6 vessels. The more recent analysis is appropriate for the DAEC RPV because it evaluates the bounding LOCA event, a main steam line break, for a BWR vessel design that is similar to the DAEC vessel. The DAEC vessel inside diameter is appreciably smaller than the BWR-6 vessel sizes evaluated in the BWR-6 analysis, and the DAEC vessel beltline has a wall thickness less than that evaluated in the BWR-6 analysis. Therefore, the temperature change (cooldown) due to the reflood event at the 1/4T depth would potentially be greater for the DAEC vessel than that of the BWR-6 vessel; therefore, the more recent BWR-6 analysis was re-evaluated for the DAEC BWR-4 reactor vessel.

The BWR-6 analysis results in a peak stress intensity factor, K, at 1/4T of approximately 100 ksi√inch. For the DAEC, the re-evaluation showed that the allowable material fracture toughness resides on the upper shelf of 200 ksi√inch. The bounding applied stress intensity factor, K, for DAEC of 100 ksi√inch is less than the available fracture toughness of 200 ksi√inch after 54 EFPY (corresponding to 60 years), which is acceptable.

Disposition: 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation.

4.2.5 REACTOR VESSEL THERMAL LIMIT – OPERATING PRESSURE-TEMPERATURE LIMITS

10 CFR Part 50 Appendix G requires RPV thermal limit analyses to determine operating pressure-temperature (P-T) limits for boltup, hydrostatic test, pressure tests and normal operating and anticipated operational occurrences.

The current DAEC Technical Specifications contain P-T limit curves for heat up, cooldown, and in-service leakage and hydrostatic testing and also limits the maximum rate of change of reactor coolant temperature. The criticality curves provide limits for both heat up and criticality calculated for a 32 EFPY operating period. The P-T curves were developed to present steam dome pressure versus minimum vessel metal temperature Incorporating appropriate non-beltline limits and irradiation embrittlement effects in the beltline. The methodology used to generate the current P-T curves included the incorporation of ASME Code Case N-640. The fluence was calculated in accordance with GE Licensing Topical Report NEDC-32983P, which has been approved by the NRC and is in compliance with Regulatory Guide 1.190.

Revised P/T curves were created for 32 and 54 effective full power years (EFPY) of operation, using the methodology of the 2001 Edition, 2003 Addenda of ASME Code, Section XI, Appendix G, and 10CFR50 Appendix G. As discussed previously, 54 EFPY corresponds to 60 years at 90 percent capacity factor. The curves were developed in accordance with the methodology of the Boiling Water Reactor Owners' Group (BWROG) Licensing Topical Report, "Pressure Temperature Limits Report Methodology for Boiling Water Reactors" Structural Integrity Associates Report No. SIR-05-044-A, Revision 0, "Pressure-Temperature Limits Report Methodology for Boiling Water Reactors," April 2007. Fluence was determined, as previously discussed, using NRC-approved RAMA methodology. The full set of P-T curves (i.e. Pressure Test, Normal Operation Core Not Critical, and Normal Operation Core Critical) are evaluated for all DAEC reactor pressure vessel (RPV) regions, which are consolidated into three evaluated regions: (1) the beltline, (2) the bottom head, and (3) the feedwater nozzle/upper vessel.

Pressure Temperature Limits for the Reactor Coolant System are currently specified in Technical Specification 3.4.9. Prior to exceeding 32 EFPY, DAEC will incorporate appropriate changes to reflect the higher neutron exposure.

Nozzles N-2 and N-16 are located in the RPV beltline region where the fluence exceeds $1.0\text{x}10^{17}$ n/cm^2. Consideration was given to the determination of the location that would be more controlling from a P-T curve perspective - the limiting RPV beltline plate location (i.e., where the ART is highest, but there is no stress concentration effect of nozzles or discontinuities) or the RPV beltline plate locations where the nozzles are located (i.e., where the ART values are lower but there are stress concentration effects due to the presence of the nozzles). In order to establish which location is more limiting from a P-T curve point of view, two P-T curves were developed: (1) a P-T curve for the limiting beltline plate location using the highest plate ART and no stress concentration effect, and (2) a P-T curve for the limiting nozzle with stress concentration effects. Although the N-16 ART value is slightly higher than that of the N-2 nozzle, the limiting nozzle is determined by examining the thermal transients for each. The N-16 nozzle does not have any significant cycling. Therefore, the N-2 nozzle is considered the limiting nozzle. The upper vessel and beltline nozzles require stress coefficients to calculate stress intensity factors. The stress intensity factors for the feedwater nozzle was calculated from output of a detailed finite element analysis (FEM) using ANSYS. The feedwater and N-2 nozzles, although not identical, are similar. This allows the FEM developed for the feedwater nozzle to be used to determine the pressure stress coefficients for the N-2 nozzle, so long as conservative scaling factors are applied to account for geometric differences.

Disposition: 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation.

4.2.6 REACTOR VESSEL CIRCUMFERENTIAL WELD EXAMINATION RELIEF

ASME Section XI governs inspection of the RPV circumferential welds, as implemented by the DAEC Inservice Inspection Program. These welds are required to be inspected at regular intervals described in Table IWB-2500-1 of Section XI. DAEC has received inspection relief for the circumferential welds for the time remaining in the 40 year licensed operating period; this inspection relief is based upon NRC Generic Letter (GL) 98-05.

Relief from RPV circumferential weld examination requirements under GL 98-05 is based on probabilistic assessments that predict an acceptably low probability of failure per reactor operating year. The analysis is based on RPV metallurgical conditions as well as flaw indication sizes and frequencies of occurrence that are expected at the end of a licensed operating period. The basis for this relief request was an analysis that satisfied the limiting conditional failure probability for the circumferential welds at the expiration of the current license, based on BWRVIP-05 and the extent of neutron embrittlement. The anticipated changes in metallurgical conditions expected over the extended licensed operating period require an additional analysis for 54 EFPY (corresponding to 60 years) and approval by the NRC to extend this relief request.

To address this TLAA, an evaluation was performed based on the methodology presented in EPRI Report No. TR-105697, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations (BWRVIP-05).

There is one circumferential weld, DE (VCB-A2), in the beltline region. Four axial welds, (E1 (VLB-A2), E2 (VLB-A1), D1 (VLA-A1), and D2 (VLA-A2)), have at least a portion of their length in the beltline region. Only the portions of welds within the beltline region are subjected to significant neutron fluence from the reactor core; neutron fluence on the welds outside the beltline regions is considered insignificant.

The probability of failure (PoF) due to a limiting event (i.e., low temperature over-pressurization, or LTOP) was estimated for the case of 90% axial weld inspection (based on actual weld inspection coverage achieved in previous examinations). PoF results were calculated for 60 years (54 EFPY) for the RPV beltline axial welds and the beltline circumferential weld, including the consideration of the LTOP occurrence probability of $1x10^{-3}$ per year. The PoF for the beltline circumferential weld due to an LTOP event is $1.5x10^{-9}$ at 60 years (54 EFPY) and $2.5x10^{-11}$ per year. The $1.5x10^{-9}$ value is less than the value of $1.78x10^{-5}$ for the CB&I plant in the Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC No. M93925), July 1998. The $1.78x10^{-5}$ value reported in the Final Safety Evaluation is for 64 EFPY. Using the value of $2.0x10^{-7}$ in the Final Safety Evaluation for 32 EFPY and interpolating to obtain the 54 EFPY value results in a value of $1.23x10^{-5}$. The $1.5x10^{-9}$ value is less than this interpolated value of $1.23x10^{-5}$. The difference between the two inspection coverage cases (0% and 90%) at the circumferential weld is $5.0x10^{-11}$ probability of failure event per year. This difference is less than the $1x10^{-6}$ per year requirement as specified in Regulatory Guide 1.174. The PoF for both 0% and 90% inspection coverage for the DAEC beltline circumferential weld remains essentially the same. The PoF for the circumferential welds is below that calculated in the Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC No. M93925), July, 1998. The DAEC inspection coverage on axial welds satisfies ASME Code requirements. The probability of failure event for the beltline axial welds due to an LTOP event is 2.24×10^{-7} at 60 years (54 EFPY) and 3.74×10^{-9} per year for 90% inspection; this is well below the probability of 5×10^{-6} quoted in the Supplement to Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC No. MA3395), March 7, 2000. The 3.74×10^{-9} probability for axial weld failure includes an LTOP frequency of 1×10^{-3} per year.

These results justify the elimination of the RPV circumferential weld examination in the vessel beltline region to the end of the extended period of operation (60 years or 54 EFPY).

The procedures and training used to limit reactor pressure vessel cold over-pressure events will be the same as those approved by the NRC when the DAEC requested approval of the BWRVIP-05 technical alternative for the term of the current operating license. A request for extension for the 60-year extended operating period will be submitted to the NRC prior to the period of extended operation.

Disposition: 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation.

4.3 METAL FATIGUE

Fatigue is the progressive localized permanent structural change that occurs in a material subjected to repeated or fluctuating strains at nominal stresses having maximum values often much less than the tensile strength of the material. In the case of the Duane Arnold reactor pressure vessel, fatigue is based on the postulated cycles during operation of the plant; the most common of these being the startup/shutdown cycle. To address this design consideration for the reactor pressure vessel, explicit metal fatigue calculations were specified in the ASME Boiler and Pressure Vessel Code.

4.3.1 REACTOR PRESSURE VESSEL FATIGUE

The original RPV stress report included a fatigue analysis for the RPV components based on a set of design basis duty cycles. The original RPV Stress Report contains fatigue evaluations performed to assure that the cyclic load combinations do not exceed Code allowables; that is, that cumulative usage factors (CUFs) do not exceed 1.0. The original 40-year analyses demonstrated that the CUFs for the critical components would remain below the ASME Code Section III allowable value of 1.0. The original 40-year analysis assumed thermal cycles as provided in APED-A41-003 GE Reactor Thermal Cycles).

In 1998, DAEC personnel performed a fatigue re-assessment of the DAEC RPV. That evaluation was intended to remove excess conservatism from the existing fatigue calculations for all RPV components, and to incorporate transient cycles projected to occur at 40 years based on actual plant operation as of that time. The 1998 re-assessment was performed using the same methodology utilized by the original DAEC RPV Stress Report.

Evaluations were also performed to support NRC approval of Extended Power Uprate (EPU) for the DAEC. The EPU evaluations did not incorporate the 1998 fatigue re-assessment. This issue was entered into the corrective action program. The re-evaluation of fatigue to support license renewal included the effort to resolve the discrepancies between the EPU evaluation and the 1998 re-assessment.

In addition, a revised fatigue evaluation for the main closure region was performed to support reduced-pass stud tensioning performed in the 2007 refueling outage (RFO).

To determine the number of transient cycles that should be assumed in the 60 year fatigue calculations, projections were made using a forward projection methodology that uses trending from the 1998 through 2005 time period of plant operation. This method eliminates “learning curve” effects of early plant operation where cyclic accumulation was high, and it more properly reflects the most recent operating trends for DAEC. For selected events, additional conservatism was added beyond the mathematically projected number of cycles to accommodate potential variation in plant performance late in plant life, as well as to allow for additional events where the projected number of cycles was very low and the likelihood of additional events could not be ruled out.

Table 4.3-1 shows the cycles assumed for 40 year operation in the current design basis, as well as the corresponding cycles assumed in the 60-year fatigue analyses. Note that not all cycles apply to all locations evaluated.

The cumulative usage factor (CUF) values obtained from the 40 year analyses were updated to incorporate revised numbers of cycles for sixty years of operation. In addition, refined fatigue analyses were performed for several locations to support the environmental fatigue assessment. These refined calculations are not considered to form a part of the DAEC Current Licensing Basis (CLB), as the environmental fatigue assessments are a requirement for license renewal that is outside of the CLB.

The values of CUFs determined for 60 years of operation are provided in Table 4.3-2, as well as the design basis 40 year CUFS. Note that, contrary to what might typically be expected, the 60 year design CUFs for some components are less than those components' 40 year design CUFs. For example, the 40-year CUF for the Main Closure Studs is 0.9191, while the 60 year design CUF is 0.5842. This is primarily because the 40 year CUF assumes 123 boltup/unbolt cycles, while the 60 year CUF assumes 45 boltup/unbolt cycles, resulting in a smaller contribution from that transient to the overall usage factor for the component. A smaller number of boltup/unbolt cycles was assumed for the 60 year CUF evaluation based on DAEC and industry operating experience regarding how often the vessel head is removed (typically during refueling outages about every 2 years).

As shown in Table 4.3-2, the 60 year CUFs are less than 1.0, and therefore are acceptable.

The DAEC reactor pressure vessel internals are not Class 1 pressure boundary components. As such, no plant-specific fatigue analysis of the entire reactor vessel internals was performed. The shroud support is considered part of the vessel; the CUF calculated in the vessel stress report for the shroud support is included in Table 4.3-2.

Disposition: 10 CFR 54.21(c)(1)(iii).

The Metal Fatigue of Reactor Coolant Pressure Boundary Program will monitor the numbers of cycles of the design transients and assure action is taken prior to any analyzed numbers of transients being exceeded. As such, the Metal Fatigue of Reactor Coolant Pressure Boundary Program will manage the effects of aging due to fatigue on the reactor vessel in accordance with 10 CFR 54.21(c)(1)(iii).

Table 4.3-1, Cycles

Transient Type	Cycles after approx. 30 yrs of Operation	40 Year Design Cycles	60 Year Design Cycles
Bolt up/Unbolt	24	123	45
Design hydro test	32	130	49
Start up/Shutdown	98	120	176
“Aborted” Startup (Cold Shutdown to Hot Standby and return to Cold Shutdown)	23	30	36
Loss of FW heater, Turbine trip at 25%	1	10	6
Loss of FW heater, FW heater bypass	14	70	16
Scram *	110	200	150
Improper start of cold recirc loop	3	5	5
Sudden start of pump in cold recirc loop	0	5	2
Hydrostatic Test	1	3	1

*The total number of scrams assumed for 40 years is 200, apportioned as follows:

Loss of FW pumps, isolation valves close	10
Turbine generator trip, FW on, isolation valves stay open	40
Reactor overpressure, delayed scram, FW stays on, isol valves stay open	1
Single relief of safety valve blowdown	2
All other Scrams	147

The total number of scrams assumed for 60 years is 150, apportioned as follows:

Loss of FW pumps, isolation valves close	8
Turbine generator trip, FW on, isolation valves stay open	30
Reactor overpressure, delayed scram, FW stays on, isol valves stay open	1
Single relief of safety valve blowdown	2
All other Scrams	110

Note that the sum of the apportionment is 151 due to rounding.

Table 4.3-2, Usage Factors

Location	CUF 40 year	CUF 60 year
Main Closure Studs	0.9191	0.5842
Main Closure Flanges	Exempted	Exempted
Skirt to Head Junction	0.0337	0.0272
Shroud Support	0.1991 (Pt. 21) 0.0898 (Pt. 19) 0.3197 (Pt. 42) 0.3360 (Pt. 44)	0.1760 (Pt. 21) 0.0800 (Pt. 19) 0.2430 (Pt. 42) 0.3028 (Pt. 44)
Feedwater Nozzle	Exempted (Forging) 0.5791 (Safe End) 0.6519 (Pt. 7, Thermal Sleeve) 0.5179 (Pt. 8, Thermal Sleeve) 0.7908 (Pt. 9, Safe End)	Exempted (Forging) 0.5868 (Safe End) 0.6604 (Pt. 7, Thermal Sleeve) 0.4583 (Pt. 8, Thermal Sleeve) 0.9116 (Pt. 9, Safe End)
CRD Penetration	Exempted (Housing) Exempted (Stub Tube) Exempted (Vessel Wall) 0.1063 (Stub tube-to-RPV Weld) 0.1472 (RPV Wall Grinding)	Exempted (Housing) Exempted (Stub Tube) Exempted (Vessel Wall) 0.0929 (Stub tube-to-RPV Weld) 0.1816 (RPV Wall Grinding)
CRD-HSR Nozzle	1.000 (Safe End) Exempted (Forging)	0.7731 (Safe End) Exempted (Forging)
CS Nozzle	0.7347 (Cladding)	0.7743 (Cladding)
Recirc Inlet	Exempted (Forging) 0.1503 (Safe End)	Exempted (Forging) 0.2542 (Safe End)
Recirc Outlet	0.4084	0.6231
Steam outlet	Exempted	Exempted
Misc nozzles	Exempted	Exempted
Refueling Bellows Support	0.5800	0.6561

4.3.2 FATIGUE OF CLASS 1 PIPING

As shown in UFSAR Table 3.2, DAEC Class 1 piping systems were designed in accordance with B31.1 or B31.7 requirements. Those piping systems designed in accordance with B31.7 were explicitly analyzed for fatigue. The analyses demonstrated that the 40 year cumulative usage factors (CUFs) for the limiting components in the affected systems were below the ASME Code Section III allowable value of 1.0, or that the systems were exempt from fatigue analysis. The B31.7 evaluations have been reviewed to ensure that CUFs will remain less than 1.0 for 60 years of operation, or that the fatigue exemptions remain valid.

For the systems that were designed in accordance with ANSI B31.1 methodology, fatigue usage factors were not determined. For these systems, although the code of construction did not invoke fatigue analyses, a stress range reduction factor which is applied to the allowable stress range for expansion stresses is required to account for cyclic thermal conditions. The allowable secondary stress range is 1.0 S_A for 7,000 equivalent full temperature thermal cycles or less and is incrementally reduced to 0.5 S_A for greater than 100,000 cycles. Since this piping will not exceed 7000 full temperature cycles in 60 years of operation, existing stress analyses remain valid for the period of extended operation.

Disposition: 10 CFR 54.21(c)(1)(i) and 10 CFR 54.21(c)(1)(ii)

The analyses remain valid or have been projected through the period of extended operation.

4.3.3 IRRADIATION ASSISTED STRESS CORROSION CRACKING

Austenitic stainless steel RPV internal components exposed to neutron fluence greater than 5 x10^{20} n/cm^2 (E > 1 MeV) are considered susceptible to IASCC in the BWR environment; IASCC of RPV internals is considered a TLAA. Fluence calculations have been performed for the internals, using NRC-approved RAMA Methodology. Regarding the threshold fluence value of 5 x10^{20} n/cm^2 for energy >1.0 MeV:

• Shroud circumferential welds H3, H4 and H5 and vertical welds V3 through V8 have exceeded the threshold fluence prior to the end of operating cycle 20. No other welds are expected to exceed the threshold prior to the end of extended design life of 54 EFPY (60 years).

• The entire axial extent of the top guide plates has exceeded the threshold fluence value prior to the end of cycle 20;

• The core support plate component is expected to exceed threshold fluence at 39.8 EFPY.

Although no calculations were performed for the incore instrumentation dry tubes and guide tubes, these components are identified as being susceptible to IASCC in BWRVIP-47.

Disposition: 10 CFR 54.21(c)(1)(iii).

The effects of aging on the intended function(s) will be adequately managed for the period of extended operation by the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, Water Chemistry Program, BWR Stress Corrosion Cracking Program, and BWR Vessel Internals Program.

4.3.4 STRESS RELAXATION (CORE PLATE RIM HOLD-DOWN BOLTS)

As described in the SER to BWRVIP-25, plants must consider relaxation of the rim hold-down bolts as a TLAA issue. Because the DAEC has not installed core plate wedges, the loss of preload must be considered in the TLAA evaluation.

An evaluation performed for EPRI demonstrated that at the end of plant life, the loss-of-preload caused by cracking in the rim hold-down bolts would not diminish the integrity of the core plate. The analysis assumed a standard 360˚ crack initiated after five years of plant operation and estimated the loss-of-preload after 60 years of operation. At the end of plant life (60 years) the crack depth was postulated as 30% of the bolt radius. The amount of preload lost after sixty years, however, was only 53 pounds of the original 10,980 pounds. Even if all the hold-down bolts cracked to 30% of their radii, the loss-of-preload would not diminish core plate integrity. The analysis also found that core plate hold-down bolts have a high flaw tolerance. The allowable crack depth was greater than 50% of the bolt radius. Significant reductions in preload did not occur until the crack depth became greater than 50% of the bolt radius.

Disposition: 10 CFR 54.21(c)(1)(i)

The analysis remains valid for the period of extended operation.

4.3.5 EFFECTS OF REACTOR COOLANT ENVIRONMENT (GSI 190)

Generic Safety Issue (GSI) 166, later renumbered as GSI-190, was identified by the NRC because of concerns about the effects of reactor water environments on the fatigue life of components and piping during the period of extended operation. GSI-190 was closed in December of 1999, and concluded that environmental effects have a negligible impact on core damage frequency, and as such, no generic regulatory action is required. However, as part of the closure of GSI-190, the NRC concluded that licensees who apply for license renewal should address the effects of coolant environment on component fatigue life as part of their aging management programs.

As a part of the NRC's Fatigue Action Plan, incorporation of environmental fatigue effects originally involved a reduced set of fatigue design curves, such as those proposed by Argonne National Laboratory (ANL) in NUREG/CR-5999. As a part of the effort to close GSI-166 (later GSI-190) for operating nuclear power plants during the current 40-year licensing term, Idaho National Engineering Laboratory (INEL) evaluated fatigue-sensitive component locations at plants designed by all four U. S. nuclear steam supply system (NSSS) vendors. The ANL fatigue curves were used by INEL to recalculate the cumulative usage factors (CUFs) for fatigue-sensitive component locations in early and late vintage Combustion Engineering (CE) pressurized water reactors (PWRs), early and late vintage Westinghouse PWRs, early and late vintage General Electric (GE) boiling water reactors (BWRs), and Babcock & Wilcox Company (B&W) PWRs. The results of the INEL calculations were published in NUREG/CR-6260 (Reference 4.8.2). The INEL calculations took advantage of conservatisms present in governing ASME Code fatigue calculations, including the numbers of actual plant transients relative to the numbers of design-basis transients, but did not recalculate stress ranges based on actual plant transient profiles. The BWR calculations, especially the early-vintage GE BWR calculations, are directly relevant to DAEC.

Per Chapter X, "Time-Limited Aging Analyses Evaluation of Aging Management Programs Under 10 CFR 54.21(c)(1)(iii)," Section X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary," of the Generic Aging Lessons Learned (GALL) Report, detailed, vintage-specific, fatigue calculations are required for plants applying for license renewal for the locations identified in NUREG/CR-6260. Therefore, detailed environmental fatigue calculations were performed for DAEC for locations associated with the older vintage GE plant. The older-vintage GE plant in NUREG/CR-6260 is the appropriate comparison to DAEC since some of the original piping design at DAEC was in accordance with USAS B31.1, as well as the fact that the older-vintage boiling water reactor (BWR) in NUREG/CR-6260 was a BWR-4 plant, which is the same as DAEC.

From NUREG/CR-6260 [Reference 4.8-2] for the older-vintage GE plant, the following locations require evaluation:

- RPV shell at lower head to shell transition
- RPV recirculation outlet nozzle
- RPV recirculation inlet nozzle
- RPV feedwater nozzle bore
- RPV core spray nozzle and safe end
- Feedwater/RCIC tee
- Recirculation piping/RHR return tee
- Class 1 RHR piping at tapered transition

Per Section X.M1 of the GALL Report, the EAF evaluation must use the appropriate F_{en} relationships from NUREG/CR-6583 (for carbon/low alloy steels) and NUREG/CR-5704 (for stainless steels), as appropriate for the material for each location. The methodology documented in NUREG/CR-6583 (Reference 4.8.3) and NUREG/CR-5704 (Reference 4.8.4) was used to evaluate environmental effects for DAEC components.

Bounding F_{en} values are determined or F_{en} values are computed for each load pair in the detailed fatigue calculation for each component. The environmental fatigue is then determined as $U_{env} = (U)\ (F_{en})$, where U is the original fatigue usage and U_{env} is the environmentally assisted fatigue (EAF) usage factor.

EAF calculations were performed for DAEC locations as shown in Table 4.3.6-1. The locations were selected based on the locations identified in NUREG/CR-6260 (Reference 4.8-2) for the older vintage GE plant. To perform the environmental fatigue evaluations, HWC conditions were assumed to exist for 72.4% of the time, and NWC conditions to exist for 27.6% of the time. The environmental fatigue calculations for 60 years make use of the 60-year cycles for DAEC as listed previously.

ASME Code, Section III fatigue usage evaluations and plant-specific evaluations of reactor water environmental effects were performed for 60 years of operation for the RPV recirculation outlet nozzle, feedwater nozzle and core spray nozzle. The fatigue calculations used the methodology of Subarticle NB-3200 of Section III of the ASME Code, 2001 Edition with Addenda through year 2003. Thermal stresses were combined with stresses due to pressure and attached piping loads, both of which were scaled based on the magnitudes of the pressure and attached piping loads during each thermal transient. All six components of the stress tensor were used for the fatigue calculations. The fatigue calculations were performed at limiting locations in the safe ends and nozzle corners.

The cumulative usage factors for all locations, when re-evaluated to include environmental effects, remains below 1.0. In addition, continued compliance with fatigue acceptance criteria will be assured by the DAEC Metal Fatigue of Reactor Coolant Pressure Boundary Program.

Disposition: 10 CFR 54.21(c)(1)(iii).

The effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The Metal Fatigue of Reactor Coolant Pressure Boundary Program will monitor the numbers of cycles of the design transients and assure action is taken prior to any analyzed numbers of transients being exceeded. As such, the Metal Fatigue of Reactor Coolant Pressure Boundary Program will manage the effects of aging due to environmentally assisted fatigue for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

Table 4.3.6-1

Summary of EAF Evaluation Results for DAEC

NUREG/CR-6260 Location	DAEC Location/Component	Material	60 Year CUF	Overall Environmental Multiplier	60 Year Environmental CUF	Result
Reactor vessel (lower head-to-shell transition)	Reactor Vessel Shell and Lower Head (Reactor Vessel lower head-to-shell transition adjacent to shroud support connection)	Low Alloy Steel	0.1760	5.66	0.9961	Accept
RPV inlet nozzle	Recirculation Inlet Nozzle (Safe End)	Alloy 600	0.2542	1.49	0.3788	Accept
RPV outlet nozzle	Recirculation Outlet Nozzle (Safe End)	SA336 Class F8	0.0146	13.42	0.1957	Accept
RPV outlet nozzle	Recirculation Outlet (Nozzle Corner)	SA508 Class 2	0.0309	7.02	0.2173	Accept
Reactor recirculation piping (RHR return line tee)	Class 1 Recirculation Loop B RHR Return Tee	Stainless steel	0.0369	13.42	0.4952	Accept
RPV Feedwater nozzle (nozzle bore)	Feedwater Nozzle (Safe End)	SA508 Class 1	0.3214	1.74	0.5598	Accept
RPV Feedwater nozzle (nozzle bore)	Feedwater Nozzle (Safe End)	SB166	0.0355	1.49	0.0529	Accept

Table 4.3.6-1 (continued)

Summary of EAF Evaluation Results for DAEC

NUREG/CR-6260 Location	DAEC Location/Component	Material	60 Year CUF	Overall Environmental Multiplier	60 Year Environmental CUF	Result
FW RPV nozzle (nozzle bore)	Feedwater (Nozzle Corner)	SA508 Class 2	0.0908 0.012 (rapid cycling)	3.19 (CUF due to rapid cycling is not subject to EAF)	0.302	Accept
CS RPV nozzle and associated Class 1 piping	Core Spray (Nozzle Corner)	Low Alloy Steel	0.0349	5.00	0.175	Accept
CS RPV nozzle and associated Class 1 piping	Core Spray Nozzle (Safe End)	Alloy 600	0.0003	1.49	0.0004	Accept
FW line Class 1 piping (RCIC tee)	Feedwater/RCIC Piping Connection (Located outside containment but in Class 1 portion of the feedwater line)	Carbon Steel	0.1023	2.74	0.2806	Accept
RHR Class 1 piping (Tapered transition to a valve)	RHR Return Isolation Valve	Carbon Steel	0.0463	6.17	0.2857	Accept

4.4 ENVIRONMENTAL QUALIFICATION OF ELECTRICAL EQUIPMENT (EQ)

The DAEC EQ Program is an existing program, established to meet commitments for 10 CFR 50.49 The DAEC EQ Program is consistent with NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” Section X.E1, “Environmental Qualification of Electric Components.” In accordance with 10 CFR54.21(c)(1)(iii), the EQ Program, which implements the requirements of 10 CFR 50.49, is viewed as an aging management program for license renewal.

The Nuclear Regulatory Commission (NRC) has established nuclear station environmental qualification (EQ) requirements in 10 CFR Part 50, Appendix A, Criterion 4, and 10 CFR 50.49. 10 CFR 50.49 specifically requires that an EQ program be established to demonstrate that certain electrical components located in harsh plant environments (that is, those areas of the plant that could be subject to the harsh environmental effects of a loss of coolant accident [LOCA], high energy line breaks [HELBs] or post-LOCA environment) are qualified to perform their safety function in those harsh environments after the effects of inservice aging. 10 CFR 50.49 requires that the effects of significant aging mechanisms be addressed as part of environmental qualification.

All operating plants must meet the requirements of 10 CFR 50.49 for certain electrical components important to safety. 10 CFR 50.49 defines the scope of components to be included, requires the preparation and maintenance of a list of in-scope components, and requires the preparation and maintenance of a qualification file that includes component performance specifications, electrical characteristics, and the environmental conditions to which the components could be subjected. 10 CFR 50.49(e)(5) contains provisions for aging that require, in part, consideration of all significant types of aging degradation that can affect component functional capability. 10 CFR 50.49(e) also requires replacement or refurbishment of components not qualified for the current license term prior to the end of designated life, unless additional life is established through ongoing qualification. 10 CFR 50.49(f) establishes four methods of demonstrating qualification for aging and accident conditions. 10 CFR 50.49(k) and (l) permit different qualification criteria to apply based on plant and component vintage. Supplemental EQ regulatory guidance for compliance with these different qualification criteria is provided in the DOR Guidelines, Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors; NUREG-0588, Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment; and Regulatory Guide 1.89, Rev. 1, Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants. Compliance with 10 CFR 50.49 provides reasonable assurance that the component can perform its intended functions during accident conditions after experiencing the effects of inservice aging.

EQ programs manage component thermal, radiation, and cyclical aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, EQ components not qualified for the current license term are to be refurbished, replaced, or have their qualification extended prior to reaching the aging limits established in the evaluation. Aging evaluations for EQ components that specify a qualification of at least 40 years are considered time-limited aging analyses (TLAAs) for license renewal.

Aging evaluations of electrical components in the EQ program at DAEC that specify a qualified life of at least forty (40) years are considered TLAAs. Reanalysis of an aging evaluation to extend the qualification of components under 10 CFR 50.49(e) is performed as part of the EQ Program at DAEC.

Under 10 CFR 54.21(c)(1)(iii), plant EQ programs, which implement the requirements of 10 CFR 50.49 (as further defined and clarified by the DOR Guidelines, NUREG-0588, and Regulatory Guide 1.89, Rev. 1), are viewed as aging management programs (AMPs) for license renewal. Reanalysis of an aging evaluation to extend the qualification of components under 10 CFR 50.49(e) is performed on a routine basis as part of an EQ program. Important attributes for the reanalysis of an aging evaluation include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). These attributes are discussed in the "EQ Component Reanalysis Attributes" section.

This reanalysis program can be applied to EQ components now qualified for the current operating term (i.e., those components now qualified for 40 years or more). As evaluated below, this is an acceptable AMP. Thus, no further evaluation is recommended for license renewal if an applicant elects this option under 10 CFR 54.21(c)(1)(iii) to evaluate the TLAA of EQ of electric equipment.

The reanalysis of an aging evaluation is normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation. Reanalysis of an aging evaluation to extend the qualification of a component is performed on a routine basis pursuant to 10 CFR 50.49(e) as part of an EQ program. While a component life limiting condition may be due to thermal, radiation, or cyclical aging, the vast majority of component aging limits are based on thermal conditions. Conservatism may exist in aging evaluation parameters, such as the assumed ambient temperature of the component, an unrealistically low activation energy, or in the application of a component (de-energized versus energized). The reanalysis of an aging evaluation is documented according to the station's quality assurance program requirements, which requires the verification of assumptions and conclusions. As already noted, important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). These attributes are discussed below.

Analytical Methods: The analytical models used in the reanalysis of an aging evaluation are the same as those previously applied during the prior evaluation. The Arrhenius methodology is an acceptable thermal model for performing a thermal aging evaluation. The analytical method used for a radiation aging evaluation is to demonstrate qualification for the total integrated dose (that is, normal radiation dose for the projected installed life plus accident radiation dose). For license renewal, one acceptable method of establishing the 60-year normal radiation dose is to multiply the 40-year normal radiation dose by 1.5 (that is, 60 years/40 years). The result is added to the accident radiation dose to obtain the total integrated dose for the component. For cyclical aging, a similar approach may be used. Other models may be justified on a case-by-case basis.

Data Collection and Reduction Methods: Reducing excess conservatism in the component service conditions (for example, temperature, radiation, cycles) used in the prior aging evaluation is the chief method used for a reanalysis. Temperature data used in an aging evaluation is to be conservative and based on plant design temperatures or on actual plant temperature data. When used, plant temperature data can be obtained in several ways, including monitors used for technical specification compliance, other installed monitors, measurements made by plant operators during rounds, and temperature sensors on large motors (while the motor is not running). A representative number of temperature measurements are conservatively evaluated to establish the temperatures used in an aging evaluation. Plant temperature data may be used in an aging evaluation in different ways, such as (a) directly applying the plant temperature data in the evaluation, or (b) using the plant temperature data to demonstrate conservatism when using plant design temperatures for an evaluation. Any changes to material activation energy values as part of a reanalysis are to be justified on a plant-specific basis. Similar methods of reducing excess conservatism in the component service conditions used in prior aging evaluations can be used for radiation and cyclical aging.

Underlying Assumptions: EQ component aging evaluations contain sufficient conservatism to account for most environmental changes occurring due to plant modifications and events. When unexpected adverse conditions are identified during operational or maintenance activities that affect the normal operating environment of a qualified component, the affected EQ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions.

Acceptance Criteria and Corrective Actions: The reanalysis of an aging evaluation could extend the qualification of the component. If the qualification cannot be extended by reanalysis, the component is to be refurbished, replaced, or requalified prior to exceeding the period for which the current qualification remains valid. A reanalysis is to be performed in a timely manner (that is, sufficient time is available to refurbish, replace, or requalify the component if the reanalysis is unsuccessful).

Disposition: 10 CFR 54.21(c)(1)(iii).

The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

4.5 CONCRETE CONTAINMENT TENDON PRESTRESS

This section is not applicable as DAEC does not have a concrete containment with pre-stressed tendons.

4.6 FATIGUE OF PRIMARY CONTAINMENT, PIPING, AND COMPONENTS

The containment vessel is a Mark I design with a drywell and toroidal suppression chamber. The DAEC primary containment was designed in accordance with the ASME Code, Section III. Subsequently, during large scale testing for the Mark III containment system and the in-plant testing for Mark I primary containment systems, new suppression chamber hydrodynamic loads were identified. These loads result from blowdown into the suppression chamber during a postulated LOCA and during SRV operation for plant transients.

The Mark I analyses are detailed in the DAEC Plant Unique Analysis Report (PUAR) and assume 60 multiple SRV lifts and 740 single SRV lifts. Since these analyses include fatigue evaluations based on the occurrence of a limited number of transient cycles during the current licensed term of operation (40 years), they are TLAAs.

The number of SRV lifts throughout the DAEC's operating history has not been consistently tracked. To address license renewal requirements, the historical number of SRV Lifts was needed; documentation was therefore researched to determine the number of SRV lifts from 1974 until 2007. Using this information and projecting the results for 60 years provided a projected number of 334 single SRV lifts for 60 years, and a projected number of 42 multiple lifts for 60 years. Both of these numbers are well below the values assumed in the Mark I analyses (740 single SRV lifts and 60 multiple SRV lifts).

4.6.1 FATIGUE ANALYSIS OF SUPPRESSION CHAMBER

As detailed in the DAEC PUAR, the fatigue usage factors for the controlling suppression chamber component and weld are:

NOC+SBA: CUF =0.467 (torus shell)

NOC+SBA: CUF =0.226 (weld)

NOC+IBA: CUF =0.356 (torus shell)

NOC+IBA: CUF =0.195 (weld)

where NOC=normal operating conditions, SBA=small break accident, and IBA=intermediate break accident.

The maximum CUF (for 40 years) for the torus shell and welds is 0.467. Multiplying this value by 60/40 results in a CUF (for 60 years) of 0.70, which is less than 1.0.

Disposition: 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation.

4.6.2 FATIGUE ANALYSIS OF THE VENT SYSTEM AND VENT LINE BELLOWS

As detailed in the DAEC PUAR, the maximum fatigue usage factors for the Vent System Components and Welds are:

NOC+SBA: CUF = 0.12 (Vent Header)

NOC+SBA: CUF = 0.33 (Weld)

NOC+IBA: CUF = 0.12 (Vent Header)

NOC+IBA: CUF = 0.33 (Weld)

Therefore the maximum CUF (for 60 years) is 0.50 (0.33 x 60/40).

For the vent lines bellows, thermal load is the largest contributor to displacements. The PUAR specifies 150 thermal load cycles. Multiplying by 60/40 results in 225 cycles and rated capacity is 500 cycles; they remain adequate for fatigue.

Disposition: 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation.

4.6.3 FATIGUE ANALYSIS OF SUPPRESSION CHAMBER EXTERNAL PIPING AND PENETRATIONS

These analyses include the large and small bore torus attached piping (TAP) and suppression chamber penetrations. Fatigue analyses were completed that were based on cycles postulated to occur within the 40 year operating life of the plant. Therefore these calculations are considered TLAAs.

The Mark I Owners Group prepared and submitted a generic fatigue evaluation report *[Mark I Containment Program Augmented Class 2/3 Fatigue Evaluation Method and Results for Typical Torus Attached and SRV Piping Systems, MPR Associates, Inc, , MPR-751, November 1982]* to the NRC in late 1982. The report addressed fatigue on a generic basis, and reported cumulative usage factors below 0.5. Conservatively multiplying the large and small bore piping CUFs by 1.5 (60 years divided by 40 years) results in 60-year CUFs of 0.75, which are less than 1.0 and therefore, acceptable.

The PUAR concludes that the 40-year CUFs for the controlling components are also less than the acceptable fatigue usage value of 1.0.

As discussed previously, 334 single SRV lifts are projected for 60 years, and 42 multiple lifts are projected for 60 years. Both of these numbers are well below the values assumed in the Mark I analyses (740 single SRV lifts and 60 multiple SRV lifts). Therefore the analyses for the penetrations remain valid for 60 years.

Disposition: 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation.

4.6.4 STRESS REPORT – DESIGN CALCULATIONS CONTAINMENT VESSEL

The Stress Report includes a determination that the containment vessel is exempt from fatigue analysis. The determination is based on an assumed number of load fluctuations. After increasing this number to account for the additional cycles of a 60 year life, the fatigue analysis exemption remains valid.

Disposition: 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation.

4.6.5 DESIGN ANALYSES OF FLUED HEADS FOR CLASS 1 PENETRATIONS

The analyses include the verification of adequacy of the flued heads by comparing allowable stresses (based on an assumed number of cycles) and maximum stress intensities. (The value of 2Sa corresponding to the number of cycles is compared to the maximum stress intensity to verify adequacy.)

These evaluations were reviewed to ensure that the number of assumed cycles could be multiplied by 1.5 (60 years/40 years) with acceptable stress results. In all cases, the maximum stress intensities remained below 2Sa, and are therefore acceptable.

Disposition: 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation.

4.7 OTHER PLANT-SPECIFIC TLAAS

4.7.1 CRANES – REACTOR AND TURBINE BUILDING

The Turbine and Reactor Building Crane specifications assume a 40-year useful life for fatigue stress analysis purposes. The specification states that maximum usage of each component at rated load and full speed shall be taken as a minimum of 1% of this time. Actual operating time at less than rated will average less than 1,000 hours per year.

The Ederer Generic Licensing Topical Report EDR-1(NP)–A, applicable to the Reactor Building Crane describes the crane as CMAA Class A crane. There are implicit cycle requirements for cranes designed in accordance with Crane Manufacturers Association of America (CMAA)-70. The cycle range for Class A cranes in CMAA-70 is 20,000 to 200,000 cycles.

Since the cranes were designed for a set number of lifts for 40 years, they are considered a TLAA.

Disposition: 10 CFR 54.21(c)(1)(iii).

The Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will adequately manage the effects of aging on intended function(s) for the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

4.7.2 EVALUATION OF THE FATIGUE LIFE OF THE STABILIZER ASSEMBLY

This calculation evaluated the fatigue life of the stabilizer assembly at Elev. 816'-3" between the bioshield wall and the containment due to relative thermal growth between these two components. The conclusion of the calculation states that:

"Based on a best estimate analysis, the fatigue life of the stabilizer assembly due to relative thermal movement of that attached structure is approximately 4750 cycles, and is controlled by the welds of the pipe to the bioshield wall. Employing all the conservatisms and safety factors associated with new design, the system is qualified for at least 400 fatigue cycles. In either case the system has substantial margin against a design life of 120 cycles."

120 cycles is the number of startups assumed for 40 years. The number of startups assumed in 60 year design fatigue calculations is 212 (176 startups plus 36 "aborted" startups), which is less than 400 cycles.

Disposition: 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation.

4.7.3 EVALUATION OF EXISTING HCC-B002 "DOLLAR WELD" INDICATION

During RFO 17, inspections identified an indication in a circumferential weld in the reactor head (Vessel Head Dollar Weld HCC-B002) that did not meet ASME Section XI IWB-3500 acceptance standards. The indication was evaluated and determined to be acceptable to leave as-is (IWB-3600 evaluation).

Per BWRVIP-74-A - BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal, components that have indications that have been previously analytically evaluated in accordance with Subsection IWB-3600 of Section XI to the ASME Code until the end of the 40-year service period, shall be re-evaluated for the 60 year service period corresponding to the LR term.

A re-evaluation was performed regarding the "dollar" weld indication. The flaw acceptance re-evaluation is based on the acceptance standards for flaws in reactor vessels that are contained in Article IWB-3000 of Section XI of the ASME Boiler and Pressure Vessel Code. In particular, the flaw acceptance criteria of Subarticles IWB-3500 and IWB-3600 of Section XI of the Code are used in this evaluation. Appendix A of Section XI provides a specific methodology that may be used for the detailed fracture mechanics evaluations prescribed in IWB-3600.

The re-evaluation concluded that for the Normal and Upset conditions, the maximum end of service life, applied stress intensity factor calculated for the indication is 16.1 ksi√in. This applied stress intensity factor is well below the material fracture toughness of 63.2 ksi√in. For Emergency and Faulted conditions, the maximum end of service life, applied stress intensity factor calculated in this analysis is 18.3 ksi√in. This applied stress intensity factor is well below the material fracture toughness of 141.42 ksi√in.

Based on these results, the existing flaw is acceptable and meets the requirements of ASME Code, Section XI, IWB-3610. The re-evaluation shows acceptability for 54 EFPY (corresponding to 60 years) as discussed in BWRVIP-74-A.

Disposition: 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation.

4.7.4 EVALUATION OF THERMAL FATIGUE EFFECTS ON STEAM LEAD AND INLET TO RPV

This calculation evaluates potential thermal fatigue effects on the steam lead into the condensing pot and the inlet to the RPV. The evaluation increased the number of significant temperature cycles by using a 1.5 multiplier on the existing 177 significant temperature cycles (resulting in 265.5 cycles) and an additional 25 cycles of maximum possible backflow and 200 cycles of design backflow rate. The evaluation showed that the additional cycles that would be incurred during a 60 year life can be tolerated by the system when backflow is initiated.

Disposition: 10 CFR 54.21(c)(1)(ii)

The analysis has been projected through the period of extended operation.

4.7.5 CONTROL ROD DRIVE MECHANISM FATIGUE

The NRC Safety Evaluation for Extended Power Uprate (Amendment 243) discusses the fatigue analysis of the Control Rod Drive Mechanisms (CRDMs). The analysis for cyclic operation of the CRDMs resulted in a maximum cumulative usage factor (CUF) of 0.15 for the limiting CRD main flange at EPU conditions.

Conservatively multiplying the CRDM CUF by 1.5 (60 years/40 years) results in a 60-year CUF of 0.225; the 60-year CUF is less than 1.0, and therefore acceptable.

The Stress Analysis Report for the Control Rod Drive Hydraulic System (CRDHS) provides analyses performed in accordance with applicable portions of ASME Section III, 1971. The CUFs for the insert/withdrawal lines, discharge piping and scram monitoring stations remain below 1.0 when multiplied by 1.5, and are therefore acceptable for 60 years. For the scram headers, multiplying by 1.5 would result in a CUF greater than 1.0; further review was needed. A review of the evaluation indicated that the cyclic fatigue on the scram header is due primarily to scram and earthquake cycles. Since the design number of scram cycles is being reduced from 200 to 150 cycles, and the earthquake assumptions remain unchanged, the 60 year CUF values remain below 1.0 and are therefore acceptable.

The fatigue analysis exemption for the SDV vent and drain valves remains bounding for a 60 year life.

Disposition: 10 CFR 54.21(c)(1)(i) and (ii)

The analyses remains valid or have been projected through the period of extended operation.

4.7.6 MAIN STEAM ISOLATION VALVE D FLAW EVALUATION

In 1993, indications were identified in the body of "D" outboard MSIV. A flaw evaluation was performed, and NRC approval was obtained for a non-Code repair. The flaw evaluation determined that the assumed flaw sizes, which are significantly larger than a conservative estimate of the remaining flaw (based on no visible indication by post-repair radiography), were acceptable per ASME Section XI 1980 Edition/Winter 81 Addenda, IWB-3600.

Disposition: 10 CFR 54.21(c)(1)(i)

The analysis remains valid for the period of extended operation.

4.7.7 BELLOWS DESIGN ANALYSIS

This document provides design analyses for Reactor Water Cleanup Supply penetration X-15 and RPV Feedwater penetration X-9A/B. For X-15, cycle life for “Accident plus Seismic” is given as 200 cycles for design cycle life, with a rated cycle life of 1220 cycles. For X-9A/B, cycle life for “Accident plus Seismic” is given as 200 cycles for design cycle life, with a rated cycle life of 2480 cycles. Multiplying the design cycles by 1.5 (60 years/40 years), it is seen that the numbers of design cycles remain below the numbers of rated cycles.

Disposition: 10 CFR 54.21(c)(1)(i)

The analysis remains valid for the period of extended operation.

4.8 REFERENCES

4.8.1 NRC Regulatory Guide 1.190, Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence, March 2001.

4.8.2 NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components," March 1995.

4.8.3 NUREG/CR-6583, "Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels," March 1998.

4.8.4 NUREG/CR-5704, "Effects of LW Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels," April 1999.

APPENDIX A

Table of Contents

APPENDIX A

Table of Contents

APPENDIX A

Table of Contents

APPENDIX A

Tables

APPENDIX A

DUANE ARNOLD UFSAR SUPPLEMENT

This appendix contains the Duane Arnold UFSAR Supplement required by 10 CFR 54.21(d) [Reference 18-1]. The Duane Arnold license renewal application (LRA) contains the technical information required by 10 CFR 54.21(a) and (c). Chapter 3 and Appendix B of the LRA provide descriptions of the programs and activities that manage the effects of aging for the period of extended operation. LRA Chapter 4 contains the evaluations of the time-limited aging analyses (TLAAs) for the period of extended operation. These LRA sections have been used to prepare the program and activity descriptions that are contained in this UFSAR supplement.

This appendix (UFSAR Chapter 18) contains a summary description of the programs for managing the effects of aging, a summary of the evaluation of time-limited aging analyses (TLAAs) and summaries of TLAA supporting activities for the period of extended operation.

The information in this appendix will be incorporated into the Duane Arnold UFSAR following receipt of the renewed operating license in accordance with 10 CFR 50.71(e). Upon inclusion of this supplement into the Duane Arnold UFSAR, changes to the descriptions and programs and activities for their implementation will be made in accordance with 10 CFR 50.59 and the FPL Energy Duane Arnold NRC commitment management program.

DUANE ARNOLD UFSAR
CHAPTER 18
(NEW)

18.0 AGING MANAGEMENT PROGRAMS AND TIME-LIMITED AGING ANALYSES ACTIVITIES

The integrated plant assessment for license renewal identified existing and new aging management programs necessary to provide reasonable assurance that components within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis (CLB) for the period of extended operation. This chapter describes these programs and their planned implementation.

This chapter discusses the evaluation results for each of the plant-specific time-limited aging analyses (TLAAs) performed for license renewal. The evaluations have demonstrated that; the analyses remain valid for the period of extended operation, the analyses have been projected to the end of the period of extended operation, or the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. In addition, this chapter discusses the activities necessary to support the TLAAs.

No 10 CFR 50.12 exemptions involving a TLAA as defined in 10 CFR 54.3 were identified for Duane Arnold.

18.1 AGING MANAGEMENT PROGRAMS

This section provides summaries of the programs and activities, in alphabetical order, credited for managing the effects of aging. These aging management programs may not exist as discrete programs at Duane Arnold. In many cases, they exist as a compilation of various implementing documents that, when taken as a whole, satisfy the intent of NUREG-1800 and/or NUREG-1801 [References 18-2 and 18-3, respectively] attributes.

The Duane Arnold Quality Assurance Program implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Appendix A.2 of NUREG-1800. The elements of corrective action, confirmation process, and administrative controls in the Quality Assurance Program are applicable to both safety related and non-safety related systems, structures, and components that are subject to an aging management review.

18.1.1 10 CFR 50 APPENDIX J PROGRAM

The 10 CFR 50 Appendix J Program is a performance based containment leak rate test program. The program implements the guidelines contained in 10 CFR Appendix J, Option B. The program performs periodic inspections and surveillance testing of primary containment systems and components penetrating the primary containment to ensure that allowable leakage rates do not exceed Technical Specification requirements.

This program is consistent with the ten elements of NUREG-1801 XI.S4 and takes no exception to NUREG-1801 XI.S4.

18.1.2 ABOVEGROUND STEEL TANKS PROGRAM

The Aboveground Steel Tanks Program manages the aging effect of the Aboveground Steel Tanks within the scope of License Renewal. This program includes preventive measures to mitigate corrosion and periodic inspections to manage the effects of loss of material due to corrosion on the exterior surface of the aboveground steel tanks within the scope of license renewal.

The program utilizes the application of a qualified protective coating on the exterior surface of the condensate storage tank to mitigate corrosion due to environmental factors. Inaccessible locations, such as the tank bottom are periodically monitored for material degradation using ultrasonic thickness measurements from the inside of the tank.

This program is consistent with the ten elements of NUREG-1801 XI.M29 and takes no exception to NUREG-1801 XI.M29.

18.1.3 ASME SECTION XI, INSERVICE INSPECTION, SUBSECTIONS IWB, IWC, AND IWD PROGRAM

The ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program facilitates inspections to identify and correct degradation in Class 1, 2, and 3 piping components, supports, and integral attachments. The program includes periodic visual, surface, and /or volumetric examinations of all Class 1, 2, and 3 pressure-retaining components, supports, and integral attachments, including welds, pump casings, valve bodies, pressure-retaining bolting, and piping/component supports and leakage tests of pressure-retaining components.

The ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program manages the aging effect of cracking due to stress corrosion cracking, intergranular stress corrosion cracking, and irradiation assisted stress corrosion cracking. Duane Arnold has identified cracking in Class 1 large bore piping.

NRC Generic Letter 88-01 required boiling water reactor plants to include a portion of the small bore population (NPS 4-inch pipe butt welds) in the ASME Section XI Inservice Inspection Program volumetric examination for cracking. Since Duane Arnold has experience cracking in Class 1 piping, all small bore Class 1 piping in-scope for license renewal has been included in the ASME Section XI Inservice Inspection Program.

The ASME Section XI, Inservice Inspection, Subsections IWB, IWC, and IWD Program detects any cracks which would result in the loss of fracture toughness due to thermal and neutron/radiation embrittlement.

This program is consistent with the ten elements of NUREG-1801 XI.M1 and takes no exception to NUREG-1801 XI.M1.

18.1.4 ASME SECTION XI, INSERVICE INSPECTION, SUBSECTION IWE PROGRAM

The ASME Section XI, Inservice Inspection, Subsection IWE Program performs visual inspections, volumetric examinations and surface examinations in accordance with the ASME Code. The program manages aging effects for the drywell, suppression chamber, and connecting piping, supports and bolting. The airlocks and hatches are included with the drywell and suppression chamber.

This program is consistent with the ten elements of NUREG-1801 XI.S1 and takes no exception to NUREG-1801 XI.S1.

18.1.5 ASME SECTION XI, INSERVICE INSPECTION, SUBSECTION IWF PROGRAM

The ASME Section XI, Inservice Inspection, Subsection IWF Program utilizes visual examinations in accordance with the ASME Code to determine the mechanical and structural condition of components and supports by verifying parameters such as clearances, settings, physical displacement, discontinuities and imperfections, such as loss of integrity of bolted or welded connections, loss or missing parts, debris, corrosion, erosion, or wear.

This program is consistent with the ten elements of NUREG-1801 XI.S3 and takes no exception to NUREG-1801 XI.S3.

18.1.6 BOLTING INTEGRITY PROGRAM

The Bolting Integrity Program manages the aging effects associated with bolting through the performance of periodic inspections. The program includes repair/ replacement controls for ASME Section XI related bolting and generic guidance regarding material selection, thread lubrication and assembly of bolted joints. The program considers the guidelines delineated in NUREG-1339 for a bolting integrity program, EPRI NP-5769 (with the exceptions noted in NUREG-1339) for safety related bolting, and EPRI TR-104213 for non-safety related bolting. The Bolting Integrity Program credits three separate aging management programs for the inspection of bolting. The four aging management programs are: (1) ASME Section XI Inservice Inspection, Subsection IWB, IWC, IWD Program, (2) ASME Section XI Inservice Inspection Subsection IWF, (3) External Surfaces Monitoring Program, and (4) Structural Monitoring Program.

This program is consistent with the ten elements of NUREG-1801 XI.M18 and takes no exception to NUREG-1801 XI.M18.

18.1.7 BURIED PIPING AND TANKS INSPECTION PROGRAM

The Buried Piping and Tanks Inspection Program include provisions for visual inspections of protective wraps and coatings on buried carbon, low-alloy and stainless steel piping and tanks in scope for license renewal. The visual inspections for damage are performed when piping and tanks are excavated for maintenance or other reasons. If damage to the protective wraps is found, the outer surface of the component is inspected for loss of material due to general (except for stainless), pitting, crevice and microbiologically- influenced corrosion.

This program is consistent with the ten elements of NUREG-1801 XI.M34 and takes no exception to NUREG-1801 XI.M34.

18.1.8 BWR CONTROL ROD DRIVE RETURN LINE NOZZLE PROGRAM

The BWR Control Rod Drive Return Line Nozzle Program ensures that cracks in the control rod drive return line nozzle due to thermal stress will be detected prior to loss of function. The program ensures that cracks in the control rod drive return line pipe containing stagnant water that is susceptible to intergranular stress corrosion cracking will be detected prior to loss of intended function.

Duane Arnold has removed the control rod drive return line nozzle thermal sleeve and installed a blind flange to prevent flow through the return line during plant operation to eliminate thermal cycling.

The ASME Section XI Inservice Inspection Program performs periodic ultrasonic inspections of the critical regions of the control rod drive return line nozzle. The Augmented Inspection Program inspects the control rod drive return line stainless steel pipe section welds that contain stagnant water and are susceptible to intergranular stress corrosion cracking.

This program is consistent with the ten elements of NUREG-1801 XI.M6 and takes no exception to NUREG-1801 XI.M6.

18.1.9 BWR FEEDWATER NOZZLE PROGRAM

The BWR Feedwater Nozzle Program consists of the ASME Section XI Inservice Inspection Program and the ASME Section XI Augmented Inspection Program as well as system modifications and operator instructions. The DAEC program performs feedwater nozzle inspections as required by ASME Section XI Subsection IWB, Table IWB 2500-1 (2001 edition including the 2002 and 2003 Addenda) and the recommendations of General Electric NE-523-A71-0594, Revision 1. The Augmented Inspection Program performs periodic ultrasonic inspection of critical regions of the Duane Arnold feedwater nozzle. The regions inspected, examination techniques, personnel qualifications, and inspection schedule are consistent with the recommendations of GE NE-523-A71-0594-A, Revision 1.

The feedwater nozzle design prevents flow of cold water behind the thermal sleeve which reduces the risk of cracking due to thermal cycling. Additionally, Duane Arnold has implemented changes to the controls of the feedwater regulating valves and placed cautions in operating procedures.

This program is consistent with the ten elements of NUREG-1801 XI.M5 and takes no exceptions to NUREG-1801 XI.M5.

18.1.10 BWR PENETRATIONS PROGRAM

The BWR Penetrations Program is part of the ASME Section XI Inservice Inspection Subsection IWB, IWC, and IWD Program. The program utilizes ultrasonic (volumetric), surface and visual inspections. The program incorporates the guidelines of BWRVIP-49-A for instrument penetrations, and BWRVIP-27-A for the Standby Liquid Control System. Water chemistry is maintained and monitored by the Duane Arnold Water Chemistry Program.

This program is consistent with the ten elements of NUREG-1801 XI.M8 and takes no exception to NUREG-1801 XI.M8.

18.1.11 BWR REACTOR WATER CLEANUP SYSTEM PROGRAM

The BWR Reactor Water Cleanup System Program ensures that cracks due to stress corrosion cracking and intergranular stress corrosion cracking in the Reactor Water Cleanup System pipe welds will be detected prior to loss of its intended function. The program includes periodic inspections, water chemistry control, and plant modifications.

The Augmented Inspection Program inspects the Reactor Water Cleanup System stainless steel pipe welds. The program includes the measures delineated in NRC Generic Letter 88-01 and follows the guidance in BWRVIP-75.

This program is consistent with the ten elements of NUREG-1801 XI.M25 with one exception. The DAEC program implements the requirements of GL 88-01 as modified by BWRVIP-75. BWRVIP-75 specifies an inspection frequency that differs from the requirements given in GL 88-01.

18.1.12 BWR STRESS CORROSION CRACKING PROGRAM

The BWR Stress Corrosion Cracking Program incorporates the guidelines of NRC Generic Letter 88-01 and Supplement 1, NUREG-0313 Rev. 2 and BWRVIP-75. The program has reduced the susceptibility to stress corrosion cracking by utilizing methods to reduce the tensile strength, such as: induction heating stress improvement, mechanical stress improvement process, weld overlay, or solution annealing. Water chemistry is maintained and monitored by the Water Chemistry Program.

This program is consistent with the ten elements of NUREG-1801 XI.M7 and takes no exception to NUREG-1801 XI.M7.

18.1.13 BWR VESSEL ID ATTACHMENT WELDS PROGRAM

The BWR Vessel ID Attachment Welds Program utilizes portions of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program. The program incorporates the guidelines of BWRVIP-48-A. Reactor water chemistry is maintained and monitored by the Water Chemistry Program.

This program is consistent with the ten elements of NUREG-1801 XI.M4 and takes no exception to NUREG-1801 XI.M4.

18.1.14 BWR VESSEL INTERNALS PROGRAM

The BWR Vessel Internals Program utilizes applicable portions of the ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD Program, appropriate BWRVIP guidelines, and the Water Chemistry Program. The BWR Vessel Internals Program incorporates BWRVIPs: BWRVIP-18, BWRVIP-25, BWRVIP-26, BWRVIP-38, BWRVIP-41, BWRVIP-47, BWRVIP-76, and BWRVIP-139.

If any repairs are required as a result of the inspections performed by the above referenced BWRVIPs, the following BWRVIPs will be used, as applicable to implement the required repair: BWRVIP-02, BWRVIP-17, BWRVIP-16, BWRVIP-19, BWRVIP-44, BWRVIP-45, BWRVIP-50, BWRVIP-51, BWRVIP-52, BWRVIP-55-A, BWRVIP-57, and BWRVIP-58.

This program is consistent with the ten elements of NUREG-1801 XI.M9 and takes no exception to NUREG-1801 XI.M9.

18.1.15 CLOSED COOLING WATER SYSTEM PROGRAM

The Closed Cooling Water System Program relies on implementation of the guidance provided in EPRI TR-107396 to ensure that the closed cycle cooling water system functions and components serviced by the system are not compromised by aging. The program includes control of chemistry parameters to minimize corrosion and stress corrosion cracking. DAEC performs testing and inspections of the CCCW systems, components to ensure the performance is maintained and the intended functions are not compromised by aging.

This program is consistent with the ten elements of NUREG-1801 XI.M21 and takes no exception to NUREG-1801 XI.M21.

18.1.16 COMPRESSED AIR MONITORING PROGRAM

The Compressed Air Monitoring Program manages or mitigates aging effects by ensuring an oil-free, dry air environment to the Instrument Air System. The program is comprised of a series of procedures and periodic observations to manage the effects of loss of material due to corrosion and the presence of unacceptable contaminants. These procedures include periodic inspections, system blowdowns, temperature and flow monitoring, and air quality samples.

The guidelines ASME OM-S/G-1998, Part 17; ISA-S7.01-1996; EPRI NP-7079; and EPRI TR-108147 have been used as guidance for the DAEC testing procedures.

This program is consistent with the ten elements of NUREG-1801 XI.M24 and takes no exception to NUREG-1801 XI.M24.

18.1.17 ELECTRICAL CABLES AND CONNECTIONS PROGRAM

The Electrical Cables and Connections Program manages the effects of aging by inspecting cables and connections susceptible to aging due to radiological, thermal and chemical aging mechanisms. Visual inspections will identify cables or connections degraded by these aging mechanisms.

Visually accessible cables and connections susceptible to thermal aging due to a combination of ambient temperature and ohmic heating will be inspected at least once every 10 years. If the cables and connections in these areas do not exhibit signs of aging then cables and connections in areas with lower ambient temperatures and ohmic heating will not exhibit signs of aging.

Cables and connections at equipment where significant heating can occur will be inspected. Equipment where significant heating can occur is defined as large motors (greater than 125 hp), motor operated valves, transformers, heaters, motor control centers, load centers, lighting panels and batteries.

Cables and connections in areas with elevated radiation levels will be visually inspected. Inspecting these cables and connections will provide reasonable assurance that cables and connections in areas with lower temperature and lower radiation dose rates will meet their intended functions.

This is a new program for Duane Arnold. New procedures and preplanned tasks will be developed and implemented to contain the scheduling information, instructions and acceptance criteria for the area inspections. Existing equipment maintenance procedures will be enhanced with steps for inspecting cables and connections during selected preventive maintenance activities and to document the cable inspection activity.

This program is consistent with the ten elements of NUREG-1801 XI.E1 and takes no exception to NUREG-1801 XI.E1.

18.1.18 ELECTRICAL CABLES AND CONNECTIONS USED IN INSTRUMENTATION CIRCUITS

The Electrical Cables and Connections Used in Instrumentation Circuits Program manages the effects of aging by measuring the insulation resistance of the cables and connections at least once every 10 years. The test methodology is time domain reflectometry.

This program is consistent with the ten elements of NUREG-1801 XI.E2 and takes no exception to NUREG-1801 XI.E2.

18.1.19 ELECTRICAL CONNECTIONS PROGRAM

The Electrical Connections Program manages the effects of aging by one-time inspection (thermographic) of a representative sample of electrical connections. The inspection is to validate that a periodic inspection program is or is not required to maintain the current licensing basis for the period of extended operation. The one-time inspection will provide the basis needed to conclude that an aging management program for electrical connections is or is not required.

This is site specific program. There is no NUREG-1801 Volume 2 Section XI program that matches this program.

18.1.20 ELECTRICAL PENETRATION ASSEMBLIES PROGRAM

The Electrical Penetration Assemblies Program is a plant-specific program that manages the effects of aging by inspecting the electrical penetration assemblies periodically. This aging management program is identical to the required maintenance activities for the electrical penetration assemblies within the scope of the Environmental Qualification Program.

Duane Arnold has experienced the failure of two electrical penetration assemblies. An analysis of one concluded that the failure was due to moisture, a random void, and a potential difference between conductors with subsequent growth of dendrites between the conductors. The dendrites formed a low resistance path, over a long period of time, for current leakage, arching, and carbonization of the epoxy. The electrical short developed when the carbonized path between the conductors became continuous and resulted in shorting between the splices of the two conductors. The moisture could have been due to less than adequate adherence to manufacturer's instructions which required internal nitrogen pressure be maintained in the assemblies. Dendrites formation required the presence of moisture.

This is site specific program. There is no NUREG-1801 Volume 2 Section XI program that matches this program.

18.1.21 EXTERNAL SURFACES MONITORING PROGRAM

The External Surfaces Monitoring Program manages aging effects of loss of material using visual inspection of external surfaces. The program consists of periodic inspections of steel components such as piping, piping components, ducting, pipe supports, and other components within the scope of license renewal.

This program is consistent with the ten elements of NUREG-1801 XI.M36 and takes no exception to NUREG-1801 XI.M36.

18.1.22 FIRE PROTECTION PROGRAM

The Fire Protection Program manages aging effects of fire protection components using surveillance test procedures and detailed inspections. Surveillance tests are performed on the diesel-driven fire pump, and fire barrier seals. Visual inspections for degradation are performed on fire barrier walls, ceilings and floors with a frequency of 35 percent each refueling outage with a 100 percent inspected in a five year period.

This program is consistent with the ten elements of NUREG-1801 XI.M26 and takes one exception to NUREG-1801 XI.M26. DAEC Fire Plan – Volume 1, Program reflects the current Duane Arnold licensing bases as defined in License Amendment Number 132. This amendment allows the frequency of the visual inspections for the walls, ceilings, and floors fire barrier to be performed at an interval of 35 percent once each operating cycle with 100 percent visually inspected within a period of five years. The NUREG-1801 XI.M26 recommends that these inspections be performed once every refueling cycle.

18.1.23 FIRE WATER SYSTEM PROGRAM

The Fire Water System Program manages aging effects of fire protection components using surveillance test procedures and detailed inspections. Fire Water System components are tested in accordance with the applicable National Fire Protection Association (NFPA) codes and standards.

This program is consistent with the ten elements of NUREG-1801 XI.M27 and takes no exception to NUREG-1801 XI.M27.

18.1.24 FLOW ACCELERATED CORROSION PROGRAM

The Flow Accelerated Corrosion Program manages aging effect of loss of material due to flow-accelerated corrosion (FAC) on the internal surfaces of carbon or low alloy steel piping, elbows, reducers, tees, expanders, and valve bodies which contain high energy fluids (both single phase and two phase flow). The program is based on the guidelines of NSAC-202L-R2. This program uses CHECWORKS as a predictive tool. Included in the program are: (a) an analysis to determine flow-accelerated corrosion susceptible lines; (b) performance of limited baseline inspections; (c) follow-up inspections to confirm the predictions; and (d) repairing or replacing components, as necessary.

This program is consistent with the ten elements of NUREG-1801 XI.M17 and takes no exception to NUREG-1801 XI.M17.

18.1.25 FUEL OIL CHEMISTRY PROGRAM

The Fuel Oil Chemistry Program complies with the plant Technical Specifications. The program consists of surveillance test procedures with supporting maintenance and chemistry procedures. The periodicity of surveillance tests allow sufficient time to correct high particulate levels prior to reaching the limit of acceptability.

This program is consistent with the ten elements of NUREG-1801 XI.M30 with the following exceptions:

- NUREG-1801 states: Fuel oil quality is maintained by monitoring and controlling fuel oil contamination in accordance with the plant's technical specifications and the guidelines of the American Society for Testing Materials (ASTM) Standards D 1796, D2276, D 2709, D 6217, and D 4057. For determination of particulates the ASTM D 6217 or Modified ASTM D 2276, Method A is recommended. The DAEC Fuel Oil Chemistry Program does not use ASTM D 6217. DAEC uses the non-modified ASTM D 2276 which uses the more conservative filter pore size of 0.8μm verses the 3.0μm as used by the Modified ASTM D 2276, Method A. The DAEC Operating Experience and generally the industry Operating Experience shows this to be acceptable.
- DAEC does not use fuel additives of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion. The monthly testing for and removal of water and the purchase of quality fuel oil negates the need for additives. The DAEC Operating Experience shows this to be an acceptable alternative.

18.1.26 FUSE HOLDERS PROGRAM

The Fuse Holders Program manages the effects of aging by visual and thermographic inspection. The visual inspection is to identify aging due to adverse localized environments.

The thermographic inspection is to identify aging due to loosening of the metal clip. Plant procedures contain the scheduling information, instructions and acceptance criteria for performing thermography on control panels.

This program is consistent with the ten elements of NUREG-1801 XI.E5 and takes no exception to NUREG-1801 XI.E5.

18.1.27 INACCESSIBLE MEDIUM VOLTAGE CABLES PROGRAM

The Inaccessible Medium-Voltage Cables Program manages the effects of aging by measuring the insulation resistance of the cables and connections at least once every 10 years in accordance with plant procedures. In-scope, medium-voltage cables exposed to significant moisture and energized a significant portion of their life are tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test, and is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state-of-the-art at the time the test is performed.

This aging management program includes actions to prevent cables from being exposed to long term exposure to significant moisture by inspecting the manholes containing cables and testing of sump pumps at least once every 2 years. Actual frequency is based on operating experience. These activities are controlled by a preplanned task.

This program is consistent with the ten elements of NUREG-1801 XI.E3 and takes no exception to NUREG-1801 XI.E3.

18.1.28 INSPECTION OF INTERNAL SURFACES IN MISCELLANEOUS PIPING AND DUCTING COMPONENTS PROGRAM

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program consists of inspections of the internal surfaces of steel piping, piping components, ducting, and other components not covered by other aging management programs. The program consists of visual inspections performed during pre-planned system and component maintenance activities when the systems are opened and the surfaces are accessible.

This program is consistent with the ten elements of NUREG-1801 XI.M38 and takes no exception to NUREG-1801 XI.M38.

18.1.29 INSPECTION OF OVERHEAD HEAVY LOAD AND LIGHT LOAD (RELATED TO REFUELING) HANDLING SYSTEMS PROGRAM

The Inspection of Overhead Heavy Load and Light Load (related to refueling) Handling Systems Program manages loss of material of structural components of heavy and light load handling systems. The Program addresses lost of material due to general corrosion of supporting steel and loss of material due to wear on the crane rails through periodic visual inspection.

In addition, the Program tracks the usage of the reactor building crane and turbine building crane.

Inspection of the torus monorail is completed as part of the Technical Specification Surveillance for the suppression chamber and drywell visual inspection.

This program is consistent with the ten elements of NUREG-1801 XI.M23 and takes no exception to NUREG-1801 XI.M23.

18.1.30 LUBRICATING OIL ANALYSIS PROGRAM

The Lubricating Oil Analysis Program ensures the oil environment in the mechanical systems is maintained to the required quality. The program maintains oil contaminants (primarily water and particulates) within acceptable limits to manage the aging effects of loss of material, cracking, and heat transfer degradation. Oil testing activities include periodic sampling, analysis, and trending of results.

This program is consistent with the ten elements of NUREG-1801 XI.M39 and takes no exception to NUREG-1801 XI.M39.

18.1.31 METAL ENCLOSED BUS PROGRAM

The Metal Enclosed Bus Program manages the effects of aging by inspecting the insulation of the metal enclosed bus periodically. Maintenance procedures and preplanned tasks contain the scheduling information, instructions and acceptance criteria for inspecting the metal enclosed bus within the scope of this program.

The Duane Arnold program applies to buses that support a license renewal function and are susceptible to any of the following aging mechanisms:

- Loosening of bolted connections due to thermal cycling and ohmic heating
- Reduced insulation resistance
- Moisture/debris intrusion

The non-segregated buses between the startup transformer and the 4.16 kV switchgear are metal enclosed buses within the scope of this program.

This program is consistent with the ten elements of NUREG-1801 XI.E4 with the following exception:

- NUREG-1801 XI.E4 recommends a 5 year frequency for visual inspections when no thermographic inspections are performed. The DAEC performs the visual inspections on a 6 year frequency as part of the major inspection of the associated transformer. The inspections that have been performed since the bus bar insulation was replaced have not identified any degradation. Therefore, performing visual inspections on a 6 year frequency provides reasonable assurance that the metal enclosed bus will be maintained consistent with the current licensing basis through the period of extended operation.

18.1.32 ONE-TIME INSPECTION PROGRAM

The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to not have an effect on the intended function of the structure or component. The program provides measures for verifying an aging management program is not needed, verifying the effectiveness of other aging management programs, or determining that degradation is occurring which will require evaluation and corrective action.

The program assesses loss of material due to crevice, galvanic, general, pitting, and microbiologically-influenced corrosion and erosion, heat transfer degradation due to fouling, and cracking due to stress corrosion cracking or cyclic loading.

This program is consistent with the ten elements of NUREG-1801 XI.M32 and takes no exception to NUREG-1801 XI.M32.

18.1.33 OPEN CYCLE COOLING WATER SYSTEM PROGRAM

The Open Cycle Cooling Water System Program relies on implementation of NRC Generic Letter 89-13 to ensure that the effects of aging on the raw water service water systems will be managed for the period of extended operation. The program manages the aging effects in the following systems: Circulating Water System, River Water Supply System, Residual Heat Removal Service Water System, and Emergency Service Water System.

This program is consistent with the ten elements of NUREG-1801 XI.M20 and takes no exception to NUREG-1801 XI.M20.

18.1.34 REACTOR HEAD CLOSURE STUDS PROGRAM

The Reactor Head Closure Studs Program is an integral part of the ASME Section XI Inservice Inspection Program. The program incorporates the appropriate Code edition and sections of ASME Section XI Subsection IWB. The program provides preventive measures to mitigate cracking. These measures include material selection, appropriate coatings, and lubrications which follow the guidelines of NRC Regulatory Guide 1.65.

This program is consistent with the ten elements of NUREG-1801 XI.M3 and takes no exception to NUREG-1801 XI.M3.

18.1.35 REACTOR VESSEL SURVEILLANCE PROGRAM

The Reactor Vessel Surveillance Program is consistent with the requirements of 10 CFR 50, Appendix H, NRC Regulatory Gide 1.88 and ASTM E-85. The program manages the effects of neutron/radiation embittement on the reactor pressure vessel beltline.

This program is consistent with the ten elements of NUREG-1801 XI.M31 and takes no exception to NUREG-1801 XI.M31.

18.1.36 SELECTIVE LEACHING OF MATERIALS PROGRAM

The Selective Leaching of Materials Program will ensure that cast iron, brass, bronze, and copper alloy components exposed to raw water, treated water, or groundwater will maintain their integrity for the period of extended operation. The program will include a one-time visual inspection and hardness measurement of selected components that may be susceptible to selective leaching.

This program is consistent with the ten elements of NUREG-1801 XI.M33 and takes no exception to NUREG-1801 XI.M33.

18.1.37 STRUCTURES MONITORING PROGRAM

The Structures Monitoring Program includes the Masonry Wall Program and the Inspection of Water Control Structures Associated with Nuclear Power Plants Program.

The Structures Monitoring Program includes periodic visual inspection of structures and structural components for the detection of aging effects. Detection of aggressive subsurface environments will be completed by periodic sampling the on-site groundwater. Examinations of inaccessible areas, such as buried concrete foundations, will be completed during inspections of opportunities during pre-planned maintenance activities. The Masonry Wall Program includes visual inspection of safety-related masonry walls for degradation. Periodic visual inspections of water controlled structures associated with the emergency core cooling water systems and/or flood protection are conducted in accordance with the Maintenance Rule Program. Individuals performing inspections and reviews will be qualified in accordance with the Maintenance Rule Program.

This program is consistent with the ten elements of NUREG-1801 XI.S5, XI.X6 and XI.S7 and takes no exception to NUREG-1801 XI.S5, XI.X6 and XI.S7.

18.1.38 THERMAL AGING AND NEUTRON IRRADIATION EMBRITTLEMENT OF CAST AUSTENITIC STAINLESS STEEL (CASS) PROGRAM

The Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program inspects the susceptible CASS components that are part of the reactor pressure vessel internals in accordance with the applicable ASME Section XI and BWRVIP documents. The program will perform enhanced VT-1 inspections of the susceptible cast austenitic stainless steel components that are part of the reactor vessel internals. These inspections will be included as part of the 10-year Inservice Inspection Plan during the period of extended operation.

This program is consistent with the ten elements of NUREG-1801 XI.M13 and takes no exception to NUREG-1801 XI.M13.

18.1.39 WATER CHEMISTRY PROGRAM

The Water Chemistry Program establishes the plant water chemistry specifications, action levels, and responses to out-of-specification water chemistry conditions. The program relies on monitoring and control of reactor water chemistry based on industry guidelines of BWRVIP-130.

This program is consistent with the ten elements of NUREG-1801 XI.M2 and takes no exception to NUREG-1801 XI.M2.

18.2 TLAA EVALUATION OF AGING MANAGEMENT PROGRAMS UNDER 10 CFR 54.21(C)(1)(iii)

18.2.1 ENVIRONMENTAL QUALIFICATION PROGRAM

The Duane Arnold Environmental Qualification Program ensures that the electrical components important to safety meet the requirements of 10 CFR 50.49. Station procedures identify components that are managed by this program.

This program is consistent with the ten elements of NUREG-1801 XI.E1 and takes no exception to NUREG-1801 XI.E1.

18.2.2 METAL FATIGUE OF REACTOR COOLANT PRESURE BOUNDARY PROGRAM

The Duane Arnold Metal Fatigue of Reactor Coolant Pressure Boundary Program is an existing program. In accordance with NUREG/CR-6260, the program has evaluated the impact of environmental effects on fatigue usage and shown them to be less than the maximum allowable (1.0) for the period of extended operation.

The following components are evaluated:

- Reactor pressure vessel shell and lower head
- Reactor pressure vessel recirculation outlet nozzle
- Reactor pressure vessel recirculation inlet nozzle
- Reactor pressure vessel feedwater nozzle bore
- Reactor pressure vessel core spray nozzle and safe end
- Feedwater/reactor core isolation cooling tee
- Recirculation piping/residual heat removal return tee
- ASME Class 1 residual heat removal piping at tapered transition

This program is consistent with the ten elements of NUREG-1801 XI.M1 and takes no exception to NUREG-1801 XI.M1.

18.2.3 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 existing TLAA related exemptions were identified.

18.3 TIME-LIMITED AGING ANALYSES

As part of a license renewal application, 10 CFR 54.21(c) requires that an evaluation of TLAAs for the period of extended operation be provided. The following TLAAs have been identified for Duane Arnold and evaluated to meet this requirement.

18.3.1 REACTOR PRESSURE VESSEL NEUTRON EMBRITTLEMENT

The materials of the RPV and internals are subject to embrittlement due to high energy (E > 1 MeV) neutron exposure. Embrittlement means the material has lower toughness (i.e., will absorb less strain energy during a crack or rupture), thus allowing a crack to propagate more easily under thermal and/or pressure loading.

The reactor vessel neutron embrittlement TLAAs have been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii). Fifty-four effective full power years (EFPY) would be the effective full power years at the end of the period of extended operation assuming an average capacity factor of 90% for 60 years.

18.3.1.1 NEUTRON FLUENCE

Analyses were performed to determine neutron fluence for extended operation to 54 EFPY. High energy (>1 MeV) neutron fluence for the welds and shells of the RPV beltline region was calculated using the RAMA fluence methodology. The RAMA methodology was developed for the Electric Power Research Institute and the Boiling Water Reactor Vessel and Internals Project. Use of this methodology for evaluations of fluence for the DAEC was performed in accordance with guidelines presented in Regulatory Guide 1.190, as recommended in NUREG-1800. The NRC has reviewed and approved RAMA for BWR RPV fluence predictions.

18.3.1.2 REACTOR VESSEL UPPER SHELF ENERGY REDUCTION

Upper Shelf Energy (USE) is the standard industry parameter used to indicate the maximum toughness of a material at high temperature. 10CFR50 Appendix G requires the predicted end-of-life Charpy impact test USE for RPV materials to be at least 50 ft-lb (absorbed energy), unless an approved analysis supports a lower value. The predicted USE drop is determined in accordance with NRC Regulatory Guide 1.99, Revision 2. For Boiling Water Reactors (BWRs) that cannot meet the 50 ft-lb criterion, the BWR Vessel and Internals Project (BWRVIP) has provided a bounding equivalent margins USE analysis for plants in BWRVIP-74-A, which is valid for up to 54 EFPY of operation.

Predicted USE drop for each RPV material in the beltline region exposed to fluence greater than 1.0×10^{17} n/cm^2 for 54 EFPY was determined in accordance with RG 1.99. In cases where the 50 ft-lb criterion cannot be met, or where USE data is absent, an equivalent margin analysis (EMA) using BWRVIP-74-A was performed.

All DAEC materials are acceptable from a USE standpoint for 54 EFPY.

18.3.1.3 ADJUSTED REFERENCE TEMPERATURE INCREASE

The adjusted reference temperature (ART) of the limiting beltline material is used to adjust the beltline P-T curves to account for irradiation effects.

The DAEC ART values were determined in accordance with Regulatory Guide (RG) 1.99, Revision 2. The limiting beltline plate material has an ART value of 152.6°F for 54 EFPY. The limiting nozzle, N-2, has an ART value of 116.4°F for 54 EFPY. ART values for 54 EFPY are below the 200ºF suggested in Regulatory Guide 1.99 and are, therefore, acceptable for the period of extended operation.

18.3.1.4 REFLOOD THERMAL SHOCK OF THE REACTOR VESSEL

A recent analysis performed for BWR-6 vessels evaluates the bounding LOCA event, a main steam line break, for a BWR vessel design that is similar to the DAEC vessel. Since the DAEC vessel inside diameter is appreciably smaller than the BWR-6 vessel sizes evaluated in the BWR-6 analysis, and the DAEC vessel beltline has a wall thickness less than that evaluated in the BWR-6 analysis, the cooldown due to the reflood event at the 1/4T depth would potentially be greater for the DAEC vessel than that of the BWR-6 vessel. A re-evaluation was performed for the DAEC which determined that the bounding applied stress intensity factor, K, for DAEC of 100 ksi√inch is less than the available fracture toughness of 200 ksi√inch after 54 EFPY, which is acceptable.

18.3.1.5 REACTOR VESSEL THERMAL LIMIT - OPERATING PRESSURE - TEMPERATURE LIMITS

Revised P/T curves were created for 54 effective full power years (EFPY) of operation, using the methodology of the 2001 Edition, 2003 Addenda of ASME Code, Section XI, Appendix G, and 10CFR50 Appendix G. The curves were developed in accordance with the methodology of the Boiling Water Reactor Owners' Group (BWROG) Licensing Topical Report, "Pressure Temperature Limits Report Methodology for Boiling Water Reactors" Structural Integrity Associates Report No. SIR-05-044-A, Revision 0, "Pressure-Temperature Limits Report Methodology for Boiling Water Reactors," April 2007). Fluence was determined using NRC-approved RAMA methodology.

18.3.1.6 REACTOR VESSEL CIRCUMFERENTIAL WELD EXAMINATION RELIEF

Relief from RPV circumferential weld examination requirements under GL 98-05 is based on probabilistic assessments that predict an acceptably low probability of failure per reactor operating year. The analysis is based on RPV metallurgical conditions as well as flaw indication sizes and frequencies of occurrence that are expected at the end of a licensed operating period. The anticipated changes in metallurgical conditions expected over the extended licensed operating period require an additional analysis for 54 EFPY and approval by the NRC to extend this relief request.

An evaluation was performed based on the methodology presented in EPRI Report No. TR-105697, "BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations (BWRVIP-05)." The evaluation included the estimate of the probability of failure due to a limiting event (i.e., low temperature over-pressurization, or LTOP) for the case of 90% axial weld inspection (based on actual weld inspection coverage achieved in previous examinations). Probability of failure (PoF) results were calculated for 60 years (54 EFPY) for the RPV beltline axial welds and the beltline circumferential weld, including the consideration of the LTOP occurrence probability of $1x10^{-3}$ per year. The probability of failure for the circumferential welds is below that calculated in the Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC No. M93925), dated July, 1998. The DAEC inspection coverage on axial welds satisfies ASME Code requirements. The probability of failure per reactor year for the axial welds is below the probability quoted in the Supplement to Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (TAC No. MA3395) dated March 7, 2000.

18.3.2 METAL FATIGUE

Fatigue is the progressive localized permanent structural change that occurs in a material subjected to repeated or fluctuating strains at nominal stresses having maximum values often much less than the tensile strength of the material. In the case of the Duane Arnold reactor pressure vessel, fatigue is based on the postulated cycles during operation of the plant; the most common of these being the startup/shutdown cycle. To address this design consideration for the reactor pressure vessel, explicit metal fatigue calculations were specified in the ASME Boiler and Pressure Vessel Code.

18.3.2.1 REACTOR PRESSURE VESSEL FATIGUE

The cumulative usage factor (CUF) values obtained from the 40 year analyses were updated to incorporate revised numbers of cycles for sixty years of operation. As shown by the analysis, the 60 year CUFs are less than 1.0, and therefore are acceptable.

18.3.2.2 FATIGUE OF CLASS 1 PIPING

DAEC Class 1 piping systems were designed in accordance with B31.1 or B31.7 requirements. Those piping systems designed in accordance with B31.7 were explicitly analyzed for fatigue. These B31.7 evaluations have been reviewed to ensure that CUFs will remain less than 1.0 for 60 years of operation, or that the fatigue exemptions remain valid.

For the systems that were designed in accordance with ANSI B31.1 methodology, fatigue usage factors were not determined. For these systems, although the code of construction did not invoke fatigue analyses, a stress range reduction factor which is applied to the allowable stress range for expansion stresses is required to account for cyclic thermal conditions. The allowable secondary stress range is 1.0 S_A for 7,000 equivalent full temperature thermal cycles or less. Since this piping will not exceed 7000 full temperature cycles in 60 years of operation, stress analyses remain valid for the period of extended operation.

18.3.2.3 IRRADIATION ASSISTED STRESS CORROSION CRACKING

Austenitic stainless steel RPV internal components exposed to neutron fluence greater than 5 $x10^{20}$ n/cm^2 (E > 1 MeV) are considered susceptible to IASCC in the BWR environment; IASCC of RPV internals is considered a TLAA.

Therefore, IASCC of the following is a TLAA for the DAEC:

- Shroud
- Top guide
- Core support plate
- Incore instrumentation dry tubes and guide tubes

18.3.2.4 STRESS RELAXATION (CORE PLATE RIM HOLD-DOWN BOLTS)

As described in the SER to BWRVIP-25, plants must consider relaxation of the rim hold-down bolts as a TLAA issue.

For the DAEC, evaluation shows that at the end of plant life, the loss-of-preload caused by cracking in the rim hold-down bolts would not diminish the integrity of the core plate. The amount of preload lost after sixty years would be only 53 pounds of the original 10,980 pounds. Even if all the hold-down bolts cracked to 30% of their radii, the loss-of-preload would not diminish core plate integrity.

18.3.2.5 EFFECTS OF REACTOR COOLANT ENVIRONMENT (GSI-190)

Generic Safety Issue (GSI) 166, later renumbered as GSI-190, was identified by the NRC because of concerns about the effects of reactor water environments on the fatigue life of components and piping during the period of extended operation. GSI-190 was closed in December of 1999, and concluded that environmental effects have a negligible impact on core damage frequency, and as such, no generic regulatory action is required. However, as part of the closure of GSI-190, the NRC concluded that licensees who apply for license renewal should address the effects of coolant environment on component fatigue life as part of their aging management programs.

Detailed environmental fatigue calculations were performed for DAEC for locations associated with the older vintage GE plant discussed in NUREG/CR-6260. Per Section X.M1 of the GALL Report, the EAF evaluation must use the appropriate F_{en} relationships from NUREG/CR-6583 (for carbon/low alloy steels) and NUREG/CR-5704 (for stainless steels), as appropriate for the material for each location. The methodology documented in NUREG/CR-6583 and NUREG/CR-5704 was used to evaluate environmental effects for DAEC components. To perform the environmental fatigue evaluations, HWC conditions were assumed to exist for 72.4% of the time, and NWC conditions to exist for 27.6% of the time.

The cumulative usage factors, including environmental effects, are shown to be below 1.0.

18.3.3 ENVIRONMENTAL QUALIFICATION

18.3.3.1 ENVIRONMENTAL QUALIFICATION OF ELECTRICAL EQUIPMENT (EQ)

The Duane Arnold Environmental Qualification Program was designed to meet Code of Federal Regulations, Title 10, Section 50.49, “Environmental qualification of electric equipment important to safety for nuclear power plants.”

10CFR50.49(a) states, "Each holder of or each applicant for a license to operate a Nuclear Power Plant shall establish a program for qualifying ..." electric equipment as defined in the code.

(a) Electric equipment as defined by 10CFR50.49(b) shall be identified and if not located in a mild environment as defined by 10CFR50.49(c)(3) shall be included in the EQ Program.

(b) A master list of equipment in the EQ Program shall be prepared and maintained in accordance with 10CFR50.49 (d).

(c) Performance specifications, electrical characteristics and environmental conditions as defined in 10CFR50.49 (d), shall be established and maintained for equipment in the EQ Program in a qualification file.

(d) Qualification requirements and methods of qualification defined in 10CFR50.49 (e) and (f) shall establish the basis for the qualification of equipment in the EQ Program.

(e) In accordance with 10CFR50.49 (j), a record file is maintained, in an auditable form, containing information permitting verification that EQ equipment:

- "is qualified for its application"
- "meets its specified performance requirements when it is subjected to the condition predicted to be present when it must perform its safety function up to the end of its qualified life"
- shall be established and maintained for the entire period the equipment is installed or stored for future use at the plant.

(f) 10CFR50.49 (k) permits the continued environmental qualification of equipment qualified, in accordance with "Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors", November 1979 (DOR Guidelines), prior to the issuance of 10CFR50.49.

(g) EQ equipment or components, replaced during plant modification or maintenance, shall be qualified as required by 10CFR50.49 (l) unless there are sound reasons to the contrary.

- These "sound reasons" shall be those delineated in Regulatory Guide 1.89, Rev. 1.

As required in Section 7.0 of DOR Guidelines, an ongoing program of surveillance and maintenance to assure that EQ equipment exhibiting age-related degradation will be identified and replaced as necessary, shall be established.

EQ Program documentation and equipment shall meet the applicable quality assurance requirements defined in 10CFR50 Appendix B.

In general, EQ components are qualified via simulated aging and testing to specified conditions in accordance with accepted regulatory requirements and industry standards. A qualified life for each component may be determined based on the test results in a number of ways, often using activation energies of each material in conjunction with the Arrhenius equation for thermal effects, and total accumulated dose respectively.

Reanalysis of an aging evaluation to extend the qualification of a components is performed on a routine basis pursuant to 10 CFR 50.49(e) as part of the EQ Program. While a component life limiting condition may be due to thermal or radiation aging, the majority of component aging limits are based on thermal conditions. Conservatism may exist in aging evaluation parameters, such as the assumed ambient temperature of the component, an unrealistically low activation energy, or in the application of a component (de-energized versus energized).

The reanalysis of an aging evaluation is documented in Tab E of each EQR file in accordance with the requirements of the DAEC quality assurance (QA) program, which requires the verification of assumptions and conclusions. Important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria and corrective actions (if acceptance criteria are not met). These attributes are discussed below.

Analytical Methods – The EQ Program uses the same analytical models in the reanalysis of an aging evaluation as those previously applied during the prior evaluation. The Arrhenius methodology is an acceptable model for performing a thermal aging evaluation. The analytical method used for a radiation aging evaluation is to demonstrate qualification for the total integrated dose (that is, normal radiation dose for the projected installed life plus accident radiation dose). For license renewal, acceptable methods for establishing the 60 year normal radiation dose include multiplying the 40 year normal radiation dose by 1.5 (that is 60 years/40 years) or using the actual calculated value for 60 years. The result is added to the accident radiation dose to obtain the total integrated dose for the component. In many cases, the normal radiation dose is insignificant when compared to the accident dose. In such cases, the use of the accident dose is valid for both the 40 year and 60 year dose.

Data Collection and Reduction Methods – Reducing excess conservatism in the component service conditions (e.g., temperature, radiation) used in the prior aging evaluation is the main method used for a reanalysis per the EQ Program. Temperature data used in an aging evaluation should be conservative and based on plant design temperatures or on actual plant temperature data. When used, plant temperature data can be obtained in several ways including monitors used for technical specification compliance, other installed monitors, measurements made by plant operators during rounds, and temperature sensors on large motors (while the motor is not running). A representative number of temperature measurements are conservatively evaluated to establish the temperatures used in an aging evaluation. Plant temperature data may be used in an aging evaluation in different ways, such as (a) directly applying the plant temperature data in the evaluation or (b) using the plant temperature data to demonstrate conservatism when using plant design temperatures for an evaluation. Any changes to material activation energy values as part of a reanalysis are to be justified on a plant-specific basis.

Underlying Assumptions – EQ component aging evaluations contain sufficient conservatism to account for most environmental changes occurring due to plant modifications and events. When unexpected adverse conditions are identified during operational or maintenance activities that affect the normal operating environment of a qualified component, the affected EQ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions.

Acceptance Criteria and Corrective Action – Under the EQ Program, the reanalysis of an aging evaluation could extend the qualification of the component. If the qualification cannot be extended by reanalysis, the component must be refurbished, replaced, or re-qualified prior to exceeding the period for which the current qualification remains valid. A reanalysis is to be performed in a timely manner (that is, sufficient time is available to refurbish, replace, or re-qualify the component if the reanalysis is unsuccessful).

Based on a review of the DAEC EQ Program and operating experience, the continued effective implementation of the program provides reasonable assurance that (a) the aging effects will be managed, and (b) EQ components will continue to perform their intended function(s) consistent with the current licensing basis for the period of extended operation. Therefore, the DAEC EQ Program is an acceptable aging management program for license renewal under 10 CFR 54.21(c)(1)(iii) during the period of extended operation.

18.3.4 FATIGUE OF PRIMARY CONTAINMENT PIPING, AND COMPONENTS

The Mark I analyses are detailed in the DAEC Plant Unique Analysis Report (PUAR) and assume 60 multiple SRV lifts and 740 single SRV lifts. Since these analyses include fatigue evaluations based on the occurrence of a limited number of transient cycles during the current licensed term of operation (40 years), they are TLAAs.

18.3.4.1 FATIGUE ANALYSIS OF SUPPRESSION CHAMBER

The maximum CUF (for 40 years) for the torus shell and welds is 0.467. Multiplying this value by 60/40 results in a CUF (for 60 years) of 0.70, which is less than 1.0.

Since the 60 year CUF is less than 1.0, the current calculation remains valid for the period of extended operation.

18.3.4.2 FATIGUE ANALYSIS OF THE VENT SYSTEM AND VENT LINE BELLOWS

The maximum CUF (for 40 years) for the vent system components and welds is 0.33. Multiplying this value by 60/40 results in a CUF (for 60 years) of 0.50, which is less than 1.0.

For the vent line bellows, multiplying the number of thermal load cycles by 60/40 results in 225 cycles, which remains below rated capacity.

18.3.4.3 FATIGUE ANALYSIS OF SUPPRESSION CHAMBER EXTERNAL PIPING AND PENETRATIONS

The Mark I Owners Group prepared and submitted a generic fatigue evaluation report which addressed fatigue on a generic basis, and reported cumulative usage factors below 0.5. Conservatively multiplying this value by 1.5 (60 years divided by 40 years) results in 60-year CUFs of 0.75, which are less than 1.0 and therefore, acceptable.

The Mark I analyses assume 740 single SRV lifts and 60 multiple SRV lifts. A projection of the number of SRV lifts results in a projection of 334 single SRV lifts and 42 multiple lifts for 60 years. Both of these numbers are well below the values assumed in the Mark I analyses. Therefore the analyses remain valid for 60 years.

18.3.4.4 STRESS REPORT-DESIGN CALCULATIONS CONTAINMENT VESSEL

The Containment Vessel Stress Report includes a fatigue analysis exemption which is based on an assumed number of cycles. After increasing this number of cycles (for 60 years), the containment vessel remains exempt from fatigue analysis.

18.3.4.5 DESIGN ANALYSES OF FLUED HEADS FOR CLASS 1 PENETRATIONS

The analyses include the verification of adequacy of the flued heads by comparing allowable stresses (based on an assumed number of cycles) and maximum stress intensities. The stress results remain acceptable for the increased number of cycles for 60 years.

18.3.5 OTHER PLANT-SPECIFIC TLAAS

18.3.5.1 CRANES - REACTOR AND TURBINE BUILDING

The Turbine and Reactor Building Crane specifications assume a 40-year useful life for fatigue stress analysis purposes. The Ederer Generic Licensing Topical Report EDR-1(NP)–A, applicable to the Reactor Building Crane describes the crane as CMAA Class A crane. There are implicit cycle requirements for cranes designed in accordance with Crane Manufacturers Association of America (CMAA)-70.

The effects of aging on the intended function(s) will be adequately managed for the period of extended operation.

18.3.5.2 EVALUATION OF THE FATIGUE LIFE OF THE STABILIZER ASSEMBLY

The evaluation of the fatigue life of the stabilizer assembly between the bioshield wall and the containment determined that the system is qualified for at least 400 fatigue cycles. The number of cycles expected for a 60-year life remains below 400.

18.3.5.3 EVALUATION OF EXISTING HCC-B002 "DOLLAR WELD" INDICATION

During RFO 17, inspections identified an indication in a circumferential weld in the reactor head (Vessel Head Dollar Weld HCC-B002) that did not meet ASME Section XI IWB-3500 acceptance standards. The indication was evaluated and determined to be acceptable to leave as-is (IWB-3600 evaluation).

Per BWRVIP-74-A, a re-evaluation shall be performed for the 60 year service period corresponding to the LR term. The re-evaluation determined that the maximum end-of-service life (54 EFPY) applied stress intensity factor calculated for the indication is well below the material fracture toughness.

Therefore, the existing flaw is acceptable for 60 year life.

18.3.5.4 EVALUATION OF THERMAL FATIGUE EFFECTS ON STEAM LEAD AND INLET TO RPV

This calculation evaluates the potential thermal fatigue effects on the steam lead into the condensing pot and the inlet to the RPV. The calculation was re-evaluated for the additional cycles that would be incurred during a 60 year life, with acceptable results.

18.3.5.5 CONTROL ROD DRIVE MECHANISM FATIGUE

The analysis for cyclic operation of the Control Rod Drive Mechanisms (CRDMs) resulted in a maximum cumulative usage factor (CUF) of 0.15 for the limiting CRD main flange at EPU conditions. Increasing this CUF by using a 1.5 multiplier (60 years/40 years) results in a 60-year CUF less than 1.0, which is acceptable.

The CUFs for the insert/withdrawal lines, discharge piping, scram monitoring stations and scram headers remain below 1.0 for 60 years, and are therefore acceptable.

18.3.5.6 MAIN STEAM ISOLATION VALVE D EVALUATION

A flaw evaluation was performed for subsurface indications identified in the body of the D outboard steam isolation valve per ASME IWB-3600.

The assumed 40 years of operation from the last radioagraphy, bounding flaw sizes evaluated, margin to acceptance criteria, and commitment to perform another radiographic inspection of the repair when the valve is disassembled for other reasons provide adequate basis for the 60 year service period.

18.3.5.7 BELLOWS DESIGN ANALYSIS

The design analyses for Reactor Water Cleanup Supply penetration X-15 and RPV Feedwater penetration X-9A/B include cycle assumptions. Multiplying the design cycles by 1.5 (60 years/40 years), it is seen that the numbers of design cycles remain below the numbers of rated cycles; the results therefore remain acceptable.

18.4 LIST OF LICENSE RENEWAL COMMITMENTS

TABLE A-1
DUANE ARNOLD LICENSE RENEWAL COMMITMENTS

Item No.	System, Component or Program	Commitment	Section	Schedule
1.	Buried Piping and Tanks Inspection Program	Develop Buried Piping and Tank Program	18.1.7	Prior to the period of extended operation
2.	BWR Vessel Internals Program	Perform an EVT-1 inspection of 5% of the top guide locations	18.1.14	Within six years of entering the period of extended operation
3.	BWR Vessel Internals Program	Perform an EVT-1 inspection of an additional 5% of the top guide locations	18.1.14	Within 12 years of entering the period of extended operation
4.	Electrical Cables and Connections Program	Establish an Electrical Cables and Connections Program.	18.1.17	Prior to the period of extended operation

TABLE A-1
DUANE ARNOLD LICENSE RENEWAL COMMITMENTS

Item No.	System, Component or Program	Commitment	Section	Schedule
5.	Electrical Cables and Connections Used in Instrumentation Circuits Program	Establish an Electrical Cables and Connections Used in Instrumentation Circuits Program.	18.1.18	Prior to the period of extended operation
6.	Electrical Connections Program	Establish an Electrical Connections Program	18.1.19	Prior to the period of extended operation
7.	Electrical Penetration Assemblies Program	Establish an Electrical Penetration Assemblies Program.	18.1.20	Prior to the period of extended operation
8.	External Surfaces Monitoring Program	Revise the inspection program to address inspector qualifications, types of components, degradation mechanisms, aging effects, acceptance criteria, and inspection frequency.	18.1.21	Prior to the period of extended operation
9.	Fire Protection Program	Revise program to include criteria for visual inspection of fire barriers, walls, ceilings, and floors to examine for signs of age related degradation.	18.1.22	Prior to the period of extended operation

TABLE A-1
DUANE ARNOLD LICENSE RENEWAL COMMITMENTS

Item No.	System, Component or Program	Commitment	Section	Schedule
10.	Fire Protection Program	Enhance procedures to inspect the entire diesel driven fire pump fuel supply line for age related degradation.	18.1.22	Prior to the period of extended operation
11.	Fire Water System Program	Establish maintenance activities to perform volumetric examinations for pipe wall thinning of fire protection piping periodically during the period of extended operation	18.1.23	Prior to the period of extended operation
12.	Fire Water System Program	Enhance procedures to include NFPA 25 criteria for sprinklers regarding replacing or testing	18.1.23	Prior to the period of extended operation
13.	Fire Water System Program	Enhance procedures to perform visual inspection of fire hydrants annually	18.1.23	Prior to the period of extended operation
14.	Fuel Oil Chemistry Program	Revise the program to require particulate testing of fuel oil samples from the diesel fire pump day tank	18.1.25	Prior to the period of extended operation

TABLE A-1
DUANE ARNOLD LICENSE RENEWAL COMMITMENTS

Item No.	System, Component or Program	Commitment	Section	Schedule
15.	Fuel Oil Chemistry Program	Enhance procedures to require sampling and testing of new fuel oil delivered to the diesel fire pump day tank	18.1.25	Prior to the period of extended operation
16.	Fuel Oil Chemistry Program	Enhance procedures activities for periodic (10 year) draining or cleaning of the diesel fuel oil day tanks, diesel fire pump day tank, and diesel driven air start air compressor fuel oil tanks	18.1.25	Prior to the period of extended operation
17.	Fuel Oil Chemistry Program	Establish procedures to require bottom thickness testing of the Standby Diesel Generator Day Tanks and the Diesel Fire Pump Day Tank	18.1.25	Prior to the period of extended operation
18.	Fuse Holders Program	Establish a Fuse Holders Program.	18.1.26	Prior to the period of extended operation
19.	Inaccessible Medium Voltage Cable Program	Establish an Inaccessible Medium Voltage Cable Program.	18.1.27	Prior to the period of extended operation

TABLE A-1
DUANE ARNOLD LICENSE RENEWAL COMMITMENTS

Item No.	System, Component or Program	Commitment	Section	Schedule
20.	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Establish an inspect of Internal, Surfaces in Miscellaneous Piping and Ducting Components Program	18.1.28	Prior to the period of extended operation
21.	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program	Enhance procedures to monitor for corrosion and wear of the supporting steel and rails	18.1.29	Prior to the period of extended operation
22.	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program	Enhance procedures to record usage of the reactor building and turbine building cranes	18.1.29	Prior to the period of extended operation
23.	Lubricating Oil Analysis Program	Enhance procedures to include diesel fire pump	18.1.30	Prior to the period of extended operation

TABLE A-1
DUANE ARNOLD LICENSE RENEWAL COMMITMENTS

Item No.	System, Component or Program	Commitment	Section	Schedule
24.	Metal Enclosed Bus Program	Establish a Metal Enclosed Bus Program	18.1.31	Prior to the extended operation
25.	One-Time Inspection Program	Establish a One Time Inspection Program	18.1.32	Prior to the period of extended operation
26.	Reactor Vessel Surveillance Program	Develop a procedure to evaluate the BWRVIP ISP data as it becomes available.	18.1.35	Prior to the period of extended operation
27.	Reactor Vessel Surveillance Program BWRVIP-74-A BWR PRV Inspection and Flaw Evaluation Guidelines for License Renewal	Revise the Reactor Vessel Surveillance Program to implement the recommendations of BWRVIP-116 BWR Vessel and Internals Project Integrated Surveillance Program Implementation for License Renewal.	18.1.35	Prior to the period of extended operation
28.	Reactor Vessel Surveillance Program	Implement BWRVIP-116 with the conditions documented in Sections 3 and 4 of the NRC Staff's SE dated March 1, 2006 for BWRVIP-116	18.1.35	Prior to the period of extended operation

TABLE A-1
DUANE ARNOLD LICENSE RENEWAL COMMITMENTS

Item No.	System, Component or Program	Commitment	Section	Schedule
29.	Selective Leaching of Materials Program	Establish a program to include one-time visual inspection and hardness measurement of selected components susceptible to selective leaching	18.1.36	Prior to the period of extended operation
30.	Structures Monitoring Program	Enhance procedures to include structures and structural components not currently in Maintenance Rule Program	18.1.37	Prior to the period of extended operation
31.	Structures Monitoring Program	Enhance procedures to include periodic sampling of groundwater for pH, chloride and sulfate concentration on a 10 year periodicity.	18.1.37	Prior to the period of extended operation
32.	Structures Monitoring Program	Enhance procedures to include a elastomer inspection to prevent leakage through containment penetration	18.1.37	Prior to the period of extended operation
33.	Structures Monitoring Program	Enhance procedures to include a requirement to contact the proper personnel to allow opportunistic inspection of the buried concrete foundation	18.1.37	Prior to the period of extended operation

TABLE A-1
DUANE ARNOLD LICENSE RENEWAL COMMITMENTS

Item No.	System, Component or Program	Commitment	Section	Schedule
34.	Structures Monitoring Program	Enhance procedures to include opportunistic inspections of the buried concrete foundation on a 10 year periodicity	18.1.37	Prior to the period of extended operation
35.	Metal Fatigue of Reactor Coolant Pressure Boundary Program	Enhance procedures to incorporate the requirements of NUREG/CR-6260 locations into the implementing procedures	18.2.2	Prior to the period of extended operation
36.	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program	Establish a Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program.	18.1.38	Prior to the period of extended operation
37.	BWRVIP-25 BWR Core Plate Inspection and Flaw Evaluation Guidelines	Inspect a sample of the rim hold-down bolts by VT-3 until an expanded technical basis for not inspecting is approved by the NRC.	18.1.14	Prior to the period of extended operation
38.	BWRVIP-74-A BWR PRV Inspection and Flaw Evaluation Guidelines for License Renewal Reactor Vessel Circumferential Weld TLAA	Submit a relief request to address the frequency requirements of the inservice inspection of the RPV circumferential welds. (BWRVIP-05)	18.3.1.6	Prior to the period of extended operation

TABLE A-1
DUANE ARNOLD LICENSE RENEWAL COMMITMENTS

Item No.	System, Component or Program	Commitment	Section	Schedule
39.	Quality Assurance Program (Corrective Action, Confirmation Process, Administrative Controls)	Expand the scope of its 10 CFR Part 50, Appendix B Quality Assurance program to include non-safety-related structures and components subject to an AMR for license renewal.	UFSAR 17.2	Prior to the period of extended operation
40.	Operating Experience	Perform an operating experience review of extended power uprate and its impact on aging management programs for systems, structures, and components (SSCs) before entering the period of extended operation.		Prior to the period of extended operation

18.5 REFERENCES

18-1 10 CFR 54.21(d) – Contents of Application – Technical Information

18-2 NUREG-1800 – Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants

18-3 NUREG-1801 – Generic Aging Lessons Learned (GALL) Report

APPENDIX B

Table of Contents

APPENDIX B

Table of Contents

APPENDIX B

Tables

APPENDIX B

AGING MANAGEMENT PROGRAMS AND ACTIVITIES

B.1 INTRODUCTION

B.1.1 GENERAL AGING MANAGEMENT PROGRAM METHODOLOGY

Each applicant is required to demonstrate that the effects of aging will be adequately managed so that the intended functions of structures and components within the scope of license renewal will be maintained during the period of extended operation. 10 CFR 54.21(a)(3) [Reference B-1] states:

> For each structure and component identified in paragraph (a)(1) of this section, demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the Current Licensing Basis (CLB) for the period of extended operation.

The Duane Arnold aging management review process, discussed in LRA Chapter 3.0, Aging Management Review Results, of this application identifies the aging effects requiring management. The method used, almost exclusively, to adequately manage the effects of aging, is to establish aging management programs. Aging management activities are then credited within these aging management programs, which manage aging in structures and components before there is a loss of intended function. The guidance in NEI 95-10 [Reference B-2] was used in this process.

In general, there are four types of aging management programs:

- Prevention programs preclude aging effects from occurring.
- Mitigation programs slow the effects of aging.
- Condition monitoring programs inspect / examine for the presence and extent of aging.
- Performance monitoring programs test the ability of a structure or component to perform its intended functions.

B.1.2 PRESENTATION METHOD

For aging management programs described in NUREG-1801 [Reference B-3], Duane Arnold presents each program in the following format:

- **PROGRAM DESCRIPTION**: Program summary description.
- **NUREG-1801 CONSISTENCY**: Summary of the degree of consistency between the Duane Arnold aging management program and the corresponding NUREG-1801 program.
- **EXCEPTIONS TO NUREG-1801**: Statement of exception(s) to the comparable NUREG-1801 program and, where applicable, justification.

- **ENHANCEMENTS TO THE DUANE ARNOLD PROGRAM**: Statement of any future enhancement(s) needed to attain consistency with the comparable NUREG-1801 program, or additional features Duane Arnold deems necessary for program adequacy.
- **OPERATING EXPERIENCE**: Operating experience information relevant to the program.
- **CONCLUSION**: Conclusion statement of program adequacy.

Table B.2.2-1 identifies the correlation of the Duane Arnold aging management programs to the programs in NUREG-1801.

For plant-specific programs, the program descriptions include a program summary, evaluations for each of the ten program elements described in NUREG-1800 [Reference B-4], in addition to the items listed above.

B.1.3 QUALITY ASSURANCE PROGRAM AND ADMINISTRATIVE CONTROLS

The aging management program elements of corrective action, confirmation process, and administrative controls are in the Quality Assurance Program. These elements are applicable to safety related and non-safety related systems, structures, and components subject to an aging management review consistent with the summary in Appendix A.2 of NUREG-1800.

The descriptions of these three elements are the same for all aging management programs credited for license renewal. No exceptions to these elements are taken in any aging management program. These three elements are described below:

<u>Corrective Actions</u>

FPL quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. Conditions adverse to quality, such as failures, malfunctions, deviations, defective material and equipment, and nonconformances, are promptly identified and corrected. In the case of significant conditions adverse to quality, measures are implemented to ensure that the cause of the nonconformance is determined and that corrective action is taken to preclude recurrence. In addition, the root cause of the significant condition adverse to quality and the corrective action implemented are documented and reported to appropriate levels of management. The corrective action controls of the (10 CFR Part 50, Appendix B) Quality Assurance Program are applicable to all aging management programs and activities during the period of extended operation.

<u>Confirmation Process</u>

FPL quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. Corrective actions and administrative (document) control for both safety-related and nonsafety related structures and components are accomplished per the existing corrective action program and document control program. The confirmation process is part of the corrective action program and includes:

- reviews to assure that proposed actions are adequate,
- tracking and reporting of open corrective actions, and
- review of corrective action effectiveness.

Any follow-up inspection required by the confirmation process is documented in accordance with the corrective action program. The corrective action program constitutes the confirmation process for aging management programs and activities. The confirmation process is consistent with NUREG-1801.

Administrative Controls

FPL quality assurance (QA) procedures, review and approval processes, and administrative controls are implemented in accordance with the requirements of 10 CFR Part 50, Appendix B. Administrative (document) control for both safety-related and nonsafety-related structures and components is accomplished per the existing document control program. The administrative controls are consistent with NUREG-1801.

B.1.4 OPERATING EXPERIENCE

Operating experience is an important resource in identifying aging effects and evaluating the effectiveness of aging management programs.

The corrective action program and interviews with site personnel were the primary sources of plant-specific operating experience.

Since the materials used for structures and components at Duane Arnold are common to most nuclear power plants and to many non-nuclear power plants that have long operating histories, industry-wide operating experience is also valuable. Screening of a large body of operating data yielded much useful data relating to aging of plant structures and components.

The Duane Arnold plant-specific data and the industry-wide operating data were valuable in:

- Providing bases for determining which aging effects require management.
- Demonstrating that existing programs are adequately managing the effects of aging.
- Pointing out the need to enhance existing programs or the need for entirely new programs.

The effects and mechanisms of age related degradation for SSCs at Duane Arnold were developed from several sources. They include plant-specific and industry operating experience, interviews with site personnel, EPRI document 1003659, Generic Communications Database Users Manual, Version 3.0, Revision 5.0, September 2002, along with the associated EPRI Generic Communications Database and NUREG-1801. No new aging effects were identified. Known aging effects and mechanisms for a given environment and material have been incorporated into NUREG-1801, up to the time of its publication in September 2005.

With respect to Aging Management Programs, existing programs/activities must demonstrate, with objective evidence, that they are effective in managing the effects of aging if credited. Operating experience related to the program/activity, including past corrective actions resulting in program enhancements, provides objective evidence the program adequately manages the effects of aging.

The FPL Operating Experience (OE) Program provides guidance for using, sharing, and evaluating OE information at FPL Nuclear Division sites. The procedure governing this program provides guidance on the effective and efficient use of OE information. The primary objectives of the FPL OE Program are:

- Systematic evaluation of significant nuclear plant operating experiences.
- Incorporation of lessons learned into appropriate plant practices, policies, programs, and procedures with the objective of preventing similar issues.
- Sharing of lessons learned internally and with other utilities to promote industry-wide safety and reliability.

By increasing awareness of previous FPL Nuclear Division and industry events and issues, the FPL OE Program expects to prevent similar events from occurring at FPL Nuclear Division sites. The FPL OE Program ensures that information that has the potential to affect safe and reliable station operation is properly screened and addressed to ensure timely response. This procedure promotes the identification and transfer of lessons learned from industry, and internal events, such that these lessons are shared between the FPL Nuclear Division and the nuclear industry. This procedure describes the methodology for receiving, processing, status reporting, screening, reviewing, evaluating, and taking preventive/corrective actions in response to OE information. This program satisfies the requirements of NUREG 0737, I.C.5 and 10 CFR 50.65(a) (1) and (a) (2).

B.2 AGING MANAGEMENT PROGRAMS

The following aging management programs are described in this appendix. The programs are either generic in nature as discussed in NUREG-1801, or are plant-specific. All generic programs are either fully consistent with, or consistent with some exceptions, to the programs discussed in NUREG-1801.

Aging Management Programs

- 10 CFR Part 50 Appendix J Program – Subsection B.3.1
- Aboveground Steel Tanks Program – Subsection B.3.2
- ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program – Subsection B.3.3
- ASME Section XI Inservice Inspection, Subsection IWE Program – Subsection B.3.4
- ASME Section XI Inservice Inspection, Subsection IWF Program – Subsection B.3.5
- Bolting Integrity Program – Subsection B.3.6
- Buried Piping and Tanks Inspection Program – Subsection B.3.7
- BWR Control Rod Drive Return Line Nozzle Program – Subsection B.3.8
- BWR Feedwater Nozzle Program – Subsection B.3.9
- BWR Penetrations Program – Subsection B.3.10
- BWR Reactor Water Cleanup System Program – Subsection B.3.11
- BWR Stress Corrosion Cracking Program – Subsection B.3.12
- BWR Vessel ID Attachment Welds Program – Subsection B.3.13
- BWR Vessel Internals Program – Subsection B.3.14
- Closed-Cycle Cooling Water System Program – Subsection B.3.15
- Compressed Air Monitoring Program – Subsection B.3.16
- Electrical Cables and Connections Program – Subsection B.3.17
- Electrical Cables and Connections Used in Instrumentation Circuits Program – Subsection B.3.18
- Electrical Connections Program – Subsection B.3.19
- Electrical Penetration Assemblies Program – Subsection B.3.20
- External Surfaces Monitoring Program – Subsection B.3.21
- Fire Protection Program – Subsection B.3.22
- Fire Water System Program – Subsection B.3.23
- Flow-Accelerated Corrosion Program – Subsection B.3.24

- Fuel Oil Chemistry Program – Subsection B.3.25
- Fuse Holders Program – Subsection B.3.26
- Inaccessible Medium Voltage Cables Program – Subsection B.3.27
- Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program – Subsection B.3.28
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program – Subsection B.3.29
- Lubricating Oil Analysis Program – Subsection B.3.30
- Metal Enclosed Bus Program – Subsection B.3.31
- One-Time Inspection Program – Subsection B.3.32
- Open-Cycle Cooling Water System Program – Subsection B.3.33
- Reactor Head Closure Studs Program – Subsection B.3.34
- Reactor Vessel Surveillance Program – Subsection B.3.35
- Selective Leaching of Materials Program – Subsection B.3.36
- Structures Monitoring Program – Subsection B.3.37
- Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program – Subsection B.3.38
- Water Chemistry Program – Subsection B.3.39

B.2.1 TIME LIMITED AGING ANALYSES AGING MANAGEMENT PROGRAMS:

The following NUREG-1801 Aging Management Programs support Time Limited Aging Analyses (TLAAs) described in LRA Section 4.0.

- Environmental Qualification Program - Subsection B.4.1
- Metal Fatigue of Reactor Coolant Pressure Boundary Program - Subsection B.4.2

B.2.2 AGING MANAGEMENT PROGRAMS CORRELATION

Correlation between NUREG-1801 aging management programs and Duane Arnold aging management programs are shown below.

TABLE B.2.2-1
AGING MANAGEMENT PROGRAM CORRELATION

NUREG-1801 AGING MANAGEMENT PROGRAM	DUANE ARNOLD AGING MANAGEMENT PROGRAM	NUREG-1801 COMPARISON	NEW/ EXISTING PROGRAM
NUREG-1801 Chapter X			
X.E1 - Environmental Qualification (EQ) of Electrical Components	Environmental Qualification Program	Consistent with NUREG-1801	Existing
X.M1 - Metal Fatigue of Reactor Coolant Pressure Boundary	Metal Fatigue of Reactor Coolant Pressure Boundary Program	Consistent with NUREG-1801	Existing – will be enhanced
X.S1 - Concrete Containment Tendon Prestress	Duane Arnold has a Mark 1 steel containment – Not applicable to Duane Arnold	Not applicable	Not applicable
NUREG-1801 Chapter XI			
XI.E1 - Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Electrical Cables and Connections Program	Consistent with NUREG-1801	New
XI.E2 - Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrument Circuits	Electrical Cables and Connections Used in Instrumentation Circuits Program	Consistent with NUREG-1801	New
XI.E3 - Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Inaccessible Medium Voltage Cables Program	Consistent with NUREG-1801	New
XI.E4 - Metal Enclosed Bus	Metal Enclosed Bus Program	Consistent with NUREG-1801 with one exception	New
XI.E5 - Fuse Holders	Fuse Holders Program	Consistent with NUREG-1801	New

TABLE B.2.2-1 (continued)
AGING MANAGEMENT PROGRAM CORRELATION

NUREG-1801 AGING MANAGEMENT PROGRAM	DUANE ARNOLD AGING MANAGEMENT PROGRAM	NUREG-1801 COMPARISON	NEW/ EXISTING PROGRAM
XI.E6 - Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Not credited for Duane Arnold	Not applicable	Not applicable
XI.M1 - ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program	Consistent with NUREG-1801	Existing
XI.M2 - Water Chemistry	Water Chemistry Program	Consistent with NUREG-1801	Existing
XI.M3 - Reactor Head Closure Studs	Reactor Head Closure Studs Program	Consistent with NUREG-1801	Existing
XI.M4 - BWR Vessel ID Attachment Welds	BWR Vessel ID Attachment Welds Program	Consistent with NUREG-1801	Existing
XI.M5 - BWR Feedwater Nozzle	BWR Feedwater Nozzle Program	Consistent with NUREG-1801	Existing
XI.M6 - BWR Control Rod Drive Return Line Nozzle	BWR Control Rod Drive Return Line Nozzle Program	Consistent with NUREG-1801	Existing
XI.M7 - BWR Stress Corrosion Cracking	BWR Stress Corrosion Cracking Program	Consistent with NUREG-1801	Existing
XI.M8 - BWR Penetrations	BWR Penetrations Program	Consistent with NUREG-1801	Existing
XI.M9 - BWR Vessel Internals	BWR Vessel Internals Program	Consistent with NUREG-1801	Existing – will be enhanced
XI.M10 - Boric Acid Corrosion	PWR Program - Not applicable to Duane Arnold	Not applicable	Not applicable
XI.M11 - Nickel-Alloy Nozzles and Penetrations	Not credited for Duane Arnold	Not applicable	Not applicable
XI.M11A - Nickel-Alloy Penetration Nozzles Welded to the Upper Reactor Vessel Closure Heads of PWRs	PWR Program - Not applicable to Duane Arnold	Not applicable	Not applicable
XI.M12 - Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	Not credited for Duane Arnold	Not applicable	Not applicable

TABLE B.2.2-1 (continued)
AGING MANAGEMENT PROGRAM CORRELATION

NUREG-1801 AGING MANAGEMENT PROGRAM	DUANE ARNOLD AGING MANAGEMENT PROGRAM	NUREG-1801 COMPARISON	NEW/ EXISTING PROGRAM
XI.M13 - Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program	Consistent with NUREG-1801	New
XI.M14 - Loose Part Monitoring	Not credited for license renewal at Duane Arnold	Not applicable	Not applicable
XI.M15 - Neutron Noise Monitoring	Not credited for license renewal at Duane Arnold	Not applicable	Not applicable
XI.M16 - PWR Vessel Internals	PWR Program - Not applicable to Duane Arnold	Not applicable	Not applicable
XI.M17 - Flow-Accelerated Corrosion	Flow-Accelerated Corrosion Program	Consistent with NUREG-1801	Existing
XI.M18 - Bolting Integrity	Bolting Integrity Program	Consistent with NUREG-1801	Existing
XI.M19 - Steam Generator Tube Integrity	PWR Program - Not applicable to Duane Arnold	Not applicable	Not applicable
XI.M20 - Open-Cycle Cooling Water System	Open-Cycle Cooling Water System Program	Consistent with NUREG-1801	Existing
XI.M21 - Closed-Cycle Cooling Water System	Closed-Cycle Cooling Water System Program	Consistent with NUREG-1801	Existing
XI.M22 - Boraflex Monitoring	Not credited for license renewal at Duane Arnold	Not applicable	Not applicable
XI.M23 - Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program	Consistent with NUREG-1801	Existing – will be enhanced
XI.M24 - Compressed Air Monitoring	Compressed Air Monitoring Program	Consistent with NUREG-1801	Existing
XI.M25 - BWR Reactor Water Cleanup System	BWR Reactor Water Cleanup System Program	Consistent with NUREG-1801 with one exception	Existing
XI.M26 - Fire Protection	Fire Protection Program	Consistent with NUREG-1801 with one exception	Existing – will be enhanced
XI.M27 - Fire Water System	Fire Water System Program	Consistent with NUREG-1801	Existing – will be enhanced

TABLE B.2.2-1 (continued)
AGING MANAGEMENT PROGRAM CORRELATION

NUREG-1801 AGING MANAGEMENT PROGRAM	DUANE ARNOLD AGING MANAGEMENT PROGRAM	NUREG-1801 COMPARISON	NEW/ EXISTING PROGRAM
XI.M28 - Buried Piping and Tanks Surveillance	Not credited for license renewal at Duane Arnold	Not applicable	Not applicable
XI.M29 - Aboveground Steel Tanks	Aboveground Steel Tanks Program	Consistent with NUREG-1801	Existing
XI.M30 - Fuel Oil Chemistry	Fuel Oil Chemistry Program	Consistent with NUREG-1801 with exceptions	Existing – will be enhanced
XI.M31 - Reactor Vessel Surveillance	Reactor Vessel Surveillance Program	Consistent with NUREG-1801	Existing – will be enhanced
XI.M32 - One-Time Inspection	One Time Inspection Program	Consistent with NUREG-1801	New
XI.M33 - Selective Leaching Of Materials	Selective Leaching Of Materials Program	Consistent with NUREG-1801	New
XI.M34 - Buried Piping and Tank Inspection	Buried Piping and Tank Inspection Program	Consistent with NUREG-1801	New
XI.M35 - One-Time Inspection of ASME Code Class 1 Small Bore Piping	Included in BWR Stress Corrosion Cracking Program and ASME Section XI Inservice, Inspection, Subsection IWB, IWC and IWD Program	Not applicable	Not applicable
XI.M36 - External Surfaces Monitoring	External Surfaces Monitoring Program	Consistent with NUREG-1801	Existing – will be enhanced
XI.M37 - Flux Thimble Tube Inspection	PWR Program - Not applicable to Duane Arnold	Not applicable	Not applicable
XI.M38 - Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program	Consistent with NUREG-1801	New
XI.M39 - Lubricating Oil Analysis	Lubricating Oil Analysis Program	Consistent with NUREG-1801	Existing – will be enhanced
XI.S1 - ASME Section XI, Subsection IWE	ASME Section XI Inservice Inspection, Subsection IWE Program	Consistent with NUREG-1801	Existing
XI.S2 - ASME Section XI, Subsection IWL	Not credited for license renewal at Duane Arnold	Not applicable	Not applicable
XI.S3 - ASME Section XI, Subsection IWF	ASME Section XI Inservice Inspection, Subsection IWF Program	Consistent with NUREG-1801	Existing

TABLE B.2.2-1 (continued)
AGING MANAGEMENT PROGRAM CORRELATION

NUREG-1801 AGING MANAGEMENT PROGRAM	DUANE ARNOLD AGING MANAGEMENT PROGRAM	NUREG-1801 COMPARISON	NEW/ EXISTING PROGRAM
XI.S4 - 10 CFR 50, Appendix J	10 CFR Part 50 Appendix J Program	Consistent with NUREG-1801	Existing
XI.S5 - Masonry Wall	Included in Structures Monitoring Program	See XI.S6	See XI.S6
XI.S6 - Structures Monitoring	Structures Monitoring Program	Consistent with NUREG-1801	Existing – will be enhanced
XI.S7 - RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Included in Structures Monitoring Program	See XI.S6	See XI.S6
XI.S8 - Protective Coating Monitoring and Maintenance	Not credited for license renewal at Duane Arnold	Not applicable	Not applicable
Plant-Specific Programs			
Plant-Specific Program	Electrical Penetration Assemblies Program	Not applicable	New
Plant-Specific Program	Electrical Connections Program	Not applicable	New

B.3 AGING MANAGEMENT PROGRAM DETAILS

B.3.1 10 CFR PART 50 APPENDIX J PROGRAM

B.3.1.1 PROGRAM DESCRIPTION

The DAEC 10 CFR Part 50, Appendix J Program is an existing program as described in the DAEC Technical Specification 5.5.12. The program manages the effects of aging of the primary reactor containment and systems and components penetrating primary containment.

The program includes the components that make up the primary containment pressure boundary.

The program performs periodic inspections and surveillance testing of primary containment, and systems and components penetrating primary containment to ensure that allowable leakage rate values specified in the DAEC Technical Specifications (TS) are not exceeded. The containment leak rate is measured while performing Surveillance Test Procedures (STP) as required for Appendix J Type A, B, and C tests. Testing frequencies are in accordance with the10 CFR Part 50, Appendix J program.

B.3.1.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.S4.

B.3.1.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.S4.

B.3.1.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.S4.

B.3.1.5 OPERATING EXPERIENCE

In 2007, during Refueling Outage 20, DAEC successfully completed the required integrated and local leak rate tests as required by 10 CFR 50 Appendix J Option B to allow the use of 10CFR50 Option B tests.

Type A Testing

Primary Containment Integrated Leakage Rate Testing was required during this refueling cycle. The "As Found" leakage rate was 0.3552 %wt/day. The acceptance criteria for the “As Found” results were 2.0 %wt/day, so at 0.3552 %wt/day the actual leakage results were acceptable. The "As Left" results were 0.3422 %wt/day.

Type B Testing

The airlock was tested at the end of the refueling outage with a leakage of 349 sccm. The Technical Specifications limit is $\leq 0.05\ L_a$ or 18,300 sccm. The inner airlock equalizing valve was tested in the accident direction with a leakage of 3,506 sccm. The combine leakage is 3,855 sccm, well below the T.S. limit.

There were no Type B test failures in Refueling Outage 20.

Type C Testing

The containment isolation valves tested during Refueling Outage 20 found acceptable minimum path leakage and identified general individual containment isolation valves that warranted maintenance.

The combine leakage rate for all penetrations subject to Type B and Type C testing meets the following criteria:

- The combined as-left leakage rates shall be verified to be less than 0. 60 L_a. The DAEC as-left leakage was 0.22L_a.

All values were with-in the acceptance criteria.

The DAEC Appendix J Program is effective in preventing unacceptable leakage through the Containment Pressure Boundary.

B.3.1.6 CONCLUSION

The 10 CFR Part 50, Appendix J Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.2 ABOVEGROUND STEEL TANKS PROGRAM

B.3.2.1 PROGRAM DESCRIPTION

The DAEC Aboveground Steel Tanks Program is an existing program. This program manages the effects of corrosion on the exterior surfaces of the aboveground steel tanks that support a license renewal intended function. These tanks are 1T005A and 1T005B, the Condensate Storage Tanks.

The program utilizes the application of a protective coating on the exterior surface of the Condensate Storage Tanks to mitigate corrosion development due to environmental factors. This coating is qualified for its intended service and applied to the exterior tank surface. To ensure that the exterior surface of the Condensate Storage Tanks is protected, the protective coating is visually inspected during the existing coatings survey. Visual inspection of the exterior coating at DAEC had been through the DAEC Maintenance Rule Program.

Material degradation may also occur in inaccessible locations, such as the tank bottom. These areas are monitored through the use of periodic ultrasonic thickness measurements from inside the tank to monitor for any exterior material degradation over time.

To ensure structural stability of the Condensate Storage Tanks, the condition of the tank foundations and anchor bolts is monitored by the DAEC Structures Monitoring Program.

B.3.2.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M29.

B.3.2.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M29.

B.3.2.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M29.

B.3.2.5 OPERATING EXPERIENCE

The DAEC Aboveground Steel Tanks Program has been effective in managing the aging effects of corrosion. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these tanks will continue to perform their intended function(s) throughout the period of extended operation.

In July 1988, a corrective maintenance action request was filed for the recoating of tanks 1T005A and 1T005B due to faded paint and various rust spots. In response, both tanks were repainted the following year before significant corrosion of the tank surface could occur. Visual inspection of the exterior protective coating of the Condensate Storage Tanks in 1996, 2001, and 2007 through the Maintenance Rule Monitoring of Structures Program confirmed that the protective coating was in an acceptable condition, with no visible signs of significant coating degradation or surface corrosion on the exterior tank surface.

Ultrasonic examination of areas inaccessible to visual inspection began in 1992 with thickness measurements of the tank bottom for both Condensate Storage Tanks. The thickness measurements included a sampling of sixty-four random locations throughout the tank bottom, along with extensive grid-based measurements of three specific one-square foot locations that would be used for trending any material degradation over time. Those measurements revealed an average tank bottom thickness at or above the specified design thickness of 0.3125 inches. Based on those measurements, it was concluded that no significant corrosion was taking place on the underside of the tank bottom. Further inspections of both tanks in 1995 and 1998 and 1T005A in 2001 confirmed this conclusion, with average ultrasonic thickness measurements continuing to be at or above the design thickness.

Self assessment activities have not identified any programmatic issues.

B.3.2.6 CONCLUSION

The Aboveground Steel Tanks Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.3 ASME SECTION XI INSERVICE INSPECTION, SUBSECTIONS IWB, IWC, AND IWD PROGRAM

B.3.3.1 PROGRAM DESCRIPTION

The DAEC ASME Section XI, Subsections IWB, IWC, IWD Inservice Inspection Program is an existing program. The program manages the aging effects due to cracking, corrosion, physical displacements, wear, erosion, or loss of integrity.

Class 1, 2, and 3 piping, components, their supports and integral attachments are included in the scope of the program.

The program includes periodic visual, surface and/or volumetric examinations of Class 1, 2 and 3 pressure-retaining components, their supports and integral attachments, including welds, pump casings, valve bodies, pressure-retaining bolting, and piping/component supports and leakage tests of pressure retaining components. These are identified in ASME Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” applicable code cases, or commitments requiring augmented inservice inspections, and are within the scope of license renewal.

This program manages the aging effect of cracking which includes stress corrosion cracking, intergranular stress corrosion cracking, and irradiation assisted stress corrosion cracking. DAEC has identified cracking in ASME Class 1 large bore piping. Generic Letter 88-01 required BWR plants to include a portion of the small bore population (pipe NPS 4 inch) in the ASME Section XI In-service Inspection Program volumetric examination of NPS 4 inch pipe butt welds for cracking. The plant ISI program has expanded the volumetric examination population of small bore piping to less than 4 inch. Since DAEC has experienced cracking in ASME Code Class 1 piping, small bore class 1 piping in-scope for license renewal has been included in the ASME Section XI ISI Program.

B.3.3.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M1.

B.3.3.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M1.

B.3.3.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M1.

B.3.3.5 OPERATING EXPERIENCE

The DAEC ASME Section XI, Subsections IWB, IWC, IWD Inservice Inspection Program has been effective in managing the aging effects of cracking, corrosion, physical displacements, wear, erosion, or loss of integrity. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

Inservice Inspection (ISI) Program Assessment by DAEC Nuclear Oversight (NOS) documents the review of closeout activities associated with the DAEC ASME Section XI ISI Program Third Period 10-Year Interval. NRC Relief Requests, ISI corrective actions and the resolution of previously identified NOS issues were also evaluated. One minor administrative issue was identified regarding an incorrect reference to the applicable weld examination in a corrective action document closure package. The evaluation concluded that DAEC ISI Program activities have been satisfactorily performed.

A portion of the NRC Integrated Inspection in 2007 involved review of ISI activities. During this inspection the NRC observed ISI inspections, reviewed ISI records and related ISI problems identified by DAEC. The NRC identified two Non-Cited Violations (NCV's). Both of the NCV's are related to ISI program implementation issues and were considered to be of low safety significance. The first NCV identified an unqualified reactor vessel weld examinations, the second NCV concerned an unqualified Main Steam Safety Relief Valve weld repair. The NRC Inspection did not identify any deficiencies in the ISI program requirements; however, the Inspection did identify ISI implementation deficiencies.

B.3.3.6 CONCLUSION

The ASME Section XI, Subsections IWB, IWC, IWD Inservice Inspection Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.4 ASME SECTION XI INSERVICE INSPECTION, SUBSECTION IWE PROGRAM

B.3.4.1 PROGRAM DESCRIPTION

The DAEC ASME Section XI, Subsection IWE Program is an existing program. The program manages the aging effects of corrosion, cracking, wear, physical displacements, loose or missing parts, debris, wear, erosion, or loss of integrity at bolted or welded connections.

The components managed by the program include the drywell, the suppression chamber (torus), and the connecting piping (vent headers), their supports and pressure retaining bolting. The airlocks and hatches are included with the drywell and suppression chamber. Seals and gaskets are managed by the DAEC 10 CFR Part 50 Appendix J program.

The program performs inspections using the primary ISI method as specified in IWE; visual examination (general visual, VT-3, VT-1). Limited volumetric examination (ultrasonic thickness measurement) and surface examination (e.g., liquid penetrant) may also be necessary in some instances. IWE specifies acceptance criteria, corrective actions, and expansion of the inspection scope when degradation exceeding the acceptance criteria is found.

B.3.4.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.S1.

B.3.4.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.S1.

B.3.4.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.S1.

B.3.4.5 OPERATING EXPERIENCE

The DAEC ASME Section XI, Subsection IWE Program has been effective in managing the aging effects of corrosion, cracking, wear, physical displacements, loose or missing parts, debris, wear, erosion, or loss of integrity at bolted or welded connections. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these systems will continue to perform their intended function(s) throughout the period of extended operation.

The review of the DAEC operating experience shows numerous examples of the program identifying degradation prior to loss of intended functions. The program has identified numerous areas of zinc depletion of the torus coating and minor pitting and other indications. These areas of concern were dispositioned in accordance with the appropriate requirements of IWE.

Recent self assessment activities have not identified any programmatic issues.

B.3.4.6 CONCLUSION

The ASME Section XI, Subsection IWE Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.5 ASME SECTION XI INSERVICE INSPECTION, SUBSECTION IWF PROGRAM

B.3.5.1 PROGRAM DESCRIPTION

The DAEC ASME Section XI Inservice Inspection Program, Subsection IWF Program is an existing program. The program manages the aging effects of corrosion, physical displacements, loose or missing parts, debris, wear, erosion, or loss of integrity at bolted or welded connections.

Class 1, 2, and 3 piping and component supports are included in the program.

The program uses VT-3 visual examination for detection of degradation. The performance requirements for VT-3 examination are provided in IWA-2213. Per

IWA-2213, VT-3 examinations are conducted to determine the general mechanical and structural condition of components and their supports by verifying parameters such as clearances, settings, and physical displacement, and to detect discontinuities and imperfections, such as loss of integrity of bolted or welded connections, loose or missing parts, debris, corrosion, wear, or erosion. Acceptance standards for supports are listed in IWF-3410. Unacceptable conditions include:

- Deformation or structural degradation of fasteners, springs, clamps, or other support items;
- Missing, detached, or loosened support items;
- Arc strikes, weld spatter, paint, scoring, roughness, or general corrosion on close tolerance machined or sliding surfaces;
- Improper hot or cold settings of spring supports and constant load supports;
- Misalignment of supports; and
- Improper clearances of guides and stops.

B.3.5.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.S3.

B.3.5.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.S3.

B.3.5.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.S3.

B.3.5.5 OPERATING EXPERIENCE

The DAEC ASME Section XI Inservice Inspection Program, Subsection IWF Program has been effective in managing the aging effects of corrosion, physical displacements, loose or missing parts, debris, wear, erosion, or loss of integrity at bolted or welded connections. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

A review of the plant specific operating experience found instances of selected supports being removed during outages prior to receiving an inspection. This was more of a work control failure than a failure of the ASME Section XI, Subsection IWF Program. There is reasonable assurance that the Subsection IWF inspection program will be effective through the period of extended operation.

Inservice Inspection (ISI) Program Assessment by DAEC Nuclear Oversight (NOS) documents the review of closeout activities associated with the DAEC ASME Section XI ISI Program Third Period 10-Year Interval. NRC Relief Requests, ISI corrective actions, and the resolution of previously identified NOS issues were also evaluated. One minor administrative issue was identified regarding an incorrect reference to the applicable weld examination in a corrective action document closure package. The evaluation concluded that DAEC ISI Program activities have been satisfactorily performed.

A portion of the NRC Integrated Inspection in 2007 involved review of ISI activities. During this inspection the NRC observed ISI inspections, reviewed ISI records and related ISI problems identified by DAEC. The NRC identified two Non-Cited Violations (NCV's). Both of the NCV's are related to ISI program implementation issues and were considered to be of low safety significance. The first NCV identified an unqualified reactor vessel weld examinations, the second NCV concerned an unqualified Main Steam Safety Relief Valve weld repair. The NRC Inspection did not identify any deficiencies in the ISI program requirements; however, the Inspection did identify ISI implementation deficiencies.

B.3.5.6 CONCLUSION

The ASME Section XI Inservice Inspection Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.6 BOLTING INTEGRITY PROGRAM

B.3.6.1 PROGRAM DESCRIPTION

The DAEC Bolting Integrity Program is an existing program that manages the aging effects of loss of preload, cracking, and loss of material due to corrosion.

The program includes guidance regarding material selection, thread lubrication and assembly of bolted joints. The program considers the guidelines delineated in NUREG-1339 for a bolting integrity program, EPRI NP-5769 (with the exceptions noted in NUREG-1339) for safety related bolting, and EPRI TR-104213 for non-safety related bolting.

The Bolting Integrity Program credits the following aging management programs for the inspection of bolting. The following aging management programs are: (1) ASME Section XI Inservice Inspection Subsections IWB, IWC, and IWD Programs, (2) External Surfaces Monitoring Program, and (3) Structural Monitoring Program and (4) ASME Section XI Inservice Inspection Subsection IWF Program. The scope of the credited programs for bolting is summarized below.

- The DAEC ASME Section XI Inservice Inspection Programs provides the requirements for inservice inspection of ASME Class 1, 2, and 3 piping, supports, and their integral attachments, which includes pressure retaining and support bolting.
- The DAEC External Surfaces Monitoring Program provides the requirements for the inspection of bolting for steel components such as piping, piping components, ducting and other components within the scope of license renewal.
- The DAEC Structural Monitoring Program provides the requirements for the inspection of all structural support bolting within the scope of license renewal.

Other bolting and fasteners are also included within the scope of this program, such as those used in supports for cable trays, conduits, and cabinet supports.

B.3.6.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M18.

B.3.6.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M18.

B.3.6.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M18.

B.3.6.5 OPERATING EXPERIENCE

The DAEC Bolting Integrity Program has been effective in managing the aging effects of loss of pre-load, cracking and corrosion. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

One bolting issue was determined to be a design issue in that Engineering did not provide the correct bolt torques to provide proper preload. The issues was documented and addressed using the Corrective Action Program.

Site self assessment activities have not identified any programmatic issues with this program.

B.3.6.6 CONCLUSION

The Bolting Integrity Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.7 BURIED PIPING AND TANKS INSPECTION PROGRAM

B.3.7.1 PROGRAM DESCRIPTION

The DAEC Buried Piping and Tanks Inspection Program is a new program. The program manages the aging effects of corrosion on the pressure-retaining capacity of buried piping and tanks.

In-scope buried carbon and low-alloy steel piping and tanks have external coatings and wrappings.

The program includes provisions for visual inspections of the protective wraps and coatings on buried carbon, and low-alloy steel, piping and tanks in-scope for license renewal. The visual inspections for damage are performed when the carbon, low-alloy, and stainless steel pipes and tanks are excavated and exposed for any reason. If damage to the protective wraps and coatings of carbon and low-alloy steel is found, the outer surface of the pipe or tank is inspected for loss of material due to general corrosion, pitting, and crevice corrosion, and microbiologically-influenced corrosion (MIC).

At DAEC buried pipes and tanks are not routinely uncovered during maintenance activities. However, the program requires that at least one opportunistic or focused inspection be performed prior to entering the period of extended operation. Inspections will be performed at least once every 10 years thereafter.

B.3.7.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M34.

B.3.7.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M34.

B.3.7.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M34.

B.3.7.5 OPERATING EXPERIENCE

The DAEC Buried Piping and Tanks is a new program; therefore, there is no plant-specific program operating experience. Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. Industry operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

B.3.7.6 CONCLUSION

The Buried Piping and Tanks Inspection Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.8 BWR CONTROL ROD DRIVE RETURN LINE NOZZLE PROGRAM

B.3.8.1 PROGRAM DESCRIPTION

The DAEC BWR Control Rod Drive Return Line (CRDRL) Nozzle Program is an existing program.

The program ensures that cracks in the CRDRL Nozzle due to thermal stress will be detected prior to loss of its intended function. The program also ensures that cracks in the CRDRL pipe containing stagnant water that is susceptible to intergranular stress corrosion cracking (IGSCC) will be detected prior to loss of its intended function. The program consists of the physical plant modifications and inspections as recommended by the NUREG 0619 and ASME Section XI.

DAEC has taken actions to eliminate thermal cycling by removing the CRDRL Nozzle thermal sleeve and installing a blind flange (spectacle) to prevent flow through the CRDRL Nozzle during plant operation. The blind (spectacle) flange is physically located on the outboard side of the second containment isolation valve in the CRDRL pipe. The inspection area described in this program only extends to the second containment isolation valve.

The DAEC complies with the applicable requirements of ASME Section XI. This DAEC program performs periodic ultrasonic inspections of critical regions of the DAEC CRDRL Nozzle.

The DAEC inspects the CRDRL stainless steel pipe section welds that contains stagnant water and is susceptible to IGSCC. The section of pipe that is susceptible to IGSCC runs from the nozzle safe-end to a reducer.

The Class 1 CRDRL pipe from the reducer to the second containment isolation valve is carbon steel which is not susceptible to IGSCC, and is not included in the DAEC CRDRL Nozzle Program.

The aging of the carbon steel and stainless steel pipe from the nozzle to the second containment isolation valve is also managed for loss of material by the DAEC Water Chemistry Program and the DAEC One Time Inspection Program.

B.3.8.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M6.

B.3.8.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M6.

B.3.8.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M6.

B.3.8.5 OPERATING EXPERIENCE

The DAEC BWR Control Rod Drive Return Line (CRDRL) Nozzle Program has been effective in managing the aging effects of cracking. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

The last scheduled inspection of the CRDRL stagnant water pipe welds was performed during Refueling Outage 18. A review of the inspections of the CRDRL stagnant water pipe welds performed during Refueling Outage 18 revealed that no indications were found in the welds.

A DAEC Nuclear Oversight assessment documented satisfactory compliance with the applicable commitments to NUREG 0619, and ASME Code Section XI.

The 2006 Inservice Inspection (ISI) Program Assessment by DAEC Nuclear Oversight documents the review of closeout activities associated with the DAEC ASME Section XI ISI Program Third Period 10-Year Interval. NRC Relief Requests, ISI corrective actions, and the resolution of previously identified NOS issues were also evaluated. One minor administrative issue was identified regarding an incorrect reference to the applicable weld examination in a corrective action document closure package. The evaluation concluded that DAEC ISI Program activities have been satisfactorily performed.

A portion of the NRC Integrated Inspection in 2007 involved review of ISI activities. During this inspection the NRC observed ISI inspections, reviewed ISI records and related ISI problems identified by DAEC. The NRC identified two Non-Cited Violations (NCV's). Both of the NCV's are related to ISI program implementation issues and were considered to be of low safety significance. The first NCV identified an unqualified reactor vessel weld examinations, the second NCV concerned an unqualified Main Steam Safety Relief Valve weld repair. The NRC Inspection did not identify any deficiencies in the ISI program requirements; however, the Inspection did identify ISI implementation deficiencies.

B.3.8.6 CONCLUSION

The BWR Control Rod Drive Return Line (CRDRL) Nozzle Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.9 BWR FEEDWATER NOZZLE PROGRAM

B.3.9.1 PROGRAM DESCRIPTION

The DAEC BWR Feedwater Nozzle Program is an existing program. The program manages the effects of aging due to cracking.

The DAEC program performs feedwater nozzle inspections as required by ASME Section XI Subsection IWB, Table IWB 2500-1 (2001 edition including the 2002 and 2003 Addenda) and the recommendations of General Electric (GE) NE-523-A71-0594, Revision 1. The DAEC performs periodic ultrasonic inspection of critical regions of the DAEC feedwater nozzle. The regions inspected, examination techniques, personnel qualifications, and inspection schedule are consistent with the recommendations of GE NE-523-A71-0594-A, Revision 1.

The DAEC feedwater nozzle prevents the flow of cold water behind the thermal sleeve which reduces the risk of cracking due to thermal cycling. Additionally, DAEC has implemented changes to the controls of the feedwater regulating valves and placed cautions in operating procedures.

B.3.9.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M5.

B.3.9.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M5.

B.3.9.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M5.

B.3.9.5 OPERATING EXPERIENCE

The DAEC BWR Feedwater Nozzle Program has been effective in managing the aging effects of cracking. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

Testing was performed by GE on the DAEC feedwater nozzles in 1977. The test monitored the temperature of the feedwater nozzles at various power levels. The test demonstrated that large thermal cycling at various power levels does not occur to the same extent as other BWR's.

A 2001 assessment performed by DAEC Nuclear Oversight documents the review of ISI Augmented Inspection Program reports. This report documented satisfactory compliance with the applicable commitments to NUREG 0619, Table 6.1 of GENE-523-A71-0594, GL 87-11, GE SIL 0455 and ASME Code Section XI.

In 2007, during Refueling Outage (RFO) 20 an In-Vessel Visual Inspection of the feedwater sparger revealed the failure of a sparger bracket keeper which allowed interface wear between the mating surfaces of the sparger bracket and the vessel bracket. Temporary repairs were made to restore the sparger to an acceptable continued use configuration and an Apparent Cause Evaluation (ACE) was initiated.

The 2006 Inservice Inspection (ISI) Program Assessment by DAEC Nuclear Oversight documents the review of closeout activities associated with the DAEC ASME Section XI ISI Program Third Period 10-Year Interval. NRC Relief Requests, ISI corrective actions, and the resolution of previously identified NOS issues were also evaluated. One minor administrative issue was identified regarding an incorrect reference to the applicable weld examination in a corrective action document closure package. The evaluation concluded that DAEC ISI Program activities have been satisfactorily performed.

A portion of the NRC Integrated Inspection in 2007 involved review of ISI activities. During this inspection the NRC observed ISI inspections, reviewed ISI records and related ISI problems identified by DAEC. The NRC identified two Non-Cited Violations (NCV's). Both of the NCV's are related to ISI program implementation issues and were considered to be of low safety significance. The first NCV identified an unqualified reactor vessel weld examinations, the second NCV concerned an unqualified Main Steam Safety Relief Valve weld repair. The NRC Inspection did not identify any deficiencies in the ISI program requirements; however, the Inspection did identify ISI implementation deficiencies.

B.3.9.6 CONCLUSION

The BWR Feedwater Nozzle Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.10 BWR PENETRATIONS PROGRAM

B.3.10.1 PROGRAM DESCRIPTION

The DAEC BWR Penetrations Program is an existing program. The program manages the aging effects of cracking.

The program performs ultrasonic (UT) volumetric, surface, and visual inspections. The guidelines in BWRVIP-49-A for instrument penetrations and BWRVIP-27-A for the Standby Liquid Control System are incorporated into the BWR Penetrations Program.

The monitoring and control of reactor coolant water chemistry is in accordance with applicable BWRVIPs which are implemented by the DAEC Water Chemistry Program.

B.3.10.2 NUREG-1801 CONSISTENCY

The program is consistent with the ten elements of NUREG-1801 XI.M8.

B.3.10.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M8

B.3.10.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M8.

B.3.10.5 OPERATING EXPERIENCE

The DAEC BWR Penetrations Program has been effective in managing the aging effects of cracking. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

DAEC operating experience demonstrates that the current Inservice and Augmented Inspection programs are effective in managing the aging effect of cracking in the nozzles. The program is effective in finding flaws prior to loss of intended function as demonstrated on other penetration, nozzle and safe-end welds.

During Refueling Outage (RFO) 16, inspections of weld susceptible to intergranular stress corrosion cracking (IGSCC) identified flaw indications on three recirculation riser nozzle-to-safe-end welds (RRB-F002 , RRD-F002 and RRF-F002).

The original scope of the examinations included three recirculation riser and one core spray nozzle-to-safe-end welds. The inspection scope was therefore expanded to include all of the remaining F002 welds, as well as the other similarly designed core spray welds.

Weld overlays using IGSCC resistant Alloy 52 were completed on the B and D riser F002 welds. On the RRF-F002 weld, a review was performed of the 1996 and 1999 automated data, it was determined that the weld crown geometry did not allow adequate access to disposition the indication. As a result, additional scans were performed after the weld had been ground flush. The re-inspection showed that the flaw was subsurface with no connection to the inside or outside surface of the piping. Review of the 1978/1979 radiographs and repair records confirmed that this was likely a small area of internal incomplete fusion between weld beads, and not attributable to IGSCC. The flaw was evaluated under the ASME Code and determined to be acceptable to leave as-is due to the size and lack of exposure to the surface.

Overlays on RRB-F002 and RRD-F002 have been re-inspected during RFO17 in addition to the re-inspection of RRF-F002.

The 2006 Inservice Inspection (ISI) Program Assessment by DAEC Nuclear Oversight documents the review of closeout activities associated with the DAEC ASME Section XI ISI Program Third Period 10-Year Interval. NRC Relief Requests, ISI corrective actions, and the resolution of previously identified NOS issues were also evaluated. One minor administrative issue was identified regarding an incorrect reference to the applicable weld examination in a corrective action document closure package. The evaluation concluded that DAEC ISI Program activities have been satisfactorily performed.

A portion of the NRC Integrated Inspection in 2007 involved review of ISI activities. During this inspection the NRC observed ISI inspections, reviewed ISI records and related ISI problems identified by DAEC. The NRC identified two Non-Cited Violations (NCV's). Both of the NCV's are related to ISI program implementation issues and were considered to be of low safety significance. The first NCV identified an unqualified reactor vessel weld examinations, the second NCV concerned an unqualified Main Steam Safety Relief Valve weld repair. The NRC Inspection did not identify any deficiencies in the ISI program requirements; however, the Inspection did identify ISI implementation deficiencies.

During the 2007 refueling outage (RFO 20), ultrasonic examinations performed in accordance with the BWRVIP-75 and ASME Section XI inspection programs identified an indication in reactor recirculation riser safe-end to nozzle weld RRF-F002. The indication did not meet ASME Section XI acceptance criteria. A scope expansion was required which identified another indication which did not meet ASME Section XI acceptance criteria (in safe-end to nozzle weld RRF-F002). Both welds were subsequently overlaid. The indications in both welds (RRF-F002 and RRC-F002) were determined to be Intergranular Stress Corrosion Cracking (IGSCC). The root cause performed (RCE 1062) concluded that, based on the fact that Duane Arnold is on HWC, it is very likely that both flaws have been present for a significant time, e.g. multiple cycles, and were not identified by previous inspections. An NRC requested review by Pacific Northwest National Laboratory (PNNL) substantiates this conclusion.

B.3.10.6 CONCLUSION

The BWR Penetrations Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.11 BWR REACTOR WATER CLEANUP SYSTEM PROGRAM

B.3.11.1 PROGRAM DESCRIPTION

The DAEC Reactor Water Cleanup System Program is an existing program. The program manages the aging effects of cracking due to SCC or IGSCC in the RWCU pipe welds.

This program includes the RWCU stainless steel pipe welds between the reactor and the second containment isolation valve.

The program includes inspections of the appropriate welds outboard of the second isolation valve, and includes the appropriate measures delineated in NUREG 0313, Rev. 2, NRC Generic Letter (GL) 88-01 and by following the guidance in BWRVIP-75.

The NRC issued a Safety Evaluation dated September 15, 2000 approving the use of BWRVIP-75 in lieu of the inspection requirements of Generic Letter (GL) 88-01. The inspection schedules/frequencies included in the NRC Safety Evaluation have been incorporated into the program.

The DAEC Water Chemistry Program manages the effect of stress corrosion (SCC) and IGSCC on all piping in the RWCU system.

B.3.11.2 NUREG-1801 CONSISTENCY

This program is consistent with six of the ten elements of NUREG-1801 XI.M25. One exception is taken that affects “Scope of Program,” “Parameters Monitored or Inspected,” “Detection of Aging Effects” and “Monitoring and Trending” of NUREG-1801 XI.M25.

B.3.11.3 EXCEPTIONS TO NUREG-1801

The DAEC program takes one exception to the guidance as stated in NUREG-1801 XI.M25. The DAEC program implements the requirements of GL 88-01 as modified by BWRVIP- 75. BWRVIP- 75 specifies an inspection frequency that differs from the requirements given in GL 88-01. This exception affects the following elements of NUREG-1801 XI.M25.

- Scope of Program
- Parameters Monitored or Inspected
- Detection of Aging Effects
- Monitoring and Trending

B.3.11.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

There are no enhancements to NUREG-1801 XI.M25.

B.3.11.5 OPERATING EXPERIENCE

The DAEC Reactor Water Cleanup System Program has been effective in managing the aging effects of cracking due to SCC or IGSCC in the RWCU piping. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

The 2006 Inservice Inspection (ISI) Program Assessment by DAEC Nuclear Oversight documents the review of closeout activities associated with the DAEC ASME Section XI ISI Program Third Period 10-Year Interval. NRC Relief Requests, ISI corrective actions, and the resolution of previously identified NOS issues were also evaluated. One minor administrative issue was identified regarding an incorrect reference to the applicable weld examination in a corrective action document closure package. The evaluation concluded that DAEC ISI Program activities have been satisfactorily performed.

A portion of the NRC Integrated Inspection in 2007 involved review of ISI activities. During this inspection the NRC observed ISI inspections, reviewed ISI records and related ISI problems identified by DAEC. The NRC identified two Non-Cited Violations (NCV's). Both of the NCV's are related to ISI program implementation issues and were considered to be of low safety significance. The first NCV identified an unqualified reactor vessel weld examination, the second NCV concerned an unqualified Main Steam Safety Relief Valve weld repair. The NRC Inspection did not identify any deficiencies in the ISI program requirements; however, the Inspection did identify ISI implementation deficiencies.

B.3.11.6 CONCLUSION

The Reactor Water Cleanup System Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.12 BWR STRESS CORROSION CRACKING PROGRAM

B.3.12.1 PROGRAM DESCRIPTION

The DAEC BWR Stress Corrosion Cracking Program is an existing program. The program manages the aging effects of cracking.

The program meets the guidelines of NUREG-0313, Rev. 2, as specified by Generic Letter 88-01 with the relaxations as afforded by Generic Letter 88-01, Supplement 1 and BWRVIP-75.

The program addresses improvements in all three elements that, in combination, cause IGSCC. These elements consist of a susceptible (sensitized) material, a significant tensile stress, and an aggressive environment. Any susceptible location that requires modification or repair will be replaced with an IGSCC resistant material or repaired by a weld overlay. DAEC BWR Stress Corrosion Cracking Program has reduced the susceptibility to stress corrosion cracking by utilizing the more appropriate second mitigator for the specific location such as; induction heating stress improvement, solution annealing, or weld overlay. DAEC has considerations of using mechanical stress improvement process in the future. The DAEC Water Chemistry Program includes the provisions for hydrogen water chemistry which helps mitigate the aggressive environment. The IGSCC susceptible components have been categorized from A through G per the guidelines of BWRVIP-75. The inspection requirements and frequencies are specified for each IGSCC category. The DAEC BWR Stress Corrosion Cracking Program meets all requirements of qualification of personnel, frequency, schedule, acceptance standards, flaw evaluation, sample expansion, and pressure test requirements.

DAEC has identified cracking in ASME Class 1 large bore piping. Generic Letter 88-01 required BWR plants to include a portion of the small bore population (pipe NPS 4 inch) in the ASME Section XI In-service Inspection Program volumetric examination of NPS 4 inch pipe butt welds for cracking. The ISI program has expanded the volumetric examination population of small bore piping to less than 4 inch. Since DAEC has experienced cracking in ASME Code Class 1 piping, small bore class 1 piping in-scope for license renewal has been included in the ASME Section XI ISI Program.

B.3.12.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M7.

B.3.12.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M7.

B.3.12.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M7.

B.3.12.5 OPERATING EXPERIENCE

The DAEC BWR Stress Corrosion Cracking Program has been effective in managing the aging effects of IGSCC. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

During Refueling Outage (RFO) 16, inspections of weld susceptible to intergranular stress corrosion cracking (IGSCC) identified flaw indications on three recirculation riser nozzle-to-safe-end welds (RRB-F002 , RRD-F002 and RRF-F002).

The original scope of the examinations included three recirculation riser and one core spray nozzle-to-safe-end welds. The inspection scope was therefore expanded to include all of the remaining F002 welds, as well as the other similarly designed core spray welds.

Weld overlays using IGSCC resistant Alloy 52 were completed on the B and D riser F002 welds. On the RRF-F002 weld, a review was performed on the 1996 and 1999 automated data, it was determined that the weld crown geometry did not allow adequate access to disposition the indication. As a result, additional scans were performed after the weld had been ground flush. The re-inspection showed that the flaw was subsurface with no connection to the inside or outside surface of the piping. Review of the 1978/1979 radiographs and repair records confirmed that this was likely a small area of internal incomplete fusion between weld beads, and not attributable to IGSCC. The flaw was evaluated under the ASME Code and determined to be acceptable to leave as-is due to the size and lack of exposure to the surface.

Overlays on RRB-F002 and RRD-F002 have been re-inspected during RFO17 in addition to the re-inspection of RRF-F002.

The 2006 Inservice Inspection (ISI) Program Assessment by DAEC Nuclear Oversight documents the review of closeout activities associated with the DAEC ASME Section XI ISI Program Third Period 10-Year Interval. NRC Relief Requests, ISI corrective actions, and the resolution of previously identified NOS issues were also evaluated. One minor administrative issue was identified regarding an incorrect reference to the applicable weld examination in a corrective action document closure package. The evaluation concluded that DAEC ISI Program activities have been satisfactorily performed.

A portion of the NRC Integrated Inspection in 2007 involved review of ISI activities. During this inspection the NRC observed ISI inspections, reviewed ISI records and related ISI problems identified by DAEC. The NRC identified two Non-Cited Violations (NCV's). Both of the NCV's are related to ISI program implementation issues and were considered to be of low safety significance. The first NCV identified an unqualified reactor vessel weld examination, the second NCV concerned an unqualified Main Steam Safety Relief Valve weld repair. The NRC Inspection did not identify any deficiencies in the ISI program requirements; however, the Inspection did identify ISI implementation deficiencies.

During the 2007 refueling outage (RFO 20), ultrasonic examinations performed in accordance with the BWRVIP-75 and ASME Section XI inspection programs identified an indication in reactor recirculation riser safe-end to nozzle weld RRF-F002. The indication did not meet ASME Section XI acceptance criteria. A scope expansion was required which identified another indication which did not meet ASME Section XI acceptance criteria (in safe-end to nozzle weld RRF-F002). Both welds were subsequently overlaid. The indications in both welds (RRF-F002 and RRC-F002) were determined to be Intergranular Stress Corrosion Cracking (IGSCC). The root cause performed (RCE 1062) concluded that, based on the fact that Duane Arnold is on HWC, it is very likely that both flaws have been present for a significant time, e.g. multiple cycles, and were not identified by previous inspections. An NRC requested review by Pacific Northwest National Laboratory (PNNL) substantiates this conclusion.

B.3.12.6 CONCLUSION

The BWR Stress Corrosion Cracking Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.13 BWR VESSEL ID ATTACHMENT WELDS PROGRAM

B.3.13.1 PROGRAM DESCRIPTION

The DAEC BWR Vessel ID Attachment Weld Program is an existing program. The program manages the aging effects of cracking due to stress corrosion cracking (SCC), including intergranular stress corrosion cracking (IGSCC)

The DAEC BWR Vessel ID Attachment Weld Program incorporates the guidelines of BWRVIP-48-A, BWR Vessel and Internals Project Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines, which is the NRC staff approved version of BWRVIP-48. The ASME Section XI, Inservice Inspection Program is implemented in accordance with the American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” ASME Section XI, 2001 Edition through the 2003 Addenda.

The DAEC Water Chemistry Program is consistent with NUREG-1801, XI.M2. The NUREG-1801, Water Chemistry Program, XI.M2 allows use of later revisions of BWRVIPs. The DAEC Water Chemistry Program implements the guidelines of BWRVIP-130: BWR Vessel and Internals Project BWR Water Chemistry Guidelines – 2004 Revision and, therefore, is consistent with NUREG-1801, XI.M2.

The program is updated periodically as required by 10 CFR 50.55a and later issues of BWRVIPs.

B.3.13.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M4.

B.3.13.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M4.

B.3.13.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M4.

B.3.13.5 OPERATING EXPERIENCE

The DAEC BWR Vessel ID Attachment Weld Program has been effective in managing the aging effects of cracking due to stress corrosion cracking (SCC), including intergranular stress corrosion cracking (IGSCC). The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

A review of site specific operating experience finds no instances of degradation to the vessel ID attachment welds which required repairs. This would indicate that the mitigation portion of this program has been adequate.

A review of the DAEC Reactor Vessel Integrity Program Health Reports for the 1st, 2nd, 3rd, and 4th quarters of 2007, which encompass the BWRVIP guidelines for the BWR Vessel ID Attachment Welds, shows that the program status is degraded due to the Mitigation Performance Indicator. Improvement activities were initiated. Operating Experience from the mitigation performance is captured in the Water Chemistry Program.

The 2006 Inservice Inspection (ISI) Program Assessment by DAEC Nuclear Oversight documents the review of closeout activities associated with the DAEC ASME Section XI ISI Program Third Period 10-Year Interval. NRC Relief Requests, ISI corrective actions, and the resolution of previously identified NOS issues were also evaluated. One minor administrative issue was identified regarding an incorrect reference to the applicable weld examination in a corrective action document closure package. The evaluation concluded that DAEC ISI Program activities have been satisfactorily performed.

A portion of the NRC Integrated Inspection in 2007 involved review of ISI activities. During this inspection the NRC observed ISI inspections, reviewed ISI records and related ISI problems identified by DAEC. The NRC identified two Non-Cited Violations (NCV's). Both of the NCV's are related to ISI program implementation issues and were considered to be of low safety significance. The first NCV identified an unqualified reactor vessel weld examination, the second NCV concerned an unqualified Main Steam Safety Relief Valve weld repair. The NRC Inspection did not identify any deficiencies in the ISI program requirements; however, the Inspection did identify ISI implementation deficiencies.

B.3.13.6 CONCLUSION

The BWR Vessel ID Attachment Welds Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.14 BWR VESSEL INTERNALS PROGRAM

B.3.14.1 PROGRAM DESCRIPTION

The DAEC BWR Vessel Internals Program is an existing program. The program manages the aging effects of Stress Corrosion Cracking (SCC), Intergranular Stress Corrosion Cracking (IGSCC), or Irradiated Stress Corrosion Cracking (IASCC).

The BWR Vessel Internals Program incorporates the guidelines of the appropriate BWRVIP documents and ASME Section XI.

The ASME Section XI, Inservice Inspection Program is implemented in accordance with the American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," ASME Section XI, 2001 Edition through the 2003 Addenda.

The DAEC Water Chemistry Program is consistent with NUREG -1801 XI.M2. The NUREG-1801, Water Chemistry Program, XI.M2 allows use of later revisions of BWRVIPs regarding water chemistry.

NUREG -1801, XI.M9, states: Additionally, for top guides with neutron fluence exceeding the IASCC threshold (5E20, E>1MEV) prior to the period of extended operation, inspect five percent (5%) of the top guide locations using enhanced visual inspection technique, EVT-1 within six years after entering the period of extended operation. An additional 5% of the top guide locations will be inspected within twelve years after entering the period of extended operation.

Alternatively, if the neutron fluence for the limiting top guide location is projected to exceed the threshold for IASCC after entering the period of extended operation, inspect 5% of the top guide locations (EVT-1) within six years after the date projected for exceeding the threshold. An additional 5% of the top guide locations will be inspected within twelve years after the date projected for exceeding the threshold.

The top guide inspection locations are those that have high neutron fluences exceeding the IASCC threshold. The extent of the examination and its frequency will be based on a ten percent sample of the total population, which includes all grid beam and beam-to-beam crevice slots.

Engineering evaluation shows that the top guide assembly between top guide cells 34 and 35 exceeds the neutron fluence of 5E20 prior to the period of extended operation and will reach 2.41E22 at the end of the extended period of operation. Therefore, the program shall be enhanced to meet the above requirements.

The program is updated periodically as required by 10 CFR 50.55a and later issues of BWRVIPs.

B.3.14.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M9.

B.3.14.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M9.

B.3.14.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

Since the top guide at DAEC has exceeded a neutron fluence of 5E20 prior to the period of extended operation the program shall be enhanced to require an EVT-1 inspection of five percent (5%) of the top guide locations within six years after entering the period of extended operation. An additional 5% of the top guide locations will be inspected within twelve years after entering the period of extended operation.

B.3.14.5 OPERATING EXPERIENCE

The DAEC BWR Vessel Internals Program has been effective in managing the aging effects of cracking. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these systems will continue to perform their intended function(s) throughout the period of extended operation.

The 2006 Inservice Inspection (ISI) Program Assessment by DAEC Nuclear Oversight documents the review of closeout activities associated with the DAEC ASME Section XI ISI Program Third Period 10-Year Interval. NRC Relief Requests, ISI corrective actions, and the resolution of previously identified NOS issues were also evaluated. One minor administrative issue was identified regarding an incorrect reference to the applicable weld examination in a corrective action document closure package. The evaluation concluded that DAEC ISI Program activities have been satisfactorily performed.

A portion of the NRC Integrated Inspection in 2007 involved review of ISI activities. During this inspection the NRC observed ISI inspections, reviewed ISI records and related ISI problems identified by DAEC. The NRC identified two Non-Cited Violations (NCV's). Both of the NCV's are related to ISI program implementation issues and were considered to be of low safety significance. The first NCV identified an unqualified reactor vessel weld examination, the second NCV concerned an unqualified Main Steam Safety Relief Valve weld repair. The NRC Inspection did not identify any deficiencies in the ISI program requirements; however, the Inspection did identify ISI implementation deficiencies.

B.3.14.6 CONCLUSION

The BWR Vessel Internals Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.15 CLOSED-CYCLE COOLING WATER SYSTEM PROGRAM

B.3.15.1 PROGRAM DESCRIPTION

The DAEC Closed-Cycle Cooling Water System Program is an existing program. The program manages the aging effects of corrosion, fouling, heat transfer degradation and Stress Corrosion Cracking (SCC).

The scope of the program includes Reactor Building Closed Cooling System (RBCCW), Control Building Chiller CCW System, Offgas Condenser CCW System, and Stand By Diesel Generator (SBDG) Jacket Coolers.

The CCCW program is managed through DAEC procedures and guidance documents, and is based on parameters and guidance delineated in EPRI TR-107396, “Closed Cooling Water Chemistry Guideline”.

This program relies on the implementation of guidance provided in EPRI TR-107396 to ensure that the CCCW system functions and components serviced by CCCW are not compromised by aging. The program includes control of chemistry parameters to minimize corrosion and stress corrosion cracking (SCC). DAEC maintains CCCW system corrosion inhibitors within the specified limits of EPRI TR-107396 to minimize corrosion and SCC. DAEC performs testing and inspections of the CCCW systems, components to ensure the performance is maintained and the intended functions are not compromised by aging.

DAEC implements guidance to control the chemistry parameters in closed-cycle cooling water systems. The chemistry parameters are recorded, monitored and trended on a prescribed frequency.

B.3.15.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M21.

B.3.15.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M21.

B.3.15.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M21.

B.3.15.5 OPERATING EXPERIENCE

The DAEC Closed-Cycle Cooling Water System Program has been effective in managing the aging effects of corrosion, fouling and heat transfer degradation and stress corrosion cracking (SCC). The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these systems will continue to perform their intended function(s) throughout the period of extended operation.

A review of plant operating experience related to the Closed Cycle Cooling Water Program shows that the program has been successful at identifying chemistry parameters that were out of acceptable tolerances. These issues were documented and addressed using the DAEC Corrective Action Program.

DAEC self assessments identified areas for program enhancements within the chemistry management of the CCCW systems. DAEC used the corrective action program to document and conclude the actions required to ensure the CCCW systems are managed in compliance with good industry practices and the EPRI guidance document TR-107396.

B.3.15.6 CONCLUSION

The Closed-Cycle Cooling Water System Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.16 COMPRESSED AIR MONITORING PROGRAM

B.3.16.1 PROGRAM DESCRIPTION

The DAEC Compressed Air Program is an existing program that manages or mitigates the aging effects of corrosion and assuring an oil free dry air environment in the instrument air system.

The program consists of planned and periodic maintenance on the systems compressors and air dryers as well as system monitoring.

The program includes the Control Building/Standby Gas Treatment (CB/SBGT) Instrument Air Compressors, the Standby Service Air Compressor, and the Instrument Air Compressors.

The monitoring activities includes a quarterly monitored blow-down along various portions of the system; a semi-annual air system quality check, a semi-annual swapping of the instrument air dryers.

B.3.16.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M24.

B.3.16.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M24.

B.3.16.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M24.

B.3.16.5 OPERATING EXPERIENCE

The DAEC Compressed Air Monitoring Program has been effective in managing the aging effects of corrosion. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

Few corrosion problems associated with air quality issues have been identified with the instrument air downstream of the instrument air dryers. A number of corrosion issues have been identified in the air receivers and piping upstream of the instrument air dryers. These corrosion products were also evidenced downstream of the instrument air receiver tanks in the Service Air system. The service air system air does not pass through the instrument air dryers. Corrosion products were found in the instrument air receiver tanks and in the accessible sections of the air receivers supply piping. Modifications included replacement of the carbon steel underground piping (in 2007) with stainless steel piping and the installation of blowdown piping on the Y-strainers associated with the instrument air receiver tanks to allow the Y-strainers to be cleared by blowing them down which allowed the downstream drain traps to perform their water removal function more reliably. More reliable removal of moisture from the Instrument Air receiver tanks leads to less future corrosion downstream in the instrument air system.

In several instances corrective action records show that the Compressed Air Program monitoring techniques were effective in identifying declining performance and/or system degradation, i.e. increased system air usage, dew point out of tolerances, and air leaks.

B.3.16.6 CONCLUSION

The Compressed Air Monitoring Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.17 ELECTRICAL CABLES AND CONNECTIONS PROGRAM

B.3.17.1 PROGRAM DESCRIPTION

The Electrical Cables and Connections Program is a new program with new inspection/monitoring activities. The program manages the effects of aging due to radiological, thermal and moisture aging mechanisms.

Electrical cables and connections that support a license renewal intended function are included in the scope of this program. This program does not include cables and connections that are within the DAEC Environmental Qualification Program.

Inspections will look for cables or connections degraded by radiological, thermal and moisture aging mechanisms. The aging effects inspected for are embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure/degradation of organics (thermal/thermoxidative), radiation induced oxidation, and moisture intrusion. Visually accessible cables and connections in adverse localized equipment environments will be inspected for damage. Inspecting these cables and connections will provide reasonable assurance that cables and connections in areas with lower temperature, lower radiation dose rates and/or lower moisture levels will meet their intended functions.

All unacceptable visual indications of cable and connection jacket surface anomalies are subject to an engineering evaluation. Such an evaluation is to consider the age and operating environment of the component, as well as the severity of the anomaly and whether such an anomaly has previously been correlated to degradation of conductor insulation or connections. Corrective actions may include, but are not limited to, testing, shielding or otherwise changing the environment, or relocation or replacement of the affected cable or connection. When an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connections.

B.3.17.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.E1.

B.3.17.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.E1.

B.3.17.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.E1.

B.3.17.5 OPERATING EXPERIENCE

The Electrical Cable and Connection Program is a new program; therefore, there is no plant-specific program operating experience for program effectiveness. Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

At DAEC, past inspections/monitoring activities have revealed embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength. The issues were documented and addressed using the Corrective Action Program.

B.3.17.6 CONCLUSION

The Electrical Cables and Connections Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.18 ELECTRICAL CABLES AND CONNECTIONS USED IN INSTRUMENTATION CIRCUITS PROGRAM

B.3.18.1 PROGRAM DESCRIPTION

The Electrical Cables and Connections Used in Instrumentation Circuits Program is a new program consisting of existing inspection/monitoring activities. The program manages the effects of aging due to radiological and thermal aging mechanisms that affect the insulation resistance of cables and connections used in instrumentation circuits.

Electrical cables and connections used in instrumentation circuits that support a license renewal intended function are included in the scope of this program. The scope includes cables in the Neutron Monitoring System. This program does not include cables and connections that are within the DAEC Environmental Qualification Program.

The program tests the insulation of the cables and connections periodically using time domain reflectometry. The testing includes all cables and connections from the detector to the Control Room.

Corrective actions such as recalibration and circuit trouble-shooting are implemented when calibration or surveillance results or findings of surveillances do not meet the acceptance criteria. An engineering evaluation is performed when the test acceptance criteria are not met in order to ensure that the intended functions of the electrical cable system can be maintained consistent with the current licensing basis. Such an evaluation is to consider the significance of the test results, the operability of the component, the reportability of the event, the extent of the concern, the potential root causes for not meeting the test acceptance criteria, the corrective actions required, and likelihood of recurrence.

B.3.18.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.E2.

B.3.18.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.E2.

B.3.18.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.E2.

B.3.18.5 OPERATING EXPERIENCE

The Electrical Cable and Connections Used in Instrumentation Circuits Program is a new program; therefore, there is no plant-specific program operating experience for the program. Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

The DAEC has been performing insulation resistance testing or time domain reflectometry on Neutron Monitoring System cables during refuel outages. No cable degradation has been identified either by testing or as a result of inservice failure.

B.3.18.6 CONCLUSION

The Electrical Cables and Connections Used in Instrumentation Circuits Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.19 ELECTRICAL CONNECTIONS PROGRAM

B.3.19.1 PROGRAM DESCRIPTION

The Electrical Connections Program is a new site specific program that will utilize existing maintenance activities to perform the one-time inspection of electrical connections. This aging management program for electrical connections accounts for loosening of connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation. A sample of electrical connections will be selected based on factors such as voltage level (high, medium and low voltage), circuit loading (high load) and location (adverse localized equipment environment) and plant operating experience. If the one-time inspection shows that an aging effect exists, then a periodic inspection program will be established.

If an unacceptable condition is identified, the Corrective Action Program will evaluate additional requirements. If no generic adverse aging effects are encountered, a new periodic program for electrical connections would not be required.

This program does not include Electrical Connections that are in the scope of the DAEC Environmental Qualification Program.

B.3.19.2 NUREG-1801 CONSISTENCY

This program is a plant-specific program.

B.3.19.3 EXCEPTIONS TO NUREG-1801

This program is a plant-specific program.

B.3.19.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program is a plant-specific program.

B.3.19.5 SCOPE OF PROGRAM

External connections terminating at active or passive devices are in the scope of this program. The Electrical Connections Program applies to bolted electrical connections that support a license renewal intended function and that are susceptible to aging due to loose connections resulting from thermal cycling, ohmic heating or electrical transients. The electrical connections within scope includes external connections terminating at active and passive components, terminal strips in passive components, bolted fuse holders in passive components and bolted connections between cables.

This program does include high-voltage (>35 kV) switchyard connections. The program does not include connections internal to active components and connections within the scope of the DAEC Environmental Qualification Program. The insulating material of any connection is addressed in the Electrical Cables and Connection Program.

B.3.19.6 PREVENTIVE ACTIONS

The Electrical Connections Program does not include any actions to prevent or mitigate aging degradation.

B.3.19.7 PARAMETERS MONITORED OR INSPECTED

The Electrical Connections Program focuses on loosening of bolted connections or high resistance connections. This program will focus on the metallic parts of the connection. The monitoring includes loosening of bolted connections or high resistance of cable connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation. A representative sample of electrical cable connections is tested. The following factors shall be considered for sampling: voltage level (medium and low voltage), circuit loading (high load), and location (high temperature, high humidity, vibration, etc.). The technical basis for the sample selection is to be documented.

B.3.19.8 DETECTION OF AGING EFFECTS

The Electrical Connections Program will perform a one-time inspection (thermographic) on a selected sample of electrical connections. A representative sample of electrical connections within the scope of license renewal will be tested at least once prior to the period of extended operation to confirm that there are no aging effects requiring management during the period of extended operation. The one-time inspection provides additional confirmation to support industry operating experience that shows electrical connections have not experienced a high degree of failures, and that existing installation and maintenance practices are effective. The results of the one-time inspection will be utilized to confirm that an aging effect of loosening of electrical connections due to differential heating does not exist at the DAEC.

B.3.19.9 MONITORING AND TRENDING

The Electrical Connection Program does not include trending because it is a one-time inspection program. Any trending performed will be part of the Corrective Action Program trending.

B.3.19.10 ACCEPTANCE CRITERIA

The acceptance criteria for each test are defined for the specific type of test performed and the specific type of cable connections tested.

B.3.19.11 CORRECTIVE ACTIONS

If test acceptance criteria are not met, the corrective action program will be used to perform an evaluation that will consider the extent of the condition, the indications of aging effect, and changes to the one-time inspection program. Corrective actions may include, but are not limited to sample expansion, increase inspection frequency, and replacement or repair of the affected cable connection components. As discussed in the appendix to NUREG-1801 Volume 2, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the corrective actions.

B.3.19.12 CONFIRMATION ACTIONS

As discussed in the appendix to NUREG-1801 Volume 2, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the confirmation process.

B.3.19.13 ADMINISTRATIVE CONTROLS

As discussed in the appendix to NUREG-1801 Volume 2, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the administrative controls.

B.3.19.14 OPERATING EXPERIENCE

Electrical cable connections exposed to appreciable ohmic or ambient heating during operation may experience loosening caused by repeated cycling of connected loads or of the ambient temperature environment. Only limited number of age related failures of cable connections have been reported. This one-time inspection confirms the absence of aging degradation of metallic cable connections.

The Electrical Connection Program is a new program and does not have any operating experience. Plant and industry operating experience will be considered when developing the programmatic documents. Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. Plant specific operating experience is consistent with the operating experience in the NUREG-1801 program description.

Loose/Corroded Connections have been identified during thermographic monitoring, routine maintenance activities and as a result of failure of equipment. But causal analysis was not performed on all of the loose electrical connections, so it is not known if the loose electrical connections were the result of aging or the result of poor maintenance practices. This program will provide a documented conclusion as to the causes of any loose/corroded connections identified during the one-time inspection.

B.3.19.15 CONCLUSION

The Electrical Connections Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.20 ELECTRICAL PENETRATION ASSEMBLIES PROGRAM

B.3.20.1 PROGRAM DESCRIPTION

The Electrical Penetration Assemblies Program is a new plant specific program consisting of existing inspection/monitoring activities. The program manages the effects of aging due to moisture intrusion degrading the insulation resistance of the epoxy in the Electrical Penetration Assembly (EPA).

The EPAs that support a license renewal intended function are included in the scope of this program. This program does not include the EPAs that are within the DAEC Environmental Qualification Program.

The Electrical Penetration Assemblies Program manages the effects of aging by inspecting the EPAs periodically. The inspections are identical to the required maintenance activities for the EPAs within the scope of the DAEC Environmental Qualification Program.

The DAEC has experienced the failure of two electrical penetration assemblies. An analysis of one EPA was performed. The analysis concluded that the failure was due to moisture, a random void and a potential difference between conductors with subsequent growth of dendrites between the conductors. The dendrites formed a low resistance path, over a long period of time, for current leakage, arcing and carbonization of the epoxy. The electrical short finally developed when the carbonized path between the conductors became continuous and resulted in shorting between the splices of the two conductors. The moisture could have been due to less than adequate adherence to manufacturer instructions which required internal nitrogen pressure be maintained in the assemblies. Dendrites formation requires the presence of moisture.

B.3.20.2 NUREG-1801 CONSISTENCY

This program is a plant-specific program.

B.3.20.3 EXCEPTIONS TO NUREG-1801

This program is a plant-specific program.

B.3.20.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program is a plant-specific program.

B.3.20.5 SCOPE OF PROGRAM

The program applies to EPAs that support a license renewal intended function and are susceptible to moisture aging effects on the epoxy in the EPA. All 16 of the EPAs in the Drywell have a license renewal intended function. Seven of the EPAs in the Drywell are within the scope of the Environmental Qualification Program and are therefore, outside the scope of this program. The other nine EPAs in the Drywell are within the scope of this program. The Torus EPA and the Drywell Airlock EPAs do not have a License Renewal intended electrical function.

B.3.20.6 PREVENTIVE ACTIONS

The program consists of preventive actions only. Inspections will be performed to ensure that the nitrogen pressure is not allowed to reach atmospheric pressure. The program includes monthly checks of the nitrogen pressure. This will ensure that moisture will not enter the penetration. The only aging effect/mechanism is moisture degrading the insulation properties of the epoxy.

B.3.20.7 PARAMETERS MONITORED OR INSPECTED

The program will inspect the nitrogen pressure of the assembly monthly. This will ensure that moisture will not enter the penetration. The only aging effect/mechanism is moisture degrading the insulation properties of the epoxy.

B.3.20.8 DETECTION OF AGING EFFECTS

The program checks nitrogen pressure on a monthly basis. This will ensure that moisture will not enter the penetration. The only aging effect/mechanism is moisture degrading the insulation properties of the epoxy.

B.3.20.9 MONITORING AND TRENDING

The program does not include trending. Any trending performed will be part of the Corrective Action Program trending.

B.3.20.10 ACCEPTANCE CRITERIA

The acceptance criterion for the nitrogen pressure is between 30 and 50 psig on the pressure gauge for the penetration. This criterion is listed in the appropriate site procedures. The 30 to 50 psig range ensures that the EPA maintains a positive pressure at all times. The other maintenance activities listed in the vendor manual do not address the moisture aging effects on the epoxy in the EPA.

B.3.20.11 CORRECTIVE ACTIONS

Further investigation and evaluation is performed when the acceptance criteria are not met. Corrective actions may include but are not limited to cleaning, drying, increased inspection frequency, replacement, or repair of the affected electrical penetration assemblies. If an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to other electrical penetration assemblies. As discussed in the appendix to NUREG-1801 Volume 2, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the corrective actions.

The DAEC Procedures for Corrective Actions will be utilized for documenting when test acceptance criteria have not been met.

B.3.20.12 CONFIRMATION PROCESS

As discussed in the appendix to NUREG-1801 Volume 2, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the confirmation process.

The DAEC Procedures for Corrective Actions will be utilized for documenting when test acceptance criteria have not been met.

B.3.20.13 ADMINISTRATIVE CONTROLS

As discussed in the appendix to NUREG-1801 Volume 2, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the administrative controls.

The Quality Assurance Program as described in the Florida Power and Light Company, FPL Energy Seabrook, LLC and FPL Energy Duane Arnold, LLC Quality Assurance Topical Report, FPL-1, will be utilized to provide the administrative controls.

B.3.20.14 OPERATING EXPERIENCE

The Electrical Penetration Assembly Program is a new program; therefore, there is no plant-specific program operating experience for the program. Plant operating experience forms the basis for the program. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

At DAEC, past inspections/monitoring activities have revealed degraded epoxy insulation resistance due to moisture intrusion. The issues were documented and addressed using the Corrective Action Program. On 10/22/1996, shorts between conductors in Electrical Penetration Assembly JX105C were identified. During the next outage, the shorted conductors were isolated and marked as not usable. On 5/13/1999, shorts between conductors in Electrical Penetration Assembly JX105A were identified. As a result of these two faults, the two assemblies were replaced. The failure analysis concluded that the failure of JX105C was due to moisture, a random void and a potential difference between conductors with subsequent growth of dendrites between the conductors. The dendrites formed a low resistance path, over a long period of time, for current leakage, arcing and carbonization of the epoxy. The electrical short finally developed when the carbonized path between the conductors became continuous and resulted in shorting between the splices of the two conductors. The moisture could have been due to less than adequate adherence to manufacturer instructions which required internal nitrogen pressure be maintained in the assemblies. Dendrites formation requires the presence of moisture. Dendrites were found in JX105C.

B.3.20.15 CONCLUSION

The Electrical Penetration Assemblies Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.21 EXTERNAL SURFACES MONITORING PROGRAM

B.3.21.1 PROGRAM DESCRIPTION

The DAEC External Surfaces Monitoring Program is an existing program. The program manages the aging effects of loss of material.

The program performs visual inspection of external surfaces for evidence of material loss. The program consists of periodic inspections of components such as piping, piping components, ducting, pipe supports and other components. The existing in-plant walkdowns, tour and inspection activities are utilized to perform the inspections. The primary purpose of the system walkdowns is to enable System Engineers to maintain an awareness of system condition and performance. The walkdowns include shutdown walkdowns; joint walkdowns with operations, maintenance or other department staff as appropriate. The program uses the guideline of INPO 85-033, Revision 1, (TS-413), “Use of System Engineers.”

B.3.21.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M36.

B.3.21.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M36.

B.3.21.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with six of the ten elements of NUREG-1801 XI.M36. The program requires enhancements to be consistent with the following elements:

- Scope of Program

Enhance the system walkdown to more specifically address the types of components to be inspected, the relevant degradation mechanisms and effects of interest, and the refueling outage inspection frequency.

- Parameters Monitored or Inspected

  Enhance the system walkdown to more specifically address the types of components to be inspected, and the relevant degradation mechanisms and effects of interest.

- Monitoring or Trending

  Enhance the system walkdown to more specifically address the qualifications required for inspection personnel and periodic reviews to determine program effectiveness.

- Acceptance Criteria

  Enhance the system walkdown to more specifically address the acceptance criteria for the component / aging effect combination to be sure that corrective actions will be identified before loss of intended function, and periodic reviews to determine program effectiveness.

B.3.21.5 OPERATING EXPERIENCE

The DAEC External Surfaces Monitoring Program has been effective in managing the aging effects of loss of material. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

The existing walkdowns have been effective in identifying corrosion or leakage in systems. For example, corrosion was found on the external surface of the Turbine Stop Valve pipe and a steam leak from between the cap nut and steel washer on the casing stud of the Feedwater Pump. Both examples were documented and addressed using the Corrective Action Program.

B.3.21.6 CONCLUSION

The External Surfaces Monitoring Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.22 FIRE PROTECTION PROGRAM

B.3.22.1 PROGRAM DESCRIPTION

The DAEC Fire Protection Program is an existing program. The program manages, but is not limited to the following SSCs.

- Fire Barrier Penetration Seal
- Fire Barrier walls, Ceilings, and Floors

- Diesel Driven Fire Pump fuel oil supply line
- Fire Door
- CO_2 Fire Suppression System

The DAEC Operating Experience and Work Request history for fire barrier walls, ceilings and floors have not shown any signs of degradation except few minor repairs. Based on the DAEC Operating Experience, it is concluded that the inspection frequency of 35 per cent once each operating cycle with 100 per cent visually inspected within a period of five years for fire barrier walls, ceilings and floors as defined in DAEC License Amendment Number 132 is adequate and therefore will be considered an exception to the GALL inspection frequency of once every refueling cycle.

The DAEC Maintenance Rule Program for Monitoring of Structures also provides an inspection of walls, floors and ceilings at a ten year cycle.

B.3.22.2 NUREG-1801 CONSISTENCY

This program is consistent with eight of the ten elements of NUREG-1801 XI.M26. One exception is taken that affects “Detection of Aging Effects” and “Monitoring and Trending” of NUREG-1801 XI.M26.

B.3.22.3 EXCEPTIONS TO NUREG-1801

The DAEC program takes one exception to the guidance as stated in NUREG-1801 XI.M26. This exception affects the following elements of NUREG-1801 XI.M26.

- Detection of Aging Effects
- Monitoring and Trending

The exception taken is:

- DAEC Fire Plan – Volume 1, Program reflects the current Duane Arnold licensing bases as defined in License Amendment Number 132. This amendment allows the frequency of the visual inspections for the walls, ceilings, and floors use as fire barriers to be performed at an interval of 35 per cent once each operating cycle with 100 per cent visually inspected within a period of five years The NUREG-1801 XI.M26 recommends that these inspections be performed once every refueling cycle.

B.3.22.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

The program requires enhancements to be consistent with the following elements:

- Parameters Monitored/Inspected, Detection of Aging Effects, Monitoring and Trending and Acceptance Criteria

  The Fire Protection Program shall be enhanced to include criteria for visual inspection of the fire barrier walls, ceilings, and floors to examine any sign of degradation such as cracking, spalling, and loss of material caused by freeze-thaw, chemical attack, and reaction with aggregates by fire protection qualified inspectors.

The Program will be enhanced to inspect the entire Diesel Driven Fire Pump fuel supply line for degradation (any component in a state of disrepair).

B.3.22.5 OPERATING EXPERIENCE

The DAEC Fire Protection Program has been effective in managing the aging effects for the Fire Protection System. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

Both the industry and NRC have revealed a number of instances of silicone foam fire barrier penetration seals having experienced splits, shrinkage, voids, lack of fill, and other failure modes, problems with fire barriers and water tight fire door seal degradation. The DAEC routinely evaluates NRC communications on industry fire protection issues for applicability. The procurement process and inspection process have been enhanced as a result of some of this experience.

The most recent NRC inspections of the DAEC Fire Protection Program did not identify any findings of significance for the DAEC Fire Protection Program.

DAEC performs a biennial assessment of the Fire Protection Program. The most recent assessment concluded that, on an overall basis, the Fire Protection Program is satisfactory.

B.3.22.6 CONCLUSION

The Fire Protection Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.23 FIRE WATER SYSTEM PROGRAM

B.3.23.1 PROGRAM DESCRIPTION

The DAEC Fire Water System Program is an existing program. The program manages the aging effects of loss of material.

Fire Water System components are tested in accordance with the applicable National Fire Protection Association (NFPA) codes and standards.

Periodic flow tests to verify design pressure for all Fire Water Sprinkler System piping and components are performed.

The external ring header of the fire suppression water system is periodically flushed and hydraulically tested.

The fire mains are tested using fire hydrants in the event that the maximum pressure drop is exceeded. Testing the fire mains using fire hydrants is used to identify large blockages or partially closed valves in the fire main and to verify piping integrity.

Examinations are periodically performed to detect pipe wall thinning.

Chemicals are added to the system to prevent microbiological growth, inhibit scale formation, dispense solids contained in water, improve chlorination efficiency and maintain pH level to prevent corrosion of piping and components.

Testing and inspections mentioned above ensure that corrosion, MIC or biofouling is managed at DAEC to ensure that the system function is maintained.

B.3.23.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M27.

B.3.23.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M27.

B.3.23.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

The program requires enhancements to be consistent with the following element:

- Detection of Aging Effects

  The Fire Water System Program Manual will be enhanced to assure that volumetric inspections for pipe wall thinning of fire protection piping are performed before the end of the current operating term and at plant specific intervals thereafter during the period of extended operation.

  The Fire Water System Program will be enhanced to include NFPA 25 criteria for “where sprinklers have been in place for 50 years, they shall be replaced or representative samples from one or more sample areas shall be submitted to a recognized testing laboratory for field service testing”. Perform this sampling every 10 years after the initial field service testing to ensure that signs of degradation, such as corrosion, are detected in a timely manner.

  The Fire Water System Program will be enhanced to perform visual inspection of yard hydrants annually in accordance with NFPA 25 to detect signs of corrosion.

B.3.23.5 OPERATING EXPERIENCE

The DAEC Fire Water System Program has been effective in managing the aging effects for the Fire Water System. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

Recent testing of the system has not identified any aging effects of the Fire Water System.

The DAEC routinely evaluates NRC communications on industry fire water system issues for applicability. This experience has not impacted plant fire protection program, procurement, or installations. The procurement process and inspection process have been enhanced as a result of some of this experience.

B.3.23.6 CONCLUSION

The Fire Water System Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.24 FLOW ACCELERATED CORROSION PROGRAM

B.3.24.1 PROGRAM DESCRIPTION

The Flow Accelerated Corrosion Program is an existing program. The program manages aging effects (loss of material) due to flow-accelerated corrosion (FAC) on the internal surfaces of carbon or low alloy steel piping, elbows, reducers, tees, expanders, and valve bodies which contain high energy fluids (both single phase and two phase flow).

The program determines susceptible locations, monitors, detects, and mitigates flow accelerated corrosion of susceptible components.

The program is based on the guidelines of NSAC-202L-R2. This program uses CHECWORKS as a predictive tool. Included in the program are: (a) an analysis to determine FAC susceptible lines; (b) performance of limited baseline inspections; (c) follow-up inspections to confirm the predictions; and (d) repairing or replacing components, as necessary.

This program includes: system susceptibility and long term strategy, program implementation and maintenance, inspection preparation, performance of inspections, acceptance criteria, repair and replacement criteria, expansion criteria, and reporting requirements.

B.3.24.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M17.

B.3.24.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M17.

B.3.24.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M17.

B.3.24.5 OPERATING EXPERIENCE

The DAEC Flow Accelerated Corrosion Program has been effective in managing the aging effects of loss of material. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

The DAEC FAC program has successfully identified wall thinning due to FAC prior to the loss of intended function. The program has identified susceptible locations, performed base line thickness measurements, predicted wear (thinning), and verified that actual wear was less than or equal to predicted wear. When excessive wall thinning is identified, the program requires engineering evaluation for continued use or repair or replacement of the subject component.

Results of recent operating experience and a FAC Program assessments (independent and self) revealed no significant program deficiencies and support conclusion that the FAC program effectively manages FAC in high-energy carbon steel piping and components.

B.3.24.6 CONCLUSION

The Flow Accelerated Corrosion Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.25 FUEL OIL CHEMISTRY PROGRAM

B.3.25.1 PROGRAM DESCRIPTION

The DAEC Fuel Oil Chemistry Program is an existing program. The program manages the aging effects of loss of material due to corrosion including microbiological organisms.

The program includes the fuel oil in the fuel delivery systems for the plant Standby Diesel Generators 1G021 and 1G031, the Diesel Fire Pump 1P049-E, and the Diesel Driven Air Start Air Compressors 1K010C and 1K010D for the air start system of the Standby Diesel Generators.

DAEC established a Diesel Fuel Oil Testing Program to comply with Technical Specification Section 5.5.9. The program consists of surveillance test procedures with supporting maintenance and chemistry procedures. The periodicity of surveillance tests allow sufficient time to correct high particulate levels prior to reaching the limit of acceptability.

Plant procedures are used to determine water and sediment or water, sediment and particulate in the two main plant diesel fuel oil storage tanks, 1T035 Diesel Oil Storage Tank, 1T034 Auxiliary Boiler Fuel Oil Storage Tank, the two Diesel Generator Day Tanks 1T037A and B, and the 1T089 Diesel Fire Pump Day Tank. The chemistry in the 1T034 Auxiliary Boiler Fuel Oil Storage Tank is tested and maintained to the same specifications as the fuel oil in the 1T035 Diesel Oil Storage Tank so it will be available for transfer to the 1T035 Diesel Oil Storage Tank if required.

There are no equipment specific procedures required to validate the quality of the fuel oil contained in the Diesel Driven Air Start Air Compressors 1K010C and 1K010D fuel oil tanks 1T477 and 1T478. The tanks contain a small volume of fuel oil that is replaced on a frequent basis from use and the fuel oil is manually taken from the Diesel Generator Day Tanks 1T037A and B whose quality is monitored.

B.3.25.2 NUREG-1801 CONSISTENCY

The program is consistent with six of the elements of NUREG XI.M30. Exceptions are taken to “Scope of Program,” “Preventive Actions,” “Parameters Monitored/Inspected,” and “Acceptance Criteria.” These exceptions are listed below.

B.3.25.3 EXCEPTIONS TO NUREG-1801

The DAEC program takes exception to the guidance as stated in NUREG-1801 XI.M30. These exceptions affect the following elements of NUREG-1801 XI.M30.

- DAEC Scope of Program

  NUREG-1801 states: Fuel oil quality is maintained by monitoring and controlling fuel oil contamination in accordance with the plant’s technical specifications and the guidelines of the American Society for Testing Materials (ASTM) Standards D 1796, D 2276, D 2709, D 6217, and D 4057. For determination of particulates the ASTM D 6217 or Modified ASTM D 2276, Method A is recommended.

  The DAEC Fuel Oil Chemistry Program does not use ASTM D 6217. DAEC uses the non-modified ASTM D 2276 which uses the more conservative filter pore size of 0.8μm verses the 3.0μm as used by the Modified ASTM D 2276, Method A. The DAEC Operating Experience and generally the industry Operating Experience show this to be acceptable.

- Parameters Monitored/Inspected

  For determination of particulates the Modified ASTM D 2276, Method A is recommended. DAEC uses the non-modified ASTM D 2276 which uses the more conservative filter pore size of 0.8μm verses the 3.0μm as used by the Modified ASTM D 2276, Method A. The DAEC Operating Experience and generally the industry Operating Experience show this to be acceptable.

- Preventive Actions

  DAEC does not use fuel additives of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion.

  The monthly testing for and removal of water and the purchase of quality fuel oil negates the need for additives. The DAEC Operating Experience shows this to be an acceptable alternative.

- Acceptance Criteria

  For determination of particulates the ASTM D 6217 or Modified ASTM D 2276, Method A is recommended. DAEC uses the non-modified ASTM D 2276 which uses the more conservative filter pore size of 0.8μm verses the 3.0μm as used by the Modified ASTM D 2276, Method A. The DAEC Operating Experience and generally the industry Operating Experience show this to be acceptable.

The ASTM D 6217 also uses the more conservative filter pore size of 0.8 µm along with a technique that requires less fuel oil to complete the test. DAEC has not chosen to use this alternative standard for particulate testing.

B.3.25.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

The program requires enhancements to be consistent with the following elements:

- Scope of Program, Preventive Action, Parameters Monitored/Inspected, Detection of Aging Effects
- Enhance the Program to require particulate testing of fuel oil samples from the Diesel Fire Pump day tank 1T089.
- Enhance the Program to require sampling and testing of new fuel oil delivered to the Diesel Fire Pump day tank 1T089.
- Enhance the Program to assure that the frequency for the periodic draining or cleaning of the diesel fuel oil day tanks, diesel fire pump day tank and diesel driven air start air compressor fuel oil tanks are on a schedule of every ten years.
- Enhance the Program by creating a procedure for testing the bottom thickness of the diesel fuel oil day tanks on a schedule of every ten years.
- Create procedures for bottom thickness testing of the Standby Diesel Generator Fuel Oil Day Tanks (1T37A and 1T37B) and the Diesel Fire Pump Fuel Oil Day Tank (1T089) every ten years.

B.3.25.5 OPERATING EXPERIENCE

The DAEC Fuel Oil Chemistry Program has been effective in managing the aging effects loss of material due to corrosion including microbiological organisms. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

Inspection of the main diesel fuel oil storage tank was last performed in April 2001. It was found in an excellent condition including an ultrasonic thickness survey that found no material loss from the preceding 27 years of service.

Based on the results of the existing tests and inspections, the existing Diesel Fuel Oil Testing Program has been effective at managing the effects of aging. The last inspection of the Emergency Diesel Generator Fuel Oil Storage Tank found no storage tank problems. This indicates that the existing program has been effective at preventing degradation.

Recent self assessment activities have not identified any programmatic issues.

B.3.25.6 CONCLUSION

The Fuel Oil Chemistry Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.26 FUSE HOLDERS PROGRAM

B.3.26.1 PROGRAM DESCRIPTION

The Fuse Holders Program is a new program consisting of existing inspection/monitoring activities. The program manages the effects of aging due to loosening of the metal clip due to fatigue and ohmic heating due to frequent manipulation.

The program includes fuse holders that support a license renewal function and are not part of an active component. The program is limited to the metal portion of the fuse holder. The aging effects for the insulating material of the fuse holder are addressed as part of the Electrical Cable and Connection Program.

The program manages the effects of aging by thermographic inspection. The thermographic inspection is to identify aging due to loosening of the metal clip.

An engineering evaluation is performed when the test acceptance criteria are not met in order to ensure that the intended functions of the fuse holders can be maintained consistent with the current licensing basis. Such an evaluation is to consider the significance of the test results, the operability of the component, the reportability of the event, the extent of the concern, the potential root causes for not meeting the test acceptance criteria, the corrective action necessary, and the likelihood of recurrence.

B.3.26.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.E5.

B.3.26.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.E5.

B.3.26.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.E5.

B.3.26.5 OPERATING EXPERIENCE

The Fuse Holders Program is a new program; therefore, there is no plant-specific program operating experience for program effectiveness. Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

At DAEC, past inspections/monitoring activities have not revealed loosening of the metal clip due to fatigue and ohmic heating due to frequent manipulation.

B.3.26.6 CONCLUSION

The Fuse Holders Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.27 INACCESSIBLE MEDIUM VOLTAGE CABLES PROGRAM

B.3.27.1 PROGRAM DESCRIPTION

The Inaccessible Medium Voltage Cables Program is a new program consisting of existing inspection/monitoring activities. The program manages the effects of aging due to moisture and voltage.

The program includes medium voltage cables that support a license renewal intended function, are susceptible to submergence and are energized a significant portion of their life.

The program manages the effects of aging by measuring the insulation resistance of the cables and connections periodically.

This program also includes actions to prevent cables from being exposed to long term exposure to significant moisture by periodically inspecting the manholes containing cables and testing of sump pumps.

An engineering evaluation is performed when the test acceptance criteria are not met in order to ensure that the intended functions of the electrical cables can be maintained consistent with the current licensing basis. Such an evaluation is to consider the significance of the test results, the operability of the component, the reportability of the event, the extent of the concern, the potential root causes for not meeting the test acceptance criteria, the corrective actions required, and the likelihood of recurrence. When an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to other inaccessible, in-scope, medium-voltage cables.

B.3.27.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.E3.

B.3.27.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to ten elements of NUREG-1801 XI.E3.

B.3.27.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.E3.

B.3.27.5 OPERATING EXPERIENCE

The Inaccessible Medium Voltage Cables Program is a new program; therefore, there is no plant-specific program operating experience for program effectiveness.

Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. Industry and plant-specific operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

At DAEC, past inspections/monitoring activities have not revealed degradation of insulation resistance. The issues were documented and addressed using the Corrective Action Program.

Inspections of the manholes and sump pumps have identified water in the manholes and inoperable sump pumps. The issues were documented and addressed using the Corrective Action Program.

B.3.27.6 CONCLUSION

The Inaccessible Medium Voltage Cables Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.28 INSPECTION OF INTERNAL SURFACES IN MISCELLANEOUS PIPING AND DUCTING COMPONENTS PROGRAM

B.3.28.1 PROGRAM DESCRIPTION

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a new program. The program manages the effects of aging due to loss of material, heat transfer degradation, cracking and fouling.

The program consists of inspections of the internal surfaces of steel piping, piping components, ducting, and other components that are not covered by other aging management programs. This program also includes external inspections of submerged piping not frequently accessible for external monitoring. This piping is normally submerged in the Standby Gas Treatment System Sump and has the function of a secondary containment boundary. This program also includes the external inspections of some safety related HVAC equipment air handling units that will need to have their associated housing units opened to perform that inspection.

The program inspections are inspections of opportunity, performed during the existing pre-planned periodic system and component maintenance activities when the systems are opened and the surfaces are made accessible for visual inspection. This maintenance may occur during power operations or during refueling outages when many systems are opened. The visual inspections assure that existing environmental conditions are not causing material degradation that could result in a loss of the component intended functions.

B.3.28.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M38.

B.3.28.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M38.

B.3.28.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M38.

B.3.28.5 OPERATING EXPERIENCE

The DAEC Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program is a new program; therefore, there is no plant-specific program operating experience for program effectiveness. Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. Industry operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

B.3.28.6 CONCLUSION

The Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.29 INSPECTION OF OVERHEAD HEAVY LOAD AND LIGHT LOAD (RELATED TO REFUELING) HANDLING SYSTEMS PROGRAM

B.3.29.1 PROGRAM DESCRIPTION

The DAEC Inspection of Overhead Heavy Load and Light Load Handling Systems Program is an existing program. The program manages loss of material due to general corrosion of structural components.

The program includes the following heavy and light load handling systems:

- 1H001 – Reactor Building Crane
- 1H003 – Turbine Building Crane
- 1S081 – Refueling Platform (includes 1H209 Refuel Platform Auxiliary Hoist)
- 1H005A/B – Recirculation Pump Motor Hoist
- 1H011 – Refuel Floor Jib Crane
- 1H013 – Drywell Shield Blocks & Personnel Air Lock Hoist
- 1H018 – Fuel Pool Demineralizer Area Hoist
- 1H023 – Spent Fuel Pool Gamma Scan Collimator Port Hoist

- 1H212 – South Torus Hatch Equipment Hoist
- 1H220 – Drywell Equipment Hatch Hoist
- Torus Monorail

The program addresses the management of material degradation due to general corrosion of the applicable system's supporting steel and the wear on the crane rails through periodic visual inspection in accordance with industry standards.

In addition, the program will record and evaluate the effects of past and future usage on the Reactor Building Crane and Turbine Building Crane.

The remaining in-scope load handling systems have not been designed for a limited number of lifts above their respective rated capacities. In addition, these systems have their loads limited to those within their design basis through administrative procedures. Due to this, deterioration of the structural members due to operational fatigue is not expected, and usage of these load handling systems is not recorded.

B.3.29.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M23.

B.3.29.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M23.

B.3.29.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

The program requires enhancements to be consistent with the following element:

- Parameters Inspected/Monitored

  The program will be enhanced to include corrosion and wear as monitored parameters for the supporting steel and rails of the respective load handling systems.

  The program will also be enhanced to include procedures for recording usage of the Reactor Building Crane and Turbine Building Crane.

B.3.29.5 OPERATING EXPERIENCE

The DAEC Overhead Heavy Load and Light Load Handling Systems Program has been effective in managing the aging effects of loss of material of structural components. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

Inspection of the Turbine Building Crane in 1996 through the Maintenance Rule Monitoring of Structures Program did reveal limited surface corrosion on the walking platform fasteners. However, further examination of the fasteners revealed that the degradation did not pose a threat to the operability of the crane. Follow-up inspections in 1998 and 2007 indicated no further degradation, and the issue is scheduled to be reexamined during the next regularly scheduled Maintenance Rule inspection.

During Refueling Outage 20 in 2007, inspection of the Turbine Building Crane following an overcapacity lift identified cracks along the welded interface of the mechanical stops and bridge rails. The crane manufacturer was notified of the defect and the crane manufacturer cleared the crane for further use. Additional inspections during the same outage identified three instances of loose bolting on the south end of the east bridge rail. In all occurrences, the bolting was retightened and torqued to the proper value.

B.3.29.6 CONCLUSION

The Inspection of Overhead Heavy Load and Light Load Handling Systems Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.30 LUBRICATING OIL ANALYSIS PROGRAM

B.3.30.1 PROGRAM DESCRIPTION

The Lubricating Oil Analysis Program is an existing program. The program manages the aging effects of loss of material, cracking or heat transfer degradation.

The purpose of the program is to obtain and analyze lubricating oil samples from plant equipment to ensure that the oil quality is maintained within established limits. The program maintains oil contaminants (primarily water and particulates which may be indicative of in-leakage and corrosion product buildup) within acceptable limits to preserve an operating environment that is not conducive to loss of material, cracking or heat transfer degradation.

Oil testing activities include periodic sampling, analysis and trending of results. The DAEC Lubrication Program Manual establishes the monitoring frequency. The frequency of monitoring will vary depending on such factors as regulatory or technical specification requirements, vendor recommendations, continuous versus standby use, in-plant and industry experience with similar equipment, engineering analysis of equipment performance, the relative importance of the equipment to plant operation/safety and the maintenance history of the equipment.

In general most rotating equipment will fall into the following three categories which will determine their test frequency.

- Category 1 – Safety Related Equipment whose function is necessary at all times to maintain full power production, has the potential to reduce power (load threatening) or presents a significant risk to core protection shall typically be monitored once every month or as defined by the Preventive Maintenance Program.
- Category 2 – Important to Plant Operations Equipment whose function is necessary for plant safety and/or is only operated during Technical Specification’s required surveillance’s (generally quarterly) or provides a supporting role to Category 1 equipment in the production of power, shall

typically be monitored once every quarter or as defined by the Preventive Maintenance Program.

- Category 3 – Balance of Plant/Maintenance Rule Equipment whose function has been determined through engineering analysis (MMIS, maintenance history reviews, developing problems), or vendor recommendations to be (1) necessary for plant power production, or (2) for providing a supporting role to Category 1 and/or 2 equipment, shall be monitored on a schedule consistent with the findings from the above analysis/recommendations (monthly, quarterly, semi-annually, annually, or other specified frequencies). This equipment may have redundant machine trains. Warranty requirements may also temporarily adjust monitoring criteria as well.

In addition to the major component(s) that comprise the system, the lube oil program is credited for age management of the associated piping, heat exchangers, and other components that are a part of the supporting lube oil system.

The program provides an early indication of adverse equipment condition in lubricating oil environments.

B.3.30.2 NUREG-1801 XI.M39 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M39.

B.3.30.3 EXCEPTIONS TO NUREG-1801 XI.M39

There are no exceptions to the ten elements of NUREG-1801 XI.M39.

B.3.30.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

The program requires enhancements to be consistent with the following elements:

- Parameters Monitored/Inspected

  The program will be enhanced to add Diesel Fire Pump 1P-049 to Oil Scope/Equipment Database for obtaining oil samples and required parameters to be monitored.

B.3.30.5 OPERATING EXPERIENCE

The DAEC Lubricating Oil Analysis Program has been effective in managing the aging effects of loss of materials. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these systems will continue to perform their intended function(s) throughout the period of extended operation.

In June 2006, the oil in 1P089B Upper Reservoir was observed to be dark in color. Engineering concluded that no operability issue exists and the oil was still acceptable and no wear debris generation is evident. Therefore, no further action was required.

In November 2004, the oil in 1G201A and B were found to have a low oxidation life. Engineering concluded that no operability issue exists and the oil was still acceptable and the work order was issued to change the oil in the outage. Therefore, no further action was required.

Oil Analysis Program Health Status (DAEC Program Health Database) is used to assess Oil Analysis Program issues/events. Those issues and events, whether external or plant specific, that are potentially significant to Oil Lubrication Analysis Program are evaluated. As per latest Oil Analysis Program Health Status dated 01/25/2008 the overall health status of the Oil Program is green (well within criteria and fleet standards met).

B.3.30.6 CONCLUSION

The Lubricating Oil Analysis Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.31 METAL ENCLOSED BUS PROGRAM

B.3.31.1 PROGRAM DESCRIPTION

The Metal Enclosed Bus Program is a new program consisting of existing inspection/monitoring activities. The program manages the effects of aging of loosening of bolted connections due to thermal cycling and ohmic heating, reduced insulation resistance and moisture/debris intrusion.

The program includes metal enclosed buses that support a license renewal function.

The program manages the effects of aging by inspecting the insulation of the metal enclosed bus periodically.

Further investigation and evaluation are performed when the acceptance criteria are not met. Corrective actions may include but are not limited to cleaning, drying, increased inspection frequency, replacement, or repair of the affected MEB components. If an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible MEBs.

B.3.31.2 NUREG-1801 XI.E4 CONSISTENCY

The Metal Enclosed Bus Program is consistent with nine of the ten elements of NUREG-1801 XI.E4. An exception is taken to NUREG-1801 XI.E4 “Detection of Aging Effects.” The exception is listed below.

B.3.31.3 EXCEPTIONS TO NUREG-1801

The program takes one exception to the guidance as stated in NUREG-1801 XI.E4. The exception affects the following element of NUREG-1801 XI.E4.

- Detection of Aging Effects

NUREG-1801 XI.E4 recommends a 5 year frequency for visual inspections when no thermographic inspections are performed. The DAEC performs the visual inspections on a 6 year frequency as part of the major inspection of the associated transformer. The inspections that have been performed since the bus bar insulation was replaced have not identified any degradation. Therefore, performing visual inspections on a 6 year frequency provides reasonable assurance that the metal enclosed bus will be maintained consistent with the current licensing basis through the period of extended operation.

B.3.31.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.E4.

B.3.31.5 OPERATING EXPERIENCE

The existing maintenance activities that the Metal Enclosed Bus Program will take credit for have been effective in managing the aging effects of loosening of bolted connections due to thermal cycling and ohmic heating, reduced insulation resistance and moisture/debris intrusion. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

The DAEC has not experienced failures of non-segregated electrical bus. However, the DAEC has experienced significant degradation of the bus insulation. The degradation of the bus insulation was identified as a result of periodic inspection performed in 1990. The degradation of the bus insulation did not result in failure of the bus. The bus insulation was replaced in 1992 and 1993.

The inspections performed during 1996 and 2002 did not identify any problems with insulation degradation, signs of thermal damage (indicating loose bolting) or foreign material.

B.3.31.6 CONCLUSION

The Metal Enclosed Bus Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.32 ONE-TIME INSPECTION PROGRAM

B.3.32.1 PROGRAM DESCRIPTION

The DAEC One-Time Inspection Program is a new program. This program assesses aging effects of loss of material due to corrosion (crevice, galvanic, general, pitting); loss of material due to MIC; loss of material due to erosion; loss of heat transfer due to fouling; and cracking due to SCC or cyclic loading of susceptible components.

This program addresses potentially long incubation periods for certain aging effects and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effects on the intended function of the structure or component. The One-Time Inspection Program provides measures for verifying an aging management program is not needed, verifying the effectiveness of an existing program, or determining that the degradation is occurring which will require evaluation and corrective action.

The program includes (a) determination of appropriate inspection sample size, (b) identification of inspection locations, (c) selection of examination technique, with acceptance criteria, and (d) evaluation of results to determine the need for additional inspections or other corrective actions. The inspection sample includes locations where the most severe aging effect(s) would be expected to occur. Inspection methods may include visual (or remote visual), surface or volumetric examinations, or other established NDE techniques.

This program will be used to:

- Verify the effectiveness of the Water Chemistry Program for managing the effects of aging in portions of piping, and components, exposed to a treated water environment.
- Verification of the effectiveness of Fuel Oil Chemistry control for managing the effects of aging of piping and components in systems that contain fuel oil.
- Verification of the effectiveness of the Lubricating Oil Analysis Program for managing the effects of aging of piping and components in systems that contain lube oil.

To verify the effectiveness of these programs, this program will perform a one-time inspection of selected components determined to be most susceptible to the potential corrosion mechanisms.

Some individual components have been designated to have a one-time inspection performed to verify that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. These components will not be part of a sample group rather they will be individually inspected under the One-Time Inspection program.

Any corrective actions will be implemented through the corrective action program.

The inspections will be scheduled as close to the end of the current operating license as practical with margin provided to ensure completion prior to commencing the period of extended operation. The inspection requirements may be satisfied by a review of maintenance or inspection records to confirm that the component has been inspected for aging degradation and no significant degradation has occurred within 10 years prior to the period of extended operation.

B.3.32.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M32.

B.3.32.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M32.

B.3.32.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M32.

B.3.32.5 OPERATING EXPERIENCE

The DAEC One-Time Inspection is a new program; therefore, there is no plant-specific program operating experience for program effectiveness. Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. Industry operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

B.3.32.6 CONCLUSION

The One-Time Inspection Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.33 OPEN CYCLE COOLING WATER SYSTEM PROGRAM

B.3.33.1 PROGRAM DESCRIPTION

The DAEC Open-Cycle Cooling Water System Program is an existing program. The program manages the aging effects of loss of material, and heat transfer degradation fouling.

The program manages aging effects in the following raw water systems:

- Circulating Water System
- River Water Supply System
- Residual Heat Removal Service Water System (RHRSW)
- Emergency Service Water System (ESW)

This program relies on the implementation of the recommendations of NRC Generic Letter (GL) 89-13 to ensure that the effects of aging on the raw water service water systems will be managed for the period of extended operation.

The program manages the aging effects of loss of material and heat transfer degradation – fouling in the systems, structures, and components serviced by the OCCW system. The program includes (a) surveillance and control of corrosion, silting, and heat transfer degradation – fouling, (b) tests to verify heat transfer, (c) routine inspection and maintenance of plant components, (d) system walk downs to ensure compliance with the stations licensing basis and (e) a review of maintenance, operating and training practices and procedures to ensure the effectiveness of established programs.

B.3.33.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M20.

B.3.33.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M20.

B.3.33.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M20.

B.3.33.5 OPERATING EXPERIENCE

The DAEC Open-Cycle Cooling Water System Program has been effective in managing the aging effects of loss of material and heat transfer degradation fouling. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

The DAEC Operating Experience Data Bases depict that the OCCW program processes inspect and trend the system components for aging effects due to biofouling, corrosion, erosion, and silting in structures and components serviced by OCCW systems. Those issues and events, whether external or plant specific, that are potentially significant to the Open Cycle Cooling Water Program at DAEC are evaluated for applicability.

Program effectiveness has been demonstrated by various assessments and system operational performance. These assessments have shown that the DAEC has implemented the requirements of NRC GL 89-13. Corrosion and material condition issues have been documented and evaluated in the site Corrective Action Program. Corrective actions have been implemented to address corrosion and other material condition issues of piping and components.

B.3.33.6 CONCLUSION

The Open-Cycle Cooling Water System Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.34 REACTOR HEAD CLOSURE STUDS PROGRAM

B.3.34.1 PROGRAM DESCRIPTION

The DAEC Reactor Head Closure Studs Program is an existing program that is an integral part of the DAEC ASME Section XI Inservice Inspection Program. The program manages the aging effects of cracking due to Stress Corrosion Cracking (SCC) or Intergranular Stress Corrosion Cracking (ICSCC) and loss of material due to wear.

The program incorporates ASME Subsection IWB (2001 edition including the 2002 and 2003 Addenda), IWB Table 2500-1. In accordance with 10 CFR 50.55a, DAEC will use the ASME Code Edition in effect 12 months prior to the start of the inspection interval.

The program includes preventive measures to mitigate cracking. These measures include material selection, appropriate coatings, and lubrications which follow the guidelines of Regulatory Guide 1.65.

B.3.34.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M3.

B.3.34.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M3.

B.3.34.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M3.

B.3.34.5 OPERATING EXPERIENCE

The DAEC Reactor Head Closure Studs Program has been effective in managing the aging effects of cracking and loss of material. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

DAEC has performed inspections and testing as required by the ASME Section XI Inservice Inspection Program. No recordable indications are reported for these inspections and test.

Inservice Inspection (ISI) Program Assessment by DAEC Nuclear Oversight (NOS) in 2006 documents the review of closeout activities associated with the DAEC ASME Section XI ISI Program Third Period 10-Year Interval. NRC Relief Requests, ISI corrective actions, and the resolution of previously identified NOS issues were also evaluated. One minor administrative issue was identified regarding an incorrect reference to the applicable weld examination in a corrective action document closure package. The evaluation concluded that DAEC ISI Program activities have been satisfactorily performed.

A portion of the NRC Integrated Inspection in 2007 involved review of ISI activities. During this inspection the NRC observed ISI inspections, reviewed ISI records and related ISI problems identified by DAEC. The NRC identified two Non-Cited Violations (NCV's). Both of the NCV's are related to ISI program implementation issues and were considered to be of low safety significance. The first NCV identified an unqualified reactor vessel weld examinations, the second NCV concerned an unqualified Main Steam Safety Relief Valve weld repair. The NRC Inspection did not identify any deficiencies in the ISI program requirements; however, the Inspection did identify ISI implementation deficiencies.

B.3.34.6 CONCLUSION

The Reactor Head Closure Studs Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.35 REACTOR VESSEL SURVEILLANCE PROGRAM

B.3.35.1 PROGRAM DESCRIPTION

The DAEC Reactor Vessel Surveillance Program is an existing program. The program manages the aging effects of Neutron/Radiation Embrittlement on the Reactor Pressure Vessel beltline material.

DAEC is participating in the industry Integrated Surveillance Program (ISP), as described in BWRVIP-78 and BWRVIP-86A. Use of the ISP was approved by the NRC for DAEC in Technical Specification Amendment 262. The ISP includes periodic withdrawal and testing of in-vessel capsules at DAEC and other participating Boiling Water Reactors (BWR's). The DAEC program uses the data that is made available through the BWRVIP ISP to evaluate the effects of neutron embrittlement on the reactor vessel beltline materials, and to determine plant operating limits.

The DAEC will implement BWRVIP-116 with the conditions document in Sections 3 and 4 of the NRC Staff's SE dated March 1, 2006 for BWRVIP-116.

The DAEC Reactor Vessel Surveillance Program is consistent with the requirements of 10 CFR Part 50, Appendix H, NRC Regulatory Guide 1.99 and ASTM E185.

B.3.35.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M31.

B.3.35.3 EXCEPTIONS TO NUREG-1801

This program takes no exceptions to the ten elements of NUREG-1801 XI.M31.

B.3.35.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

The program requires enhancements to be consistent with the following elements:

- Scope of Program, Detection of Aging Effects, Parameters Monitored/Inspected and Monitoring and Trending
- Develop a procedure to evaluate the BWRVIP ISP data as it becomes available. The evaluation will determine the effect of the data on the DAEC reactor vessel beltline materials and the plants operating limits.
- Develop requirements to ensure that in the future all capsules pulled from the vessel will be placed in storage after being tested.

B.3.35.5 OPERATING EXPERIENCE

The DAEC Reactor Vessel Surveillance Program has been effective in managing the aging effects of reduction of fracture toughness – neutron/radiation embrittlement of the reactor pressure vessel beltline material. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

DAEC placed test capsules in the reactor vessel adjacent to the vessel wall at the core mid-plane level prior to the initial unit startup. A specimen has been withdrawn at approximately 6 and 15 Effective Full Power Years (EFPY). This correlates to an estimated fluence at ¼ T (10^{18} n/cm^2 (E >1MeV)) of 0.7 and 1.2.

DAEC reconstituted the specimen removed at approximately 6 EFPY. This specimen was removed during the Cycle 7 Refueling Outage (RFO) and placed back in the vessel during the Cycle 9 RFO. This specimen is now designated as a "Standby".

Future withdrawals of specimens from the vessel will be in accordance with the schedule provided in the BWRVIP.

B.3.35.6 CONCLUSION

The Reactor Vessel Surveillance Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.36 SELECTIVE LEACHING OF MATERIALS PROGRAM

B.3.36.1 PROGRAM DESCRIPTION

The DAEC Selective Leaching of Materials Program is a new program. The program manages the aging effect of loss of material due to Selective Leaching.

The program for selective leaching will ensure that components made of cast iron, bronze, brass, and copper alloys that are exposed to raw water, treated water, or groundwater environment will maintain their integrity through the period of extended operation.

The program will include a one-time visual inspection, hardness measurement and/or mechanical test of selected components that may be susceptible to selective leaching. The program will determine whether loss of materials due to selective leaching is occurring, and whether the process will affect the ability of the components to perform their intended function for the period of extended operation.

B.3.36.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M33.

B.3.36.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M33.

B.3.36.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M33.

B.3.36.5 OPERATING EXPERIENCE

The DAEC Selective Leaching of Materials Program is a new program; therefore, there is no plant-specific program operating experience for program effectiveness. Industry operating experience that forms the basis for the program is described in the operating experience element of the NUREG-1801 program description. Industry operating experience will be evaluated in the development and implementation of this program. As additional operating experience is obtained, lessons learned will be appropriately incorporated into the program.

At DAEC, past inspections/monitoring activities have revealed graphitization removal of one of the alloying elements from the material, which leads to the enrichment of the remaining alloying elements. The issues were documented and addressed using the Corrective Action Program.

B.3.36.6 CONCLUSION

The Selective Leaching of Materials Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.37 STRUCTURES MONITORING PROGRAM

B.3.37.1 PROGRAM DESCRIPTION

XI.S6 – Structures Monitoring Program

The Structures Monitoring Program is an existing program at DAEC that will be enhanced to ensure provision of aging management for structures and structural components within the scope of this program. The Structures Monitoring Program is based on the guidance provided in NRC Regulatory Guide 1.160, Revision 2 and NUMARC 93-01, Revision 2.

The DAEC Structures Monitoring Program includes periodic visual inspection of structures and structural components for the detection of aging effects specific for that structure. These inspections are completed by qualified individuals at a frequency determined by the characteristics of the environment in which the structure is found. A structure found in a harsh environment is defined as one that is in an area that is routinely subject to outside ambient conditions, very high temperature, high moisture or humidity, frequent large cycling of temperatures, frequent exposure to caustic materials, or extremely high radiation levels. For structures in these harsh environments, the inspection is conducted on a five year basis (plus or minus one year). Structures not found in areas qualifying as a harsh environment are classified as being in a mild environment, and are inspected on a ten year basis (plus or minus one year).

Individuals conducting the inspection and reviewing the results are qualified in accordance with the requirements specified in ACI 349.3R-96. Individuals conducting the inspection and reviewing the results are to possess expertise in the design and inspection of steel, concrete and masonry structures. This individual is to be either a licensed Professional Engineer experienced in this area, or shall be working under the direction of a licensed Professional Engineer experienced in this area. In addition, the inspection of electrical panels will be completed in coordination with the Electrical Maintenance Shop.

Detection of aggressive subsurface environments will be completed through the sampling of the groundwater on site through the enhanced procedures of the Maintenance Rule Program. This procedure will monitor groundwater for chloride concentration, sulfate concentration and pH on a 10 year basis.

In addition, examination of areas not typically accessible, such as buried concrete foundations, will be completed during inspections of opportunity created during excavations. An evaluation of these opportunistic inspections for buried concrete will be completed every 10 years to ensure that the condition of buried concrete foundations on site is characterized sufficiently to provide reasonable assurance that the foundations on site will perform their intended function through the period of extended operation. Additional inspections may be performed in the event that an opportunistic inspection has not been conducted, or if visible portions of the concrete foundation reveal degradation due to the development of an aggressive groundwater environment. However, sampling of groundwater at DAEC has indicated that it is below aggressive levels.

XI.S5 – Masonry Wall Program

The Structures Monitoring Program at DAEC is an existing program that also incorporates the required elements of NUREG-1801 XI.S5, “Masonry Wall Program”. This program requires the visual inspection of safety-related masonry walls for degradation that could potentially invalidate the evaluation basis established following NRC IEB 80-11.

The qualifications of inspectors/reviewers and frequency of inspection of masonry walls are specified above in the Structures Monitoring Program.

In addition, these inspections are complimented through the application of administrative controls on modifications affecting masonry block walls in accordance with NRC IN 87-67. DAEC personnel are required to evaluate whether a proposed design or maintenance action affects a safety-related masonry wall. Modifications involving such walls are required to analyze the adequacy of the masonry wall with the proposed change.

XI.S7 – Inspection of Water Control Structures Associated with Nuclear Power Plants

The existing Structures Monitoring Program at DAEC also integrates the required elements of NUREG-1801 XI.S7, “RG 1.127 Inspection of Water Control Structures Associated with Nuclear Power Plants.”

Under the Structures Monitoring Program, periodic visual inspections of water control structures associated with emergency cooling water systems and/or flood protection are conducted in accordance with the requirements set forth in NRC RG 1.127, Revision 1. At DAEC, the Intake Structure is the only water control structure associated with emergency cooling water systems within the scope of this program.

As part of the flood protection measures at DAEC, stoplog bracing will also be inspected under the Structures Monitoring Program.

The qualifications of inspectors/reviewers and frequency of inspection are in accordance with the Structures Monitoring Program.

In accordance with NRC RG 1.127 Revision 1, the Intake Structure river water pits are also monitored and maintained for silt and debris accumulation. However, these activities are addressed through the “Open-Cycle Cooling Water System Program”.

B.3.37.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801, Chapter XI, Programs XI.S5, XI.S6, and XI.S7.

B.3.37.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801, Chapter XI, Programs XI.S5, XI.S6, and XI.S7.

B.3.37.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

The Structures Monitoring Program will include inspection of structures and structural components that are not currently included in the Maintenance Rule Program.

The Program will be enhanced to include periodic sampling of groundwater for chloride concentration, sulfate concentration, and pH on a 10 year basis.

The Program will be enhanced to include elastomer inspections for deterioration of seals leading to loss of sealing and leakage through Containment Penetrations.

The Program will be enhanced to include a requirement for contacting the proper personnel to allow for an opportunistic inspection of the buried concrete foundation.

The Program will be enhanced to include an evaluation of opportunistic inspections of buried concrete foundations on a 10 year basis.

B.3.37.5 OPERATING EXPERIENCE

XI.S6 – Structures Monitoring Program

The DAEC Structures Monitoring Program has been effective in managing the aging effects. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

According to the Periodic Maintenance Effectiveness Review of Cycle 14, the baseline inspection of online-accessible structures included concrete, masonry, and steel structures used to house plant equipment. This included the walls, floors, and roofs of buildings, along with the pedestals of mechanical and electrical equipment. The results of the visual inspections revealed the condition of structures at DAEC to be very good with no significant findings. The second baseline inspection included outage-accessible areas and was completed in late 1996 during Refueling Outage 14. The results of this inspection also revealed no significant findings.

In 2001, a visual inspection of structures and structural components found in harsh environments was conducted in accordance with the DAEC Maintenance Rule Program. This inspection focused on the same structures and structural components as those inspected during the initial baseline inspection, but did not include those areas found in mild environments. Follow-up inspections on open deficiency items from the 1996 baseline inspection were also included.

The DAEC Structures Monitoring Program itself is reviewed by an Expert Panel at least once every refueling cycle in accordance with 10 CFR 50.65(a)(3). Since the establishment of the Structures Monitoring Program, no pattern of failures indicating serious structural problems have been identified, and there have been no declarations of 50.65(a)(1) goal setting status due to structural deficiencies on DAEC structures.

Sampling of groundwater at DAEC was conducted in 2007 to determine the chloride concentration, sulfate concentration, and pH of the groundwater on site. The results of that sampling indicated that the chloride and sulfate measures were below the NUREG-1801 defined aggressive levels of 500 ppm for chlorides, 1500 ppm for sulfates, and pH levels above 5.5.

XI.S5 – Masonry Wall Program

The DAEC Masonry Wall Program has been effective in managing the aging effects. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform there intended function(s) throughout the period of intended operation.

Upon receipt of Nuclear Regulatory Commission IE Bulletin 80-11, Duane Arnold conducted a survey and evaluation of masonry walls in the plant with close proximity and interaction with safety-related equipment. The results of that evaluation indicated that all the masonry walls were acceptable without modification due to presence of reinforcement and positive end connections in all DAEC masonry walls.

Visual inspection of both safety and non-safety related masonry walls began with the establishment of Module 6 of the DAEC Maintenance Rule Program. This visual inspection included examination for any cracking and degradation of masonry walls within the areas listed in the Monitoring Checklist of Module 6 of the Maintenance Rule Program.

Since the Maintenance Rule inspections began there have been a limited number of deficiency reports indicating masonry block wall degradation. However, the evaluation basis of the masonry walls have not been invalidated due to the limited nature of the degradation. The condition of masonry block walls are continuing to be monitored through follow-up inspections under Module 6 of the Maintenance Rule Program.

In addition, administrative controls have also been established in response to NRC IN 87-67 to ensure that the evaluation basis for a wall is not invalidated through a physical plant change or system reclassification. Under ACP 109.0 (Reference 6.5) and ACP 109.1, DAEC personnel are required to evaluate whether a proposed design or maintenance action affects a safety-related masonry wall. Changes involving such walls are required to implement ACP 1203.60, which analyzes the adequacy of the masonry wall with the proposed change.

XI.S7 – Inspection of Water Control Structures Associated with Nuclear Power Plants

The DAEC Inspection of Water Control Structures Associated with Nuclear Power Plants Program has been effective in managing the aging effects. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these systems will continue to perform their intended function(s) throughout the period of extended operation.

The deficiencies that were recorded during the baseline inspections were evaluated by DAEC personnel in accordance with the Structures Monitoring Program. The evaluation included a review of the deficiency report and initiation of any necessary corrective actions. Deficiencies requiring additional monitoring were scheduled for follow-up inspections in 1998 and/or at the next regularly scheduled inspection in 2001.

No new deficiencies were initiated in the 2001 Structures Monitoring inspection.

According to the Periodic Maintenance Effectiveness Review of Cycles 19 & 20, the Intake Structure's river water pits were visually inspected for damage and degradation to the structural concrete and steel of the river water pit. In both inspections, the structural components were found in an acceptable condition, with the exception of corrosion on some support elements in Cycle 19. However, corrective actions were initiated and the corroded supports were replaced.

B.3.37.6 CONCLUSION

The Structures Monitoring Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.38 THERMAL AGING AND NEUTRON IRRADIATION EMBRITTLEMENT OF CAST AUSTENITIC STAINLESS STEEL (CASS) PROGRAM

B.3.38.1 PROGRAM DESCRIPTION

The Thermal Aging and Neutron Irradiation Embrittlement Cast Austenitic Stainless Steel (CASS) is a new program. The program manages the aging effects of reduction of fracture toughness - thermal neutron/radiation embrittlement.

The Cast Austenitic Stainless Steel (CASS) material identified at DAEC that is susceptible to thermal aging and neutron embrittlement is located internal to the reactor pressure vessel. The specific components are the fuel support casting, fittings on the core spray sparger, the jet pump ram head and the jet pump nozzles. These components are made with ASTM 351 Grade CF8 materials.

DAEC inspects the reactor pressure vessel internals in accordance with the applicable requirements of ASME Section XI and BWRVIP documents.

The program will perform enhanced VT-1 inspections of the susceptible CASS components that are part of the reactor pressure vessel internals. These inspections will be included as part of the 10-Year ISI Plan during the period of extended operation.

B.3.38.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M13.

B.3.38.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M13.

B.3.38.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M13.

B.3.38.5 OPERATING EXPERIENCE

The DAEC Thermal Aging and Neutron Irradiation Embrittlement Cast Austenitic Stainless Steel (CASS) Program is a new program; therefore, there is no plant specific program operating experience. However, the inspection methods to detect Thermal Aging and Neutron Irradiation Embrittlement of CASS components is very similar to the inspection methods performed by the ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD and the BWR Vessel Internals Programs. Therefore, the operating experience from these programs is being considered applicable to the CASS program.

The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

During the RFO 20 an examination of the fuel support casting and the jet pump assemblies revealed no relevant indications.

Inservice Inspection (ISI) Program Assessment by DAEC Nuclear Oversight (NOS) in 2006 documents the review of closeout activities associated with the DAEC ASME Section XI ISI Program Third Period 10-Year Interval. NRC Relief Requests, ISI corrective actions, and resolution of previously identified NOS issues were also evaluated. One minor administrative issue was identified regarding an incorrect reference to the applicable weld examination in a corrective action document closure package. The evaluation concluded that DAEC ISI Program activities have been satisfactorily performed.

A portion of the NRC Integrated Inspection in 2007 involved review of ISI activities. During this inspection the NRC observed ISI inspections, reviewed ISI records and related ISI problems identified by DAEC. The NRC identified two Non-Cited Violations (NCV's). Both of the NCV's are related to ISI program implementation issues and were considered to be of low safety significance. The first NCV identified an unqualified reactor vessel weld examinations, the second NCV concerned an unqualified Main Steam Safety Relief Valve weld repair. The NRC Inspection did not identify any deficiencies in the ISI program requirements; however, the Inspection did identify ISI implementation deficiencies.

B.3.38.6 CONCLUSION

The Thermal Aging and Neutron Irradiation Embrittlement Cast Austenitic Stainless Steel (CASS) Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.3.39 WATER CHEMISTRY PROGRAM

B.3.39.1 PROGRAM DESCRIPTION

The DAEC Water Chemistry Program is an existing program. The program manages the aging effects of loss of material due to corrosion and cracking (SCC).

The purpose of the DAEC Water Chemistry Program is to control certain water chemistry control parameters and identify the actions required if the parameters exceed limits.

The NUREG 1801 Section XI.M2 for Water Chemistry states that the water chemistry program for boiling water reactors (BWRs) relies on monitoring and control of reactor water chemistry based on industry guidelines such as the boiling water reactor vessel and internals project (BWRVIP)-29 (Electric Power Research Institute [EPRI] TR-103515) or later revisions.

The next revision to this industry guidance was published as BWRVIP-79, "BWR Water Chemistry Guidelines". The subsequent revision, BWRVIP-130, "BWR Water Chemistry Guidelines" is what DAEC uses as a basis for the plant water chemistry control.

DAEC Water Chemistry Program establishes the plant water chemistry specifications, actions levels, and responses to out-of-specification water chemistry conditions. The procedure defines chemistry control parameters for the following conditions.

- Reactor Water – Cold Shutdown or Refuel Mode
- Reactor Water – Hot Shutdown or Startup/Hot Standby Mode
- Feedwater/Condensate/Hotwell – Hot Shutdown or Startup/Hot Standby Mode
- Reactor Water – Run Mode

- Feedwater/Hotwell – Run Mode

DAEC uses a One-Time Inspection program of selected components at susceptible locations to verify the effectiveness of the chemistry control program.

The effectiveness of the Water Chemistry Program is verified by:

- One Time Inspection Program

The Water Chemistry Program is used in conjunction with the following programs to manage the effects of aging on various components:

- BWR Stress Corrosion Cracking
- BWR Penetrations
- BWR Vessel ID Attachment Welds
- ASME Section XI Inservice Inspection, IWB, IWC and IWD
- BWR Vessel Internals

The combination of these programs ensures that significant degradation is not occurring and that the component will maintain its intended function during the period of extended operation.

B.3.39.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M2.

B.3.39.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 XI.M2.

B.3.39.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 XI.M2.

B.3.39.5 OPERATING EXPERIENCE

The DAEC Water Chemistry Program has been effective in managing the aging effects of loss of material and cracking. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

The DAEC Water Chemistry Program has identified when various contaminants have exceeded the action Levels. These issues involved decisions related to timing of change-out of the Reactor Water Clean-up (RWCU) filter beds and a hydro test which led to an unexpected conductivity excursion.

On January 31, 2003, high conductivity (above Chemistry Action Level 1) was indicated in the condenser hotwell. Condenser hotwell, reactor feedwater, and reactor coolant conductivity indications continued to increase, and on February 1, 2003 a normal plant shutdown was commenced. Conductivity levels continued to rise resulting in the insertion of a manual reactor scram at 50% power. Reactor coolant chemistry continued to degrade after insertion of the scram until main circulating water system and condensate and feedwater systems were secured. The immediate cause of the chemistry excursion was leakage of circulating water into the main condenser hotwell through a punctured condenser tube. The tube was punctured by impact of a deflector plate that broke free inside the condenser following approximately four months of continuous use of a Feedwater Heater dump valve for heater level control. Repairs were completed and water chemistry parameters were restored within limits.

In March of 2007, Duane Arnold was in the process of starting up from a refueling outage. Shortly after a condensate demineralizer was placed in service, a significant degradation of reactor water chemistry parameters occurred. The plant was promptly shut down and reactor water temperature was reduced to minimize the impact on fuel, RPV internals, and plant components. Plant demineralizer systems were subsequently operated to restore reactor water chemistry. Troubleshooting subsequently determined that the chemistry excursion was the result of a resin intrusion from condensate demineralizers into the Condensate System. A root cause evaluation was conducted and it was concluded that keeping several condensate demineralizer subsystems in HOLD after the Condensate System was secured during the first week of the refueling outage created opportunities for resin to enter the influent headers of condensate filter demineralizers due to existing equipment deficiencies. Resin that had accumulated was subsequently passed forward into the reactor causing the chemistry excursion, water chemistry parameters were restored within limits.

B.3.39.6 CONCLUSION

The Water Chemistry Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.4 TLAA EVALUATION OF AGING MANAGEMENT PROGRAMS UNDER 10 CFR 54.21(C)(1)(iii)

B.4.1 ENVIRONMENTAL QUALIFICATION PROGRAM

B.4.1.1 PROGRAM DESCRIPTION

The Environmental Qualification (EQ) Program is an existing program. The program manages the effects of aging by meeting the requirements of 10 CFR 50.49 “Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants.”

The program includes electrical and instrumentation and control components that are required to operate during and after a design basis event and that are in a harsh environment during and after a design basis event.

The program provides for maintenance of the qualified life for electrical equipment important to safety within the scope of the program. Program activities establish, demonstrate, and document the level of qualification, qualified configuration, maintenance, surveillance and replacement requirements necessary to meet program requirements. Reanalysis addresses attributes of analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, corrective actions if acceptance criteria are not met, and the period of time prior to the end of qualified life when the reanalysis will be completed. Qualified life is determined for equipment within the scope of the Environmental Qualification (EQ) Program and appropriate actions such as replacement or refurbishment are taken prior to or at the end of the qualified life of the equipment so that the aging limit is not exceeded.

EQ Component Reanalysis Attributes

The reanalysis of an aging evaluation is normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation. Reanalysis of an aging evaluation to extend the qualification of a component is performed on a routine basis pursuant to 10 CFR 50.49(e) as part of an EQ program. While a component life limiting condition may be due to thermal, radiation, or cyclical aging, the vast majority of component aging limits are based on thermal conditions. Conservatism may exist in aging evaluation parameters, such as the assumed ambient temperature of the component, an unrealistically low activation energy, or in the application of a component (de-energized versus energized). The reanalysis of an aging evaluation is documented according to the station's quality assurance program requirements, which requires the verification of assumptions and conclusions. As already noted, important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). These attributes are discussed below.

Analytical Methods: The analytical models used in the reanalysis of an aging evaluation are the same as those previously applied during the prior evaluation. The Arrhenius methodology is an acceptable thermal model for performing a thermal aging evaluation. The analytical method used for a radiation aging evaluation is to demonstrate qualification for the total integrated dose (that is, normal radiation dose for the projected installed life plus accident radiation dose). For license renewal, one acceptable method of establishing the 60-year normal radiation dose is to multiply the 40-year normal radiation dose by 1.5 (that is, 60 years/40 years). The result is added to the accident radiation dose to obtain the total integrated dose for the component. For cyclical aging, a similar approach may be used. Other models may be justified on a case-by-case basis.

Data Collection and Reduction Methods: Reducing excess conservatism in the component service conditions (for example, temperature, radiation, cycles) used in the prior aging evaluation is the chief method used for a reanalysis. Temperature data used in an aging evaluation is to be conservative and based on plant design temperatures or on actual plant temperature data. When used, plant temperature data can be obtained in several ways, including monitors used for technical specification compliance, other installed monitors, measurements made by plant operators during rounds, and temperature sensors on large motors (while the motor is not running). A representative number of temperature measurements are conservatively evaluated to establish the temperatures used in an aging evaluation. Plant temperature data may be used in an aging evaluation in different ways, such as (a) directly applying the plant temperature data in the evaluation, or (b) using the plant temperature data to demonstrate conservatism when using plant design temperatures for an evaluation. Any changes to material activation energy values as part of a reanalysis are to be justified on a plant-specific basis. Similar methods of reducing excess conservatism in the component service conditions used in prior aging evaluations can be used for radiation and cyclical aging.

Underlying Assumptions: EQ component aging evaluations contain sufficient conservatism to account for most environmental changes occurring due to plant modifications and events. When unexpected adverse conditions are identified during operational or maintenance activities that affect the normal operating environment of a qualified component, the affected EQ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions.

Acceptance Criteria and Corrective Actions: The reanalysis of an aging evaluation could extend the qualification of the component. If the qualification cannot be extended by reanalysis, the component is to be refurbished, replaced, or requalified prior to exceeding the period for which the current qualification remains valid. A reanalysis is to be performed in a timely manner (that is, sufficient time is available to refurbish, replace, or requalify the component if the reanalysis is unsuccessful).

B.4.1.2 NUREG-1801 CONSISTENCY

This program is consistent with the 10 elements of NUREG-1801 X.E1.

B.4.1.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the 10 elements of NUREG-1801 X.E1.

B.4.1.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

This program does not require any enhancements to be consistent with the ten elements of NUREG-1801 X.E1.

B.4.1.5 OPERATING EXPERIENCE

The DAEC Environmental Qualification Program has been effective in managing the aging effects. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these components will continue to perform their intended function(s) throughout the period of extended operation.

Recent maintenance and inspection activities have not identified any age related degradation of equipment in the scope of the DAEC Environmental Qualification Program.

Recent self assessments have not identified any programmatic deficiencies.

B.4.1.6 CONCLUSION

The Environmental Qualification (EQ) Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.4.2 METAL FATIGUE OF REACTOR COOLANT PRESSURE BOUNDARY PROGRAM

B.4.2.1 PROGRAM DESCRIPTION

The DAEC Metal Fatigue of Reactor Coolant Pressure Boundary Program is an existing program. In accordance with NUREG/CR-6260, the impact of environmental effects on fatigue usage have been evaluated and shown to be less than the maximum allowable (1.0) for the sixty (60) year license renewal term of operation.

The following components/equipment items are applicable to the DAEC in accordance with Section 5.7 of NUREG/CR-6260:

1. Reactor Vessel Shell and Lower Head

   Considering environmental effects and cycles for an operating period of 60 years, the maximum fatigue usage for the reactor vessel shell and lower head location is shown to be 0.996.

2. RPV recirculation outlet nozzle

   Two locations were analyzed for fatigue acceptance for the recirculation outlet nozzle: the safe end (SA336 Class F8) and the nozzle inner corner or blend radius (SA508 Class 2). Considering environmental effects and cycles for an operating period of 60 years, the maximum fatigue usage for the safe end location is shown to be 0.1957; and for the nozzle corner, 0.2173.

3. RPV recirculation inlet nozzle

   Considering environmental effects and cycles for an operating period of 60 years, the maximum fatigue usage for the recirculation inlet nozzle safe end location is shown to be 0.3788.

4. RPV feedwater nozzle bore

   Three locations were analyzed for fatigue acceptance for the feedwater nozzle: the safe end (SA508 Class 1 & SB166 locations) and the blend radius (SA508 Class 2). Considering environmental effects and cycles for an operating period of 60 years, the maximum fatigue usage for the SB166 safe end location is shown to be 0.0529; for the carbon steel safe end location, 0.5598; and for the blend radius location, 0.302.

5. RPV core spray nozzle and safe end

   Two locations were analyzed for fatigue acceptance for the core spray nozzle: the safe end (SB166) and the blend radius (SA508 Class 2). Considering environmental effects and cycles for an operating period of 60 years, the maximum fatigue usage for the safe end location is shown to be 0.0004; and for the blend radius location, 0.175.

6. Feedwater/RCIC tee

   Considering environmental effects and cycles for an operating period of 60 years, the maximum fatigue usage for the Feedwater/RCIC Piping Connection location is shown to be 0.281.

7. Recirculation piping/RHR return tee

   Considering environmental effects and cycles for an operating period of 60 years, the maximum fatigue usage for the Loop B Recirculation/RHR return tee location is shown to be 0.4952.

8. Class 1 RHR piping at tapered transition

   Considering environmental effects and cycles for an operating period of 60 years, the maximum fatigue usage for the RHR Return Isolation Valve location (tapered transition) is shown to be 0.2857.

B.4.2.2 NUREG-1801 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 X.M1.

B.4.2.3 EXCEPTIONS TO NUREG-1801

There are no exceptions to the ten elements of NUREG-1801 X.M1.

B.4.2.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

The program requires enhancement to be consistent with the following element:

- Scope of Program

Incorporate requirements for inclusion of NUREG/CR-6260 locations in the implementing procedure for the DAEC Metal Fatigue of Reactor Coolant Pressure Boundary Program.

B.4.2.5 OPERATING EXPERIENCE

The DAEC Metal Fatigue of Reactor Coolant Pressure Boundary Program has been effective in managing the aging effects of thermal fatigue. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these systems will continue to perform their intended function(s) throughout the period of extended operation.

Temperature trends indicated that the bottom head drain temperature had sharply decreased immediately following a reactor scram in June of 2000. Evaluation showed that the automatic scram had occurred as a result of a generator perturbation. Due to the generator trip, a recirculation pump trip (RPT) ensued as designed. Reactor water level did not drop low enough to initiate Reactor Water Cleanup (RWCU) isolation. Reactor recirculation flow had ceased, control rod drive cooling water continued to feed the reactor vessel while RWCU continued to withdraw vessel water. This action resulted in control rod drive cooling water short circuiting directly to the reactor cleanup drain line which resulted in a rapid local temperature decrease in the reactor bottom head drain line to reactor water cleanup. The evaluation concluded that no operability concerns existed with the RPV at that time with regards to fatigue usage, cycles remaining, stress limits and margin against fracture due to higher heatup/cooldown rates during the reactor transient event (scram).

During the Cycle 19 startup (April 2003) a concern was identified that additional reactor vessel fatigue was incurred because of prolonged operation at low power with feedwater heaters out of service. A similar concern was identified in November of 2003 when the plant was operating at very low reactor power in support of troubleshooting condenser air inleakage. These concerns were addressed in the corrective action program.

Inconsistencies in RPV fatigue cycle assumptions were identified in November 2006 during a review of RPV and piping calculations for the purpose of scoping Time Limited Aging Affects (TLAA) evaluations. This was addressed using the corrective action program. Corrective actions included revision of the fatigue calculations as part of the License Renewal Project.

In 2007, a NOS evaluator found that procedural direction did not exist to record cumulative time spent in a hot-standby condition. These concerns were addressed using the corrective action program.

A review of plant data showed that during an automatic scram in November 2006 which resulted in a loss of all Recirculation system flow, the plant appeared to have exceeded the Technical Specification limit for cooldown and heatup rates. In the

November 2006 scram, the Turbine Stop valves closed due to equipment malfunction during testing of the Turbine Overspeed Trip Device. Both Reactor Recirculation pumps tripped, but RWCU remained in-service since vessel level did not drop below the RWCU isolation point. The bottom head temperature trend for the November 2006 event shows the metal bottom head temperature did drop after both recirculation pumps tripped, and rose after the restart of one recirculation pump with rates in either case below 100°F per hour for the November 2006 event. The June 2000 event and operating experience at another plant have shown this same rapid temperature change in the bottom head drain line but not at the bottom head during the plant conditions that DAEC experienced in November 2006 and June 2000. The piping design for the bottom head drain line allows for transients that are more severe than the November 2006 Scram. DAEC trends the Reactor Vessel Thermal Cycles to ensure the design bases for the RPV is maintained. This program does not trend thermal cycles for attached piping to the vessel. The evaluation concluded that the RPV drain line piping did experience a heatup and cooldown that was above 100 Degrees F per hour, but the rates experienced are bounded by analysis, such as a MSIV closure event with a loss of feedwater. As a result of the evaluation, corrective actions were initiated to evaluate if the current design calculations require specific thermal cycle counting for attached piping such as the bottom head drain, or do the calculations ensure that vessel cycle counting will adequately track attached piping cycles, especially in cases with loss of forced circulation.

B.4.2.6 CONCLUSION

The Metal Fatigue of Reactor Vessel Coolant Pressure Boundary Program provides reasonable assurance that the effects of aging will be managed such that applicable components will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B.5 REFERENCES

B-1 Code of Federal Regulations, Title 10, Energy.

B-2 NEI 95-10, Industry Guideline for Implementing the Requirements of 10 CFR Part 54 -The License Renewal Rule, Rev. 6, Nuclear Energy Institute, June 2005.

B-3 NUREG-1801 Rev. 1, Generic Aging Lessons Learned (GALL) Report, U.S. Nuclear Regulatory Commission, September 2005.

B-4 NUREG-1800 Rev. 1, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, U.S. Nuclear Regulatory Commission, September 2005.

APPENDIX C

Tables

APPENDIX C

RESPONSE TO BWRVIP APPLICANT ACTION ITEMS

Of the BWRVIP Reports credited for Duane Arnold license renewal, the following have NRC safety evaluation reports (SERs) for license renewal:

- BWRVIP-18-A, BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines
- BWRVIP-25, BWR Core Plate Inspection and Flaw Evaluation Guidelines
- BWRVIP-26-A, BWR Top Guide Inspection and Flaw Evaluation Guidelines
- BWRVIP-27-A, BWR Standby Liquid Control System/Core Plate DP Inspection and Flaw Evaluation Guidelines
- BWRVIP-38, BWR Shroud Support Inspection and Flaw Evaluation Guidelines
- BWRVIP-41, BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines
- BWRVIP-47-A, BWR Lower Plenum Inspection and Flaw Evaluation Guidelines
- BWRVIP-48-A, BWR Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines
- BWRVIP-49-A, BWR Instrument Penetration Inspection and Flaw Evaluation Guidelines
- BWRVIP-74-A, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal
- BWRVIP-116, BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal

License renewal applicant action items identified in the corresponding safety evaluation reports for each of the above BWRVIP reports are addressed in the following tables. BWR VIP-116 does not appear in the tables because the associated safety evaluation report does not contain any applicant action items.

TABLE C-1
BWRVIP-18
BWR CORE SPRAY INTERNALS
INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
1) The license renewal applicant is to verify that its plant is bounded by the report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-18 report to manage the effects of aging on the functionality of the core spray internals during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the AMP within the BWRVIP-18 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor pressure vessel components or other information presented in the report, such as materials of construction, will have to be identified by the LR applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The BWRVIP report has been reviewed and the DAEC has been verified to be bounded by the report. Additionally, the DAEC commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Commitments are administratively controlled in accordance with the requirements of 10 CFR 50, Appendix B.
2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-18 report for the core spray internals shall ensure that the programs and activities specified as necessary in the BWRVIP-18 report are summarily described in the FSAR supplement.	The DAEC UFSAR supplement, Appendix A of this application, includes a summary description of the programs and activities as required in the AAI.

typically be monitored once every quarter or as defined by the Preventive Maintenance Program.

- Category 3 – Balance of Plant/Maintenance Rule Equipment whose function has been determined through engineering analysis (MMIS, maintenance history reviews, developing problems), or vendor recommendations to be (1) necessary for plant power production, or (2) for providing a supporting role to Category 1 and/or 2 equipment, shall be monitored on a schedule consistent with the findings from the above analysis/recommendations (monthly, quarterly, semi-annually, annually, or other specified frequencies). This equipment may have redundant machine trains. Warranty requirements may also temporarily adjust monitoring criteria as well.

In addition to the major component(s) that comprise the system, the lube oil program is credited for age management of the associated piping, heat exchangers, and other components that are a part of the supporting lube oil system.

The program provides an early indication of adverse equipment condition in lubricating oil environments.

B.3.30.2 NUREG-1801 XI.M39 CONSISTENCY

This program is consistent with the ten elements of NUREG-1801 XI.M39.

B.3.30.3 EXCEPTIONS TO NUREG-1801 XI.M39

There are no exceptions to the ten elements of NUREG-1801 XI.M39.

B.3.30.4 ENHANCEMENTS TO DUANE ARNOLD PROGRAM

The program requires enhancements to be consistent with the following elements:

- Parameters Monitored/Inspected

  The program will be enhanced to add Diesel Fire Pump 1P-049 to Oil Scope/Equipment Database for obtaining oil samples and required parameters to be monitored.

B.3.30.5 OPERATING EXPERIENCE

The DAEC Lubricating Oil Analysis Program has been effective in managing the aging effects of loss of materials. The program incorporates both industry and plant-specific operating experience to provide added assurance that the aging effects are managed such that these systems will continue to perform their intended function(s) throughout the period of extended operation.

In June 2006, the oil in 1P089B Upper Reservoir was observed to be dark in color. Engineering concluded that no operability issue exists and the oil was still acceptable and no wear debris generation is evident. Therefore, no further action was required.

In November 2004, the oil in 1G201A and B were found to have a low oxidation life. Engineering concluded that no operability issue exists and the oil was still acceptable and the work order was issued to change the oil in the outage. Therefore, no further action was required.

TABLE C-2
BWRVIP-25
BWR CORE PLATE
INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
1) The license renewal applicant is to verify that its plant is bounded by the BWRVIP-25 report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-25 report to manage the effects of aging on the functionality of the core plate assembly during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the AMP within the BWRVIP-25 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The BWRVIP report has been reviewed and the DAEC has been verified to be bounded by the report. Additionally, the DAEC commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Commitments are administratively controlled in accordance with the requirements of 10 CFR 50, Appendix B.
2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-25 report for the core plate will ensure that the programs and activities specified as necessary in the BWRVIP-25 report are summarily described in the FSAR supplement.	The DAEC UFSAR supplement, Appendix A of this application, includes a summary description of the programs and activities as required in the AAI.

TABLE C-2 (continued)
BWRVIP-25
BWR CORE PLATE
INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix B to the BWRVIP-25 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the core plate as a result of its AMR and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the BWRVIP-25 report for the core plate will ensure that the inspection strategy described in the BWRVIP-25 report does not conflict or result in any changes to their technical specifications (TS). If TS changes do result, then the applicant must ensure that those changes are included in its application for license renewal	No technical specification changes have been identified for the DAEC based upon the BWRVIP report.
4) Due to susceptibility of the rim hold-down bolts to stress relaxation, applicants referencing the BWRVIP-25 report for license renewal should identify and evaluate the projected stress relaxation as a potential TLAA issue.	DAEC has evaluated rim hold-down bolts loss of preload as a TLAA. See Section 4 of this application.
5) Until such time as an expanded technical basis for not inspecting the hold-down bolts is approved by the staff, applicants referencing the BWRVIP-25 report for license renewal should continue to perform inspections of the rim hold-down bolts.	DAEC will inspect a sample of the rim hold-down bolts by VT-3 during the license renewal period until such time as an expanded technical basis for not inspecting the hold-down bolts is approved by the NRC Staff.

TABLE C-3
BWRVIP-26-A
BWR TOP GUIDE
INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
1) The license renewal applicant is to verify that its plant is bounded by the topical report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-26 report to manage the effects of aging on the functionality of the top guide structure during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the AMP within the BWRVIP-26 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The DAEC performs inspections that meet the intent of BWRVIP-26. The DAEC commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Commitments are administratively controlled in accordance with the requirements of 10 CFR 50, Appendix B.
2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-26 report for the top guide system shall ensure that the programs and activities specified as necessary in the BWRVIP-26 report are summarily described in the FSAR supplement.	The DAEC UFSAR supplement, Appendix A of this application, includes a summary description of the programs and activities as required in the AAI.

TABLE C-3 (continued)
BWRVIP-26-A
BWR TOP GUIDE
INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix C to the BWRVIP-26 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the top guide as a result of its AMR and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the BWRVIP-26 report for the top guide shall ensure that the inspection strategy described in the BWRVIP-26 report does not conflict or result in any changes to their TS. If TS changes do result, then the applicant should ensure that those changes are included in its application for license renewal.	No technical specification changes have been identified for the DAEC based upon the BWRVIP report.
4) Due to IASCC of the subject safety-related components, applicants referencing the BWRVIP-26 report for license renewal should identify and evaluate the projected accumulated neutron fluence as a potential TLAA issue. This issue is discussed in more detail in Section 3.5 of this report.	DAEC has evaluated IASCC of internal components. Components have been identified as being susceptible to IASCC for the period of extended operation include: the top guide, shroud, and core support plate. See Section 4.0 of this application.

TABLE C-4
BWRVIP-27-A
BWR STANDBY LIQUID CONTROL SYSTEM/CORE PLATE DP INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
1) The license renewal applicant is to verify that its plant is bounded by the report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP report to manage the effects of aging on the functionality of the DP/SLC vessel penetration/nozzle and safe-end extensions during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within this BWRVIP report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The BWRVIP report has been reviewed and the DAEC has been verified to be bounded by the report. Additionally, the DAEC commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Commitments are administratively controlled in accordance with the requirements of 10 CFR 50, Appendix B.
2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-27 report for the DP/SLC vessel penetration/nozzle and safe end extensions shall ensure that the programs and activities specified as necessary in the BWRVIP-27 document are summarily described in the FSAR supplement	The DAEC UFSAR supplement, Appendix A of this application, includes a summary description of the programs and activities as required in the AAI.

TABLE C-4 (continued)
BWRVIP-27-A
BWR STANDBY LIQUID CONTROL SYSTEM/CORE PLATE DP INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix B to the BWRVIP-27 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the DP/SLC vessel penetration/nozzle and safe end extensions as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing BWRVIP-27 for the DP/SLC vessel penetration/nozzle and safe end extensions shall ensure that the inspection strategy described in the BWRVIP-27 report does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its application for license renewal..	No technical specification changes have been identified for the DAEC based upon the BWRVIP report.
4) Due to the susceptibility of the subject components to fatigue, applicants referencing the BWRVIP-27 report for license renewal should identify and evaluate the projected fatigue cumulative usage factors as a potential TLAA issue. TLAA is discussed in more detail in Section 3.5 of this report.	The DAEC SBLC nozzle has been evaluated for fatigue and shown to be acceptable for 60 years. See Section 4 of this application.

TABLE C-5
BWRVIP-38
BWR SHROUD SUPPORT
INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
(1) The license renewal applicant is to verify that its plant is bounded by the topical report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-38 report to manage the effects of aging on the functionality of the shroud support components during the period of extended operation, including actions planned to inspect welds that are presently inaccessible. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within the BWRVIP-38 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The BWRVIP report has been reviewed and the DAEC has been verified to be bounded by the report. Additionally, the DAEC commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Commitments are administratively controlled in accordance with the requirements of 10 CFR 50, Appendix B.
2) An FSAR supplement is required by 10 CFR 54.21 (d) for the facility and must contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-38 report for the shroud support shall ensure that the programs and activities specified as necessary in the BWRVIP-38 report are summarily described in the FSAR supplement.	The DAEC UFSAR supplement, Appendix A of this application, includes a summary description of the programs and activities as required in the AAI.

TABLE C-5 (continued)
BWRVIP-38
BWR SHROUD SUPPORT
INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
3) Each application for license renewal is required by 10 CFR 54.22 to include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix B to the BWRVIP-38 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the shroud support as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the BWRVIP-38 report for the shroud support shall ensure that the inspection strategy described in the BWRVIP-38 report does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its application for license renewal.	No technical specification changes have been identified for the DAEC based upon the BWRVIP report.

TABLE C-6
BWRVIP-41
BWR JET PUMP ASSEMBLY
INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
1) The license renewal applicant is to verify that its plant is bounded by the BWRVIP-41 report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-41 report to manage the effects of aging on the functionality of the jet pump components during the period of extended operation, including actions planned to mitigate the issue concerning the inspection of welds that are presently inaccessible and the thermal and/or neutron embrittlement TLAA. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within the BWRVIP-41 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The BWRVIP report has been reviewed and the DAEC has been verified to be bounded by the report. Additionally, the DAEC commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Commitments are administratively controlled in accordance with the requirements of 10 CFR 50, Appendix B.
2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-41 report for the jet pump components shall ensure that the programs and activities specified as necessary in the BWRVIP-41 report are summarily described in the FSAR supplement.	The DAEC UFSAR supplement, Appendix A of this application, includes a summary description of the programs and activities as required in the AAI.

TABLE C-6 (continued)
BWRVIP-41
BWR JET PUMP ASSEMBLY INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix A to the BWRVIP-41 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the jet pump assembly as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the BWRVIP-41 report for the jet pump assembly shall ensure that the inspection strategy described in the BWRVIP-41 report does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its application for license renewal.	No technical specification changes have been identified for the DAEC based upon the BWRVIP report.

TABLE C-7
BWRVIP-47-A
BWR LOWER PLENUM INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
1) The LR applicant is to verify that its plant is bounded by the BWRVIP-47 report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-47 report to manage the effects of aging on the functionality of the lower plenum during the period of extended operation. LR applicants will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the AMPs within the BWRVIP-47 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The BWRVIP report has been reviewed and the DAEC has been verified to be bounded by the report. Additionally, the DAEC commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Commitments are administratively controlled in accordance with the requirements of 10 CFR 50, Appendix B.
2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for LR referencing the BWRVIP-47 report for the lower plenum shall ensure that the programs and activities specified as necessary in the BWRVIP-47 document are summarily described in the FSAR supplement.	The DAEC UFSAR supplement, Appendix A of this application, includes a summary description of the programs and activities as required in the AAI.

TABLE C-7 (continued)
BWRVIP-47-A
BWR LOWER PLENUM INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
3) 10 CFR 54.22 requires that each LR application include any TS changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the LR application. In its Appendix A to the BWRVIP-47 report, the BWRVIP stated that there are no generic changes or additions to TSs associated with the lower plenum as a result of its AMR and that the applicant will provide the justification for plant-specific changes or additions. Those LR applicants referencing the BWRVIP-47 report for the lower plenum shall ensure that the inspection strategy described in the BWRVIP-47 report does not conflict or result in any changes to their TSs. If technical specification changes do result, then the applicant should ensure that those changes are included in its LR application.	No technical specification changes have been identified for the DAEC based upon the BWRVIP report.
4) Due to fatigue of the subject safety-related components, applicants referencing the BWRVIP-47 report for LR should identify and evaluate the projected CUF as a potential TLAA issue. This issue is discussed in more detail in Section 3.5 of this report.	The lower plenum components considered in BWRVIP-47 are the control rod drive housing and stub tube, control rod guide tube, orificed fuel support, in-core housing, guide tube and dry tube assemblies. Of these, fatigue is a TLAA for the CRD stub tube and housing and was determined to be acceptable for 60 years. See Section 4 of this application.

TABLE C-8
BWRVIP-48-A
BWR VESSEL ID ATTACHMENT WELD INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
1) The license renewal applicant is to verify that its plant is bounded by the BWRVIP-48 report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-48 report to manage the effects of aging on the functionality of the bracket attachments during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within the BWRVIP-48 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The BWRVIP report has been reviewed and the DAEC has been verified to be bounded by the report. Additionally, the DAEC commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Commitments are administratively controlled in accordance with the requirements of 10 CFR 50, Appendix B.
2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-48 report for the bracket attachments shall ensure that the programs and activities specified as necessary in the BWRVIP-48 report are summarily described in the FSAR supplement.	The DAEC UFSAR supplement, Appendix A of this application, includes a summary description of the programs and activities as required in the AAI.

TABLE C-8 (continued)
BWRVIP-48-A
BWR VESSEL ID ATTACHMENT WELD INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix A to the BWRVIP-48 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the bracket attachments as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the BWRVIP-48 report for the bracket attachments shall ensure that the inspection strategy described in the BWRVIP-48 report does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its LR application.	No technical specification changes have been identified for the DAEC based upon the BWRVIP report.

TABLE C-9
BWRVIP-49-A
BWR INSTRUMENT PENETRATION INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
1) The license renewal applicant is to verify that its plant is bounded by the topical report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP report to manage the effects of aging on the functionality of the reactor vessel instrument penetrations during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within this BWRVIP report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The BWRVIP report has been reviewed and the DAEC has been verified to be bounded by the report. Additionally, the DAEC commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Commitments are administratively controlled in accordance with the requirements of 10 CFR 50, Appendix B.
2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP- 49 report for the instrument penetrations shall ensure that the programs and activities specified as necessary in the BWRVIP-49 document are summarily described in the FSAR supplement.	The DAEC UFSAR supplement, Appendix A of this application, includes a summary description of the programs and activities as required in the AAI.

TABLE C-9 (continued)
BWRVIP-49-A
BWR INSTRUMENT PENETRATION INSPECTION AND FLAW EVALUATION GUIDELINES

Applicant Action Item Text	Duane Arnold Response
3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix A to the BWRVIP-49 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with instrument penetrations as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing BWRVIP-49 for the instrument penetrations shall ensure that the inspection strategy described in the BWRVIP-49 document does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its application for license renewal..	No technical specification changes have been identified for the DAEC based upon the BWRVIP report.

TABLE C-10
BWRVIP-74-A
BWR REACTOR PRESSURE VESSEL INSPECTION AND FLAW EVALUATION GUIDELINES FOR LICENSE RENEWAL

Applicant Action Item Text	Duane Arnold Response
1) The LR applicant is to verify that the BWRVIP-74 report is applicable to its plant. Further, the LR applicant is to commit to programs described as necessary in the BWRVIP-74 report to manage the effects of aging on the functionality of the RPV components during the period of extended operation. LR applicants will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the AMP within the BWRVIP-74 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the LR applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The BWRVIP report has been reviewed and the DAEC has been verified to be bounded by the report. Additionally, the DAEC commits to programs described as necessary in the BWRVIP reports to manage the effects of aging during the period of extended operation. Commitments are administratively controlled in accordance with the requirements of 10 CFR 50, Appendix B. The inspections necessary to manage the effects of aging on the functionality of the RPV components are summarized in Table 4-1 of BWRVIP-74-A.
2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those LR applicants referencing the BWRVIP-74 report for the RPV components shall ensure that the programs and activities specified as necessary in the BWRVIP-74 report are summarily described in the FSAR supplement.	The DAEC UFSAR supplement, Appendix A of this application, includes a summary description of the programs and activities as required in the AAI.

TABLE C-10 (continued)
BWRVIP-74-A
BWR REACTOR PRESSURE VESSEL INSPECTION AND FLAW EVALUATION GUIDELINES FOR LICENSE RENEWAL

Applicant Action Item Text	Duane Arnold Response
3) 10 CFR 54.22 requires that each LR application include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the LR application. In its Appendix A to the BWRVIP-74 report, the BWRVIP stated that the technical specification changes resulting from neutron embrittlement will be made at the appropriate time prior to the end of the current license. Those LR applicants referencing the BWRVIP-74 report for the RPV components shall ensure that the inspection strategy described in the BWRVIP-74 report does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its LR application.	No technical specification changes have been identified for the DAEC based upon the BWRVIP report.
4) The staff is concerned that leakage around the reactor vessel seal rings could accumulate in the VFLD lines, cause an increase in the concentration of contaminants and cause cracking in the VFLD line. The BWRVIP-74 report does not identify this component as within the scope of the report. However, since the VFLD line is attached to the RPV and provides a pressure boundary function, LR applicants should identify any AMP for the VFLD line.	The DAEC reactor vessel flange leak detection lines are included within the scope of license renewal. Aging Management effects of the flange leak detection line will be monitored and managed in accordance with the One-Time Inspection and Water Chemistry Programs.

**TABLE C-10 (continued)
BWRVIP-74-A
BWR REACTOR PRESSURE VESSEL INSPECTION AND FLAW EVALUATION GUIDELINES FOR LICENSE RENEWAL**

Applicant Action Item Text	Duane Arnold Response
5) LR applicants shall describe how each plant-specific aging management program addresses the following elements: (1) scope of 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.	A description of DAEC AMPs credited for license renewal is provided in Appendix B of the LRA. These descriptions include a summary of all required elements (10) for each AMP.
6) The staff believes that inspection by itself is not sufficient to manage cracking. Cracking can be managed by a program that includes inspection and water chemistry. BWRVIP-29 describes a water chemistry program that contains monitoring and control guidelines for BWR water that is acceptable to the staff. BWRVIP-29 is not discussed in the BWRVIP-74 report. Therefore, in addition to the previously discussed BWRVIP reports, LR applications shall contain water chemistry programs based on monitoring and control guidelines for reactor water chemistry that are contained in BWRVIP-29.	The DAEC BWR Stress Corrosion Cracking Program includes water chemistry as a preventative measure. The DAEC Water Chemistry Program implements the guidelines of BWRVIP-130, BWR Water Chemistry Guidelines - 2004 Revision. BWRVIP-130 supersedes BWRVIP-29 (BWR Water Chemistry Guidelines - 1993 Revision).
7) LR applicants shall identify their vessel surveillance program, which is either an ISP or plant-specific in-vessel surveillance program, applicable to the licensed term.	The DAEC Reactor Vessel Surveillance Program is an integrated surveillance program (ISP). The DAEC will implement BWRVIP-116, BWR Vessel and Internals Project Integrated Surveillance Program (ISP) Implementation for License Renewal.

TABLE C-10 (continued)
BWRVIP-74-A
BWR REACTOR PRESSURE VESSEL INSPECTION AND FLAW EVALUATION GUIDELINES FOR LICENSE RENEWAL

Applicant Action Item Text	Duane Arnold Response
8) LR applicants should verify that the number of cycles assumed in the original fatigue design is conservative to assure that the estimated fatigue usage for 60 years of plant operation is not underestimated. The use of alternative actions for cases where the estimated fatigue is projected to exceed 1.0 will require case-by-case staff review and approval. Further, a LR applicant must address environmental fatigue for the components listed in the BWRVIP-74 report for the LR period.	DAEC has reviewed the design basis and confirmed that fatigue usage factors will remain below 1.0 for the extended period of operation, and environmental fatigue has been addressed for the required components. See Section 4 of this application for discussion of fatigue and effects of reactor coolant environment.
9) Appendix A to the BWRVIP-74 report indicates that a set of P-T curves should be developed for the heatup and cooldown operating conditions in the plant at a given EFPY in the LR period.	See Section 4 of this application for DAEC's disposition of the TLAA for neutron embrittlement and P-T curves for the LR period.
10) To demonstrate that the beltline materials meet the Charpy USE criteria in Appendix B or the report, the applicant shall demonstrate that the percent reduction in Charpy USE for their beltline materials are less than those specified for the limiting BWR3-6 plates and the non-Linde 80 submerged arc welds and that the percent reduction in Charpy USE for their surveillance weld and plate are less than or equal to the values projected using the methodology in RG 1.99, revision 2.	See Section 4 of this application regarding RPV Materials USE Reduction due to Neutron Embrittlement.

TABLE C-10 (continued)
BWRVIP-74-A
BWR REACTOR PRESSURE VESSEL INSPECTION AND FLAW EVALUATION GUIDELINES FOR LICENSE RENEWAL

Applicant Action Item Text	Duane Arnold Response
11) To obtain relief from the in-service inspection of the circumferential welds during the LR period, the BWRVIP report indicates that each licensee will have to demonstrate that (1) at the end of the renewal period, the circumferential welds will satisfy the limiting conditional failure frequency for circumferential welds in the Appendix E of the staff's July 28, 1998, FSER, and (2) that they have implemented operator training and established procedures that limit the frequency of cold overpressure events to the amount specified in the staff's FSER.	The basis for relief during the LR period is included in the TLAA Report (RPV Circumferential Weld Examination Relief). This discussion and the associated relief request approvals substantiate compliance with conditional failure frequency requirements at the end of the license renewal period and that DAEC has implemented the necessary operator training and procedural controls. The DAEC will submit a request for relief prior to entering the period of extended operation.
12) As indicated in the staff's March 7, 2000 letter to Carl Terry, a LR applicant shall monitor axial beltline weld embrittlement. One acceptable method is to determine the mean RTNDT of the limiting axial beltline weld at the end of the extended period of operation is less than the values specified in Table 1 of this FSER.	See the discussion of Axial Weld Failure Probability in Section 4 of this application.
13) The Charpy USE, P-T limit, circumferential weld and axial weld RPV integrity evaluations are all dependent on neutron fluence. The applicant may perform neutron fluence calculations using a staff approved methodology or may submit the methodology for staff review. If the applicant performs the neutron fluence calculation using a methodology previously approved by the staff, the applicant should identify the NRC letter that approved the methodology.	DAEC used the RAMA methodology to perform the neutron fluence calculation for embrittlement. Approval of this methodology is documented in the NRC's SER. See Section 4 of this application for details.
14) Components that have indications that have been previously analytically evaluated in accordance with Subsection IWB-3600 of Section XI to the ASME Code until the end of the 40-year service period, shall be re-evaluated for the 60 year service period corresponding to the LR term.	Indications that have been previously evaluated in accordance with Subsection IWB-3600 of Section XI to the ASME Code until the end of the 40-year service period have been re-evaluated for the 60-year period. See Section 4 of this application.

No Technical Specification changes or additions were identified as necessary to manage the effects of aging during the period of extended operation and as such no Technical Specification changes or additions are included with this License Renewal Application.